ADDIS ABABA UNIVERSITY
COLLEGE OF BUSINESS AND ECONOMICS
SCHOOL OF COMMERCE

KEY DRIVERS OF LIQUIDITY RISK IN THE BANKING INDUSTRY OF ETHIOPIA

A Thesis Submitted to the of Department of Accounting and Finance presented in Partial Fulfillment of the requirements for the Degree of Master of Science in Corporate Finance Specialized in Investment Management (CFIM)

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DECLARATION

I, Anbessa Abebe, declare that, this paper prepared for the partial fulfillment of the requirements for Master of Science in Corporate Finance Specialized in Investment Management (CFIM) is prepared with my own effort. I have made it independently with the close advice and guidance of my advisor. I also assert that this thesis has not been submitted earlier for the award of any other degree or diploma anywhere else.

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Certification

This is to certify that the thesis prepared by Anbessa Abebe, entitled: key drivers of liquidity risk in the banking industry of Ethiopia and submitted in partial fulfillment of the requirements for the degree of Degree of Master of Science in Corporate Finance Specialized in Investment Management (CFIM) complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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ACRONYM

ALM	Asset Liability Management
AQ	Asset Quality
BS	Bank Size
CAR	Capital Adequacy Ratio
CBE	Commercial Bank of Ethiopia
CLRM	Classic Linear Regression Model
DAQ	First Difference of AQ
DBE	Development Bank of Ethiopia
DLDR	First Difference of LDR
FDI	Foreign Direct Investment
FEM	Fixed Effect Model
GDP	Gross Domestic Product
GMM	Generalized Method of Moment
INFR	Inflation Rate
INTR	Interest Rate Spread (Lending minus Deposit)
LCR	Liquidity Coverage Ratio
LDR	Loan to Deposit Ratio
LR	Liquidity Ratio
NBE	National Bank of Ethiopia
NPLs'	Non-Performing Loans
NSFR	Net Stable Fund Ratio
OLS	Ordinary Least Square
POLS	Pooled Ordinary Least Square
REM	Rondom Effect Model
ROA	Return on Asset
SIFI	Systematically Important Financial Institution
SUR	Seemingly Unrelated Regression

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ABSTRACT

This study investigates the key drivers of liquidity risk in the Ethiopian banking industry, using bank-specific and macroeconomic factors. Using panel data from 17 commercial banks over the period 2000–2023, the research employs a fixed effects model to analyze the determinants of liquidity risk, measured by the liquidity ratio (LR). Bank-specific factors such as bank size (BS), capital adequacy ratio (CAR), asset quality (AQ), and loan-to-deposit ratio (LDR) are examined alongside macroeconomic variables, including GDP growth rate (GDPR), inflation rate (INFR), and interest rate spread (INTR). The findings of the study revealed that Lagged LR and capital adequacy have a significant positive impact on liquidity. Conversely, the loan-to-deposit ratio shows a Significance negative relationship with liquidity. Macroeconomic factors such as GDP growth and inflation have negative and insignificance influences on liquidity, while interest rate spreads has positive and significant impact on liquidity. The research concluded that both bank specific and macroeconomic factors have impact on the liquidity of banks. Thus, the researcher recommended that commercial banks and policymakers need to ensure prudent lending practices, regulatory oversight, and macroeconomic stability to mitigate liquidity risks. This study contributes to the existing literature by providing a comprehensive analysis on the determinants of liquidity risk in a developing economy, offering valuable insights for academicians, practitioners, and policymakers.

Key Words: Bank Size, Capital Adequacy Ratio, Liquidity Ratio, Loan to Deposit.

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

Liquidity is a bank's ability to meet financial obligations without excessive losses (Basel, 2008) and involves managing cash flows to sustain operations (European Central Bank, 2009). Liquidity risk arises when banks face maturity mismatches between assets and liabilities, leading to potential payment defaults (European Development Bank Council, 2023). Effective liquidity management is critical, as a single bank's failure can trigger systemic risks (Basel, 2000).

In Ethiopia, the National Bank of Ethiopia (NBE) enforces liquidity regulations requiring banks to hold at least 15 percent of net deposits as liquid assets (Bank Risk Management Guidelines, 2010; NBE Directive, 2014). Although the banking sector maintains a 24.2% liquidity ratio (2023), exceeding the minimum, stress tests reveal fragility. A simulated withdrawal by top depositors could fall liquidity to 13 percent, barely above the regulatory threshold (NBE Financial Stability Report, 2024). Moreover, private banks frequently experience cash shortages, delaying customer withdrawals and payments indicating deeper liquidity strains.

While Ethiopian commercial banks maintain regulatory liquidity ratios above the required minimum, emerging evidence suggests underlying vulnerabilities that warrant closer examination. The banking sector's aggregate liquidity ratio of 24.2 percent as of June 2023 appears robust at first glance, yet stress test results reveal that a withdrawal of funds by major depositors could rapidly deplete liquidity buffers to near-critical levels of 13%. This discrepancy between reported ratios and stress scenarios indicates potential weaknesses in how liquidity risk is measured and managed. Furthermore, frequent cash shortages observed at private bank branches demonstrate operational liquidity constraints that are not fully captured by conventional metrics.

The existing regulatory framework, while setting clear minimum liquidity requirements, may not adequately account for the concentration risks posed by large depositors or the day-to-day liquidity pressures faced by banks. There is also limited research examining how factors such as deposit volatility, asset illiquidity, and macroeconomic conditions specifically affect Ethiopian banks' liquidity positions. Without a deeper understanding of these dynamics, banks and regulators may be underestimating systemic liquidity risks.

This study seeks to address these gaps by identifying the key determinants of liquidity risk in the Ethiopian banking context, providing insights that can strengthen both bank-level risk management and regulatory oversight.

1.2 Statement of the Problem

The banking industry is an essential component of economic development, serving as a critical intermediary between savers and borrowers, facilitating payment systems, and enabling credit creation. However, Liquidity risk defined as a bank's inability to meet its short-term financial commitments represents a critical threat to both the stability and operational efficiency of financial institutions. Effective liquidity management is essential for maintaining depositor confidence, ensuring financial stability, and supporting the smooth functioning of the economy. Despite its importance, liquidity risk remains a persistent challenge for banks globally, especially in underdeveloped economies like Ethiopia..

Banking sector in Ethiopia has faced recurring liquidity challenges, despite the implementation of stringent regulatory frameworks by the NBE. These challenges have been exacerbated by factors like high level of non performing loans (NPLs'), volatile macroeconomic conditions, and not efficient liquidity management practices. For instance, recent reports indicate that some banks have struggled to maintain adequate liquidity buffers, leading to disruptions in their operations and raising concerns about systemic stability. This situation underscores the need to identify and address the underlying drivers of liquidity risk in the Ethiopian banking sector.

Globally, research has identified multiple factors affecting liquidity risk, encompassing bank-specific, industry-specific, and macroeconomic elements. For example, Oussama and Mouna (2017) found that capital to total assets ratio, return on assets (ROA), and historical liquidity levels significantly influence liquidity risk. Faruque (2021) highlighted the role of bank size, capital adequacy ratio (CAR), and return on equity (ROE) in determining liquidity positions, with larger banks having more diversified funding sources. Similarly, Musa et al. (2021) emphasized the impact of net interest margins on liquidity, particularly in Islamic banks where interest-based transactions are prohibited. However, these studies often yield inconsistent findings due to variations in methodologies, measurement approaches, and contextual differences across economies.

In the Ethiopian context, studies have also identified various determinants of liquidity risk, but with mixed results. Mesfin (2019) found that capital adequacy, asset quality, bank size, and profitability are crucial factors influencing liquidity risk. Wubetu (2014) emphasized the role of NPLs' in exacerbating liquidity challenges due to their impact on cash flow generation. Adugna and Kebede (2019) identified loan-to-deposit ratio and NPLs' as critical determinants, alongside macroeconomic factors such as economic growth and interest rate fluctuations. Getahun (2015) and Wassihun (2020) highlighted the influence of market related variables and asset quality on liquidity risk. Fikadu (2020) and Aleyenesh (2021) further underscored the importance of profitability, bank size, and macroeconomic variables like growth domestic product (GDP) growth rate in shaping liquidity risk.

Despite these contributions, existing studies on liquidity risk in Ethiopia suffer from several limitations. First, there is a lack of consistency in the identification of key drivers, with some studies focusing narrowly on bank-specific factors while others emphasize macroeconomic or regulatory influences. Second, many studies rely on outdated data or fail to account for recent regulatory changes and emerging challenges in the banking sector. Third, the use of varying liquidity risk measurements like (1) liquid assets-to-total assets ratio, (2) liquid assets-to-deposits ratio, (3) loans-to-total assets ratio, and (4) loans-to-deposits ratio. has led to disunited and often contradictory findings (Aleyenesh, 2021; Maechler et al., 2007; Ghosh, 2010). These inconsistencies highlight the need for a comprehensive and updated assessment of liquidity risk determinants in the Ethiopian banking sector.

This study aims to resolve these inconsistencies by providing a comprehensive analysis of liquidity risk determinants in Ethiopian commercial banks, building on the work of prior researchers while addressing their limitations. Using updated financial data (2000-2023) and drawing on the liquidity measurement frameworks proposed by Maechler et al. (2007) and Ghosh (2010), the research assessed the relative importance of bank-specific characteristics, macroeconomic conditions, and regulatory factors. The findings will offer valuable insights for both bank managers and policymakers, informing more effective liquidity risk management strategies and regulatory approaches tailored to Ethiopia's unique financial landscape. By addressing these research gaps, the study contributes to strengthening the stability and resilience of Ethiopia's banking sector, as called for in the NBE's Bank Risk Management Guidelines (2010).

1.3 Research Questions

The paper addressed the following research questions.

- **a)** What are the specific bank factors that lead to liquidity risk in the banking sector?
- **b)** What are the major macroeconomic drivers of liquidity risk of banks in Ethiopia?
- **c)** What are the relationships between liquidity risk and its key drivers?

1.4 Research Objectives

1.4.1 General Objectives

The main objective of this study was to evaluate and identify the key factors contributing to liquidity risk in Ethiopia's banking sector.

1.4.2 Specific Objectives

- ✓ To examine the effect of bank size on liquidity risk on banking industry of Ethiopia;
- ✓ To investigate the effect of CAR on liquidity risk on banking industry of Ethiopia;
- ✓ To examine the effect of Load to deposit ratio on liquidity risk on banking industry of Ethiopia;
- ✓ To investigate the effect of asset quality on liquidity risk on banking industry of Ethiopia;
- ✓ To examine the effect of GDP growth on liquidity risk on banking industry of Ethiopia;
- ✓ To examine the effect of inflation rate on liquidity risk on banking industry of Ethiopia;
- ✓ To investigate the effect of interest rate spreed on liquidity risk on banking industry of Ethiopia;

1.5 Significance of the Study

In the Ethiopian banking sector, liquidity management is currently receiving attention from regulators and policy advisors in Ethiopia. Moreover, the supervisory body, the NBE has issued a risk management guideline that mandated all banks operating in the country to prepare their own liquidity policies, which obligate them to evaluate the current and potential future liquidity risks of their operations (Bank Risk Management Guidelines, 2010). In addition, studies made to identify the main drivers of liquidity risk lacks consensus and most of these researches are conducted before the liquidity problems in Ethiopia. This study is, therefore, contribute for the banking sector in identifying the relevant factors that leads to liquidity risk and propose possible mitigation mechanisms associated with liquidity. It also has an impact to significantly advances understandings of the variables influencing banks' liquidity in comparison with previous studies made on the area. This study will provide valuable reference material for both banking sector participants and policy makers within the Ethiopian financial industry. It also emphasizes certain areas needing corrective action and implements such adjustments. Additionally, this research will provide a foundation and resource for other studies, and will aid academics and consultants interested in pursuing additional research in the same or related areas

1.6 Scope of the Study

This research aims to explore the factors influencing liquidity risk within Ethiopia's banking sector by utilizing annual financial statements and additional secondary data from commercial banks covering the years 2000 to 2023. This study evaluates both macroeconomic conditions and bank-specific determinants influencing liquidity risk in commercial banks. This study encompasses and incorporate private and public commercial banks that operated in Ethiopia at least for the past five years. In this study, the researcher examines data of 24 fiscal years, or for the period from 2000 to 2023. To this end, the paper uses a panel data with unbalanced observation based on their establishment.

1.7 Limitation of the Study

The study on the determinants of liquidity risk in the Ethiopian banking industry may encounter several limitations that could impact its findings and conclusions. Firstly, the availability and quality of data related to liquidity metrics and risk factors specific to Ethiopian banks could be limited, potentially affecting the depth and accuracy of the analysis. Moreover, the findings of the study may not be easily generalized beyond the Ethiopian context due to its unique regulatory frameworks, market conditions, and economic factors influencing liquidity. In addition, differences in the size, structure, and business models of the Ethiopian banks could introduce variability in liquidity risk profiles, limiting the study's ability to provide a universal assessment.

1.8 Definition of Terms

- ✓ **Commercial Bank** is defined as a financial institution that takes in deposits and provides loans for consumer, business, and real estate purposes.
- ✓ **Private commercial banks** shall refer to banking institutions that are privately owned and established as a shareholding company.
- ✓ **Public banks** shall refer to banks which owned by the government. Currently state-owned bank in Ethiopia are Commercial Bank of Ethiopia (CBE) and Development Bank of Ethiopia (DBE).
- ✓ **Liquidity** shall refers to a bank's capability to finance growth in assets and fulfill obligations when they are due, without facing significant losses.
- ✓ **Liquidity risk** shall refers to the possibility that a bank is unable to fulfill its contractual and contingent commitments. Liquidity risk management guarantees that banks maintain sufficient levels, composition, and duration of funds to back their assets.
- ✓ **Bank-specific variables** shall refer to internal factors that influence a bank's liquidity.
- ✓ **Macroeconomic variables** shall refer to the external sector or country-wide factors that impact bank liquidity and are beyond a company's control.

1.9 Organization of the Study

This study consists of five chapters. Chapter one presented a comprehensive summary of the report, encompassing the research problem and objectives. Chapter two covers literature review, which will include theories and empirical findings along with conceptual framework. Chapter three offers a detailed description of the research methodology, including the research design, methods for data collection, sample size, and the techniques for analysis. The findings of the research and their interpretation in relation to the research questions and existing literature, discusses the implications of the results and their significance presented in chapter four. Summary of the key findings, conclusions based on the research objectives, and recommendations for future research or practical applications were presented in last chapter of the study, chapter five.

CHAPTER TWO: LITERATURE REVIEW

2.1. Introduction

This chapter aims to examine relevant literature connected to the study topic. Therefore, this section will outline the theories related to the subject area, provide an empirical review, and discuss the conceptual frameworks of the study.

2.2. The Concept of Liquidity and Liquidity Risks

The European Central Bank (2009) defined liquidity as firms ability to exchange its present resources of products and services for additional assets. This definition includes two flows. There are two points to comprehend in this definition. The first is that liquidity is associated with flows rather than stocks, therefore liquidity refers as flow of funds among financial system agents. Second, liquidity refers to the liabilities incurred in implementing these flows. The Basel Committee on Banking Supervision (2008) defines liquidity as a financial institution's capacity to: (1) fund asset expansion, and (2) fulfill all financial obligations upon maturity, while avoiding excessive losses.

Financial intermediaries enhance market liquidity by pooling resources, thereby reducing the need for individual economic agents to maintain substantial liquid asset buffers. Diamond and Dybvig's (1983) seminal model demonstrates how banks create liquidity by transforming illiquid loans (assets) into demand-able deposits (liabilities), thereby satisfying random consumer withdrawal demands while financing long-term investments. This intermediate function is especially useful when information asymmetries discourage direct market involvement; as Leland and Pyle (1977) explain, financial institutions mitigate adverse selection by signaling asset quality through their own risk-bearing actions. Holmström and Tirole (1998) go on to show that institutions maximize liquidity allocation by discriminating between private and public liquidity demands, ensuring that nonparticipating agents (such as householders) avoid unproductive liquidity hoarding.

The primary function of the banking system is to fund illiquid, interest-bearing loans with highly liquid assets, typically customer deposits. This maturity transition process is the foundation of liquidity generation (Diamond & Dybvig, 1983). Banks produce liquidity by keeping enough reserves to cover depositor withdrawals while allocating the remainder to higher-yielding, longer-term assets. When there is a mismatch between liquid liabilities and illiquid assets liquidity creation suffers. As Kashyap, Rajan, and Stein (2002) show, banks are inherently vulnerable because they cannot instantly liquidate loans to meet sudden withdrawals, exposing them to rollover risk.

A bank's the ability to meet debts is dependent on both its reserve holdings and the marketability of its assets. When a bank's balance sheet shows insufficient liquid assets—cash or securities that may be swiftly converted—it is subject to solvency difficulties (Brunnermeier, 2009). This danger increases if depositors lose trust, resulting in bank runs (Diamond & Dybvig, 1983) or asset markets freeze, blocking fire sales (Shleifer & Vishny, 2011). Regulatory frameworks such as Basel III address this by requiring liquidity coverage ratios (LCR) to guarantee short-term resilience (BCBS, 2013), but systemic concerns remain when banks collectively under price liquidity risk.

Anthony and Marci (2018) contended that liquidity risk can occur for two reasons. The first is from the liability side, whereas the second is from the asset side. The liability side rationale happens when bank liability holders, or depositors, request prompt payment for their financial claims. When depositors demand cash, banks must either borrow extra funds or sell its assets to meet the demand of the depositors. Consistent with the maturity transformation function of banks (Diamond, 1984), financial institutions maintain minimal cash reserves (non-interest-bearing assets) to maximize profitability through investment in longer-term, interest-bearing instruments. This practice, however, exposes them to liability-side liquidity risk—the inability to meet sudden deposit withdrawals without incurring funding costs or asset fire sales (Diamond & Dybvig, 1983). As with obligation withdrawals, banks can address such liquidity needs by consume cash holdings, sell other current assets, or borrowing additional funds from other sources. However, Banks face a funding cost disadvantage when replacing lost deposits with market-based borrowing, as wholesale funding instruments (e.g., interbank loans, commercial paper) typically carry higher interest rates than core deposits. Bank liquidity will be challenged via "Bank Runs," which occur when a large number of clients remove deposits from a bank simultaneously and promptly because they do not trust the bank will be able to refund their funds in cash and on schedule (Evan et al., 2023).

On the other hand, the Council of European Development Bank argued that liquidity risk is inherent to the Bank's business and results from the mismatch in maturities between assets and liabilities. It may be related to funding – impossibility to obtain new funding and to markets inability to sell or convert liquid assets into cash without significant losses

(Europe Development Bank, 2017). World Bank (2008) defined liquidity risk as the risk of a bank's inability to meet its payment obligations as liabilities fall due.

Banks face inherent liquidity vulnerabilities that operate at both institutional and systemic levels, manifested through two interrelated risks: funding liquidity risk, which arises when a bank cannot meet its cash flow and collateral obligations without impairing its financial stability or reputation (Drehmann & Nikolaou, 2013), and market liquidity risk, which occurs when a bank cannot unwind positions without significantly moving market prices due to inadequate market depth or disruptions (Acharya & Viswanathan, 2011). These risks can create a vicious cycle, as funding shortfalls may force asset fire sales that further depress market prices (Brunnermeier & Pedersen, 2009). To mitigate these risks, banks must diversify funding sources across instruments and maturities while implementing robust liquidity governance frameworks that include clear risk management structures, forward-looking funding strategies, exposure limits, and detailed contingency plans (BCBS, 2013). Although regulatory measures like Basel III's Liquidity Coverage Ratio and Net Stable Funding Ratio have strengthened banks' liquidity defenses, challenges remain in accurately measuring and managing liquidity risk during periods of market stress when traditional correlations often break down (Brunnermeier, 2009), underscoring the need for continuous refinement of liquidity risk management practices in an evolving financial landscape.

2.3. Theories on the Determinants of Liquidity Risk

The research will consider multiple important theoretical frameworks in its search for liquidity risk factors. Start by looking at conventional theories that are based on market micro structure and concentrate on asset pricing and trading mechanics. Next, look at how macroeconomic variables, such as economic cycles and monetary policy, affect the risk of liquidity. Furthermore, take into account behavioral theories that discuss the ways in which the psychology and decision-making processes of market players affect liquidity. Lastly, discuss theories of systemic risk that highlight the connections between markets and financial institutions as well as the consequences for systemic liquidity risk. The researchers hope to give a thorough overview of the variables influencing liquidity risk by combining these many points of view, providing an important knowledge of this crucial component of financial stability and decision-making. In this analysis, it adds to the continuing conversation about how to efficiently manage and reduce liquidity risk in a constantly changing financial environment.

2.3.1. Asset-Liability Mismatch (ALM) Theory

Asset-Liability Mismatch Theory refers to the financial risk that arises when the maturities, duration, or cash flow profiles of an institution's assets and liabilities are not aligned (John C. Hull, 2018). This mismatch can lead to liquidity risk and solvency issues, particularly when there is a inequality between the short-term obligations and long-term assets of an institution (Allan M. Malz, 2015). It, occurs when the financial characteristics of a bank's assets (e.g., loans) do not match with its liabilities (e.g., deposits). This can relate to differences in maturity dates, interest rates, or cash flow timings. There are different mismatch types; firstly, maturity mismatch, when assets and liabilities have different maturities, leading to refinancing risk. Secondly, interest rate mismatch, when assets and liabilities are sensitive to interest rate changes in different ways, leading to interest rate risk. Lastly, currency mismatch, when assets and liabilities are denominated in different currencies, leading to foreign exchange risk. Some of the common reasons for liquidity risks of banks include:

- **Short-term Funding Dependence:** Banks often fund long-term loans with short-term deposits. If depositors withdraw their funds in large, banks might struggle to meet its obligations.
- **Interest Rate Changes:** Changes in interest rates can affect the value and cost of assets and liabilities differently, impacting the bank’s profitability and liquidity
- **Economic Cycles:** During economic downturns, asset values may decline, while liabilities remain constant or grow, exacerbating mismatches.
- **Regulatory Changes:** New regulations can impact the availability and cost of funding, leading to increased liquidity risk.

If banks are unable to turn long-term assets into cash fast enough to pay short-term obligations, they may experience a lack of liquidity. However, if there is a significant gap between the interest rate profiles of assets and obligations, changes in interest rates may result in losses. Therefore, if a bank is unable to pay its debts or if the value of its liabilities exceeds the value of its assets, serious mismatches may jeopardize the bank's ability to remain solvent.

ALM procedures are used by banks to control the risks brought on by mismatches. This includes techniques like gap analysis, which calculates the difference between liabilities and rate-sensitive assets over a range of time horizons. Duration analysis evaluates how sensitively the bank's liabilities and assets are affected by changes in interest rates. hedging against interest rate risk by using interest rate swaps, futures, and other derivatives. Additionally, keeping enough liquid, high-quality assets on hand to meet immediate obligations.

The Diamond-Dybvig Model illustrates how bank runs can result from the maturity mismatch between short-term liabilities (deposits) and long-term assets (loans). Modern ALM Frameworks model and manage the risks resulting from mismatches through sophisticated statistical and mathematical methodologies. These frameworks include scenario analysis, stress testing, and stochastic modeling.

2.3.2. Market Liquidity Theory

Market Liquidity Theory analyzes how easily assets can be traded in the market without causing significant changes to their prices. Market liquidity denotes the capacity to carry out transactions swiftly and at a fair price within a specific market. It is affected by elements like trading volume, bid-ask spreads, and market depth. The liquidity of an asset is influenced by the liquidity of the market where it is exchanged. Markets that are highly liquid, marked by raised trading volumes and tight bid-ask spreads, usually provide increased liquidity for the assets exchanged in them. Market liquidity can vary depending on market conditions. In times of economic stability and high investor confidence, markets may be more liquid, facilitating easy buying and selling of assets. On the other hand, in times of market stress or uncertainty, liquidity can diminish, complicating the execution of trades.

It may be difficult for banks to sell assets that become illiquid during a market downturn in order to meet their liquidity demands. Banks may be obliged to sell illiquid assets at a discount or turn to other, maybe more costly, funding sources as a result, exposing them to liquidity risk. The Market Liquidity Theory highlights the importance of considering market liquidity dynamics when managing liquidity risk. Banks must evaluate the liquidity of their assets in various market scenarios and apply this knowledge to their strategies for managing liquidity risk.

2.3.3. Funding Structure Theory

The theory of funding structures looks at how financial organizations handle their liabilities and finance their operations. Financial institutions receive funding from a number of sources, such as central bank facilities, bond issuance, equity financing, inter-bank borrowing, and consumer deposits. The percentage of various financing sources that a financial institution uses is referred to as its funding mix. A number of considerations, including cost, availability, risk, and regulatory requirements, influence the choice of funding mix. Funding sources that are predicted to be available to the institution for an extended period of time and are less susceptible to fluctuations in the market are referred to as stable funding. Retail deposits, extended wholesale financing, and equity capital are a few examples.

The way financial institutions manage their liabilities and support their operations is examined by the theory of funding structures. A variety of funding options, including bond issuance, consumer deposits, interbank borrowing, equity financing, and central bank facilities, are available to financial organizations. A financial institution's funding mix is the percentage of different sources of finance that it employs. The choice of funding mix is influenced by several factors, such as cost, availability, risk, and regulatory requirements. Stable funding is defined as sources of funding that are expected to remain available to the institution for a longer period of time and are less vulnerable to market volatility. Examples include equity capital, extended wholesale finance, and retail deposits.

2.3.4. Systemic Risk Theory

A sector of financial economics known as "systemic risk theory" emphasizes identifying and controlling risks that may threaten the stability and effective operation of an entire market or financial system. It came about as a reaction to the realization that different financial institutions and markets are intricately linked, and that a single institution failing or a market shock occurring can have a domino impact on the whole system. The extent to which markets and financial institutions are dependent upon one another via a variety of channels, including lending and borrowing, trading in derivatives, and interactions with counter parties. the transfer of shocks or financial distress from one market or institution to another, frequently made worse by exposure to shared risks and connections.

The theory suggests that certain financial institutions are so large and interconnected that their failure could lead to a total economic collapse, requiring government bailouts or other actions to prevent this from happening. Financial entities categorized as Systemically Important Financial Institutions (SIFIs) are those whose failure could put the financial system at risk, necessitating increased capital requirements and regulatory scrutiny. regulatory measures and policies that target vulnerabilities across the whole financial system as opposed to concentrating only on specific institutions in order to reduce systemic risks.

After major financial crises, like the worldwide financial crisis of 2007–2008, which highlighted the importance of comprehending and controlling risks at the systemic level, systemic risk theory has gained popularity. Models and methods are still being developed by academics and decision-makers to better assess, track, and reduce systemic risks in global financial institutions.

2.3.5. Regulatory Environment Theory

The effect of regulatory frameworks on the actions and output of financial institutions is investigated under the Regulatory Environment Theory. Financial institutions are subject to a complicated regulatory framework that is regulated by laws, rules, and oversight organizations. The goals of regulatory frameworks in the financial sector are stability, honesty, and consumer protection. The goals that regulatory bodies set include protecting depositor money, preserving financial stability, averting systemic risk, guaranteeing honest and open markets, and encouraging prudent risk management techniques.

An extensive range of regulatory obligations, including capital adequacy ratios, liquidity standards, risk management policies, transparency obligations, and anti-money laundering laws, must be followed by financial institutions. Financial institutions' business strategy, risk management techniques, capital allocation choices, product offerings, and governance frameworks are all shaped by the regulatory environment. Institutions frequently modify their operations to minimize regulatory risks and comply with regulatory regulations. Financial institutions are subject to regulatory agencies' supervision, examination, audit, and enforcement procedures. Monitoring compliance, evaluating financial soundness, spotting new risks, and fixing flaws are the goals of supervisory operations.

The regulatory environment is unstable, evolving in response to market conditions, regulatory changes, advancements in technology, and transformations in the financial industry. Regulations are regularly reviewed and updated by regulatory bodies to address new issues and bolster the robustness of the financial system. All things considered, the Regulatory Environment Theory emphasizes how important laws are to determining how financial institutions behave, operate, and perform along with preserving the stability and integrity of the financial system.

2.3.6. Behavioral Finance Theory

The study of cognitive biases and psychological variables that affect investor and financial market behavior is known as behavioral finance theory. The field of behavioral finance recognizes that investors are fallible individuals who can be swayed by emotions like fear, greed, overconfidence, and herd mentality. Market abnormalities and illogical decision-making can result from these psychological variables. Cognitive biases that affect investors include confirmation bias, overreaction, anchoring, and loss aversion. These biases can skew investors' assessments of risk and return and cause them to make less-than-ideal investing choices.

Behavioral finance recognizes different market anomalies that traditional finance theories cannot account for, including momentum, value, and size effects. These irregularities indicate that the actions of investors diverge from the principles of rationality and efficiency. Prospect theory, developed by Daniel Kahneman and Amos Tversky, describes how individuals make decisions under conditions of uncertainty. It indicates that persons often place greater importance on possible losses compared to similar gains, showing a preference for risks in loss situations and a reluctance to take risks when it comes to gains.

The field of behavioral finance acknowledges that several variables, including transaction costs, short-selling limits, and behavioral biases, may impose constraints on arbitrage—the financial markets' practice of taking advantage of mispricing. This may result in enduring oddities and inefficiencies in the market. Investors, financial professionals, and policymakers all benefit from an understanding of behavioral biases and market anomalies. The statement highlights the significance of investor education, rigorous decision-making procedures, and regulatory measures in reducing the negative consequences of illogical conduct on financial markets. All things considered, behavioral finance theory improves our comprehension of market dynamics and investor behavior by fusing ideas from behavioral economics and psychology with conventional finance theory.

2.3.7. Information Asymmetry Theory

Information asymmetry theory examines the potential adverse effects when one party in a transaction possesses more or superior information than the other. When one party involved in a transaction possesses more or superior information compared to the other, this situation is referred to as information asymmetry. This disparity in knowledge may make decision-making difficult and result in inefficiencies or market distortions. A lack of information asymmetry can impede market efficiency by impeding the ability of all players to make fully informed decisions. Ineffective markets can lead to asset mispricing, inefficient use of resources, and decreased economic well-being.

Adverse selection occurs when one party possesses more information regarding the characteristics or quality of a product or service than the other, adversely affecting the party with less information. For instance, in the insurance market, people who are more inclined to take risks could be more likely to look for coverage, which would be detrimental to insurers. Due to asymmetric information, moral hazard occurs when one party behaves differently after engaging in a transaction. Moral hazard in the loan markets, for example, might arise if lenders are unable to completely evaluate the risks that borrowers take on. A number of tactics, including as disclosure laws, signaling systems, screening procedures, reputation systems, and the employment of middlemen or third-party verifies, can lessen the impact of information asymmetry.

One type of information asymmetry known as the "principal-agent problem" arises when one person, known as the "principal," transfers decision-making authority to another, known as the "agent," who may have different motivations or interests. Conflicts of interest and agency expenses may result from this mismatch of interests. In financial markets, where investors may have varied levels of access to company information, information asymmetry is common and can result in unequal pricing and trading techniques. All things considered, the Information Asymmetry Theory emphasizes how crucial it is to have measures in place to reduce information disparities and encourage open, honest, and efficient markets.

2.3.8. Macro-Economic Conditions Theory

The Macro-Economic Conditions Theory posits that macroeconomic factors can significantly influence liquidity risks in financial markets and institutions. Economic Cycles: Economic expansions and contractions impact liquidity risks in financial markets. During economic downturns, liquidity risks tend to increase as asset prices may decline, credit conditions tighten, and funding sources become scarcer. Conversely, during economic booms, liquidity risks may decrease as market participants become more optimistic, leading to increased liquidity provision and lower funding costs.

Interest Rates and Monetary Policy: Choices made by central banks concerning monetary policy, including adjustments in interest rates and liquidity provisions, can influence liquidity risks. Reducing interest rates or enacting quantitative easing can enhance liquidity provision by lowering borrowing expenses and fostering a willingness to take risks. On the other hand, enforcing stricter monetary policy can limit liquidity since financing costs increase and risk aversion escalates.

Credit Conditions: Fluctuations in credit conditions, influenced by macroeconomic elements like GDP growth, inflation, and unemployment, may affect liquidity risks. Worsening economic conditions could result in elevated default rates and disruptions in the credit market, decreasing liquidity and heightening counterparty risk. On the other hand, better economic conditions could boost creditworthiness and lessen liquidity risks

Financial Stability: Macroeconomic stability is essential for maintaining liquidity in financial markets. Economic shocks, such as recessions or financial crises, can exacerbate liquidity risks by causing market dislocations, fire sales of assets, and disruptions in funding markets. Policies designed to enhance financial stability, including regulatory changes and macro prudential strategies, can assist in reducing liquidity risks by bolstering the robustness of financial institutions and markets.

Global Macroeconomic Factors: Global economic conditions, including international trade dynamics, exchange rate movements, and geopolitical events, can impact liquidity risks. Economic inter dependencies between countries mean that developments in one region can transmit liquidity shocks to other regions through trade and financial linkages, increasing systemic liquidity risks.

In general, the Macroeconomic Conditions Theory underscores the complex connection between macroeconomic elements and liquidity risks, stressing the importance for financial institutions to oversee and address these risks as economic conditions evolve.

2.3.9. Agency Theory and Bank Liquidity Management

Jensen and Meckling (1976) are pioneer in agency and liquidity management theory and serving as a base for other economics and finance theories. In the context of this theory, conflicts that may arise between principals (shareholders) and agents (managers) have significant effect on liquidity management of banks. Managers may opt to take on excessive risk to boost short-term profits or maintain unnecessarily high liquidity buffers to safeguard against potential losses, which may affect liquidity. The effectiveness of managing liquidity risk is greatly affected by like governance framework, including the composition and board of directors independence, incentive schemes tied to performance metrics, and the monitoring mechanisms of stakeholders. These factors collectively shape managerial decisions regarding liquidity allocation, risk-taking behavior, and the overall resilience of banks. It offers a structure to comprehend how governance and incentive systems influence banks' practices in managing liquidity risk.

Specifically, the theory examined regarding the factors influencing liquidity is as follows. Agency theory identifies determinants of liquidity management primarily through the lens of principal-agent relationships within banks. To begin with, governance structures theory highlights that the governance framework, which encompasses the makeup and autonomy of the board of directors, is vital in supervising managerial choices. Strong governance structures are expected to align managerial actions with shareholder interests, including prudent liquidity management. Secondly, Incentive Schemes, Agency theory suggests that the design of incentive schemes influences managerial behavior regarding liquidity. Performance-based compensation tied to financial metrics like return on assets may incentive managers to focus on immediate benefits over sustained liquidity stability. On the other hand, effective monitoring mechanisms, such as regular reporting, audits, and oversight by shareholders or external regulators, are essential in mitigating agency conflicts. These mechanisms are intended to ensure that managers do not deviate from optimal liquidity management strategies that align with shareholder value.

Risk Management Practices as the determinants also identified, the theory acknowledges that risk management frameworks, including policies for liquidity risk assessment and contingency planning, are integral to mitigating agency conflicts. Through the adoption of strong risk management strategies, banks can improve their ability to withstand liquidity crises and any risk-taking actions driven by agency issues. Central to agency theory is the idea that aligning the interests of managers with those of shareholders can reduce agency conflicts. This synchronizing the goals of executives to make decisions that enhance the long-term financial health and liquidity position of the bank. Finally, Disclosure and Transparency, Transparent communication and disclosure practices are emphasized as mechanisms to reduce information asymmetry between managers and shareholders. Clear reporting on liquidity positions, risk exposures, and strategic decisions enables shareholders to better monitor managerial actions and outcomes.

2.3.10. Pecking Order Theory

Myers and Majluf (1984) were pioneer in pecking order theory. The theory outlines a hierarchy of financing preferences for firms, including banks, which significantly influences liquidity risk management. The theory suggests that companies rank their financing options in this sequence: internal resources, debt, and lastly, equity issuance. This structure inherently influences the way banks handle liquidity risks:

Availability of Internal Funds: The theory posits that companies favor utilizing internally generated funds (like retained earnings) for financing investments and operations prior to pursuing external financing. For banks, this means relying on profits, deposits, or other internal sources to fund lending activities rather than immediately turning to external debt or equity markets.

Cost of External Financing: Pecking Order Theory highlights that firms choose financing options based on their relative costs. Debt is generally preferred over equity because interest payments are typically tax-deductible and perceived as less costly than issuing new equity, which dilutes existing shareholders' ownership. Banks consider the cost of issuing debt, including interest rates and borrowing conditions, when managing liquidity and funding requirements.

Market Conditions: Decisions regarding external financing are shaped by current market factors such as interest rates, investor mood, and general economic stability. During periods of economic uncertainty or tight credit markets, banks may face challenges in accessing external funding, prompting a preference for internal funds or conservative liquidity management strategies.

Theory underscores the importance of maintaining a stable and predictable internal financing base to decrease liquidity risks accompanying with external market fluctuations or adverse financing conditions. By prioritizing internal funds over debt and equity issuance, banks aim to maintain financial flexibility, reduce financing costs, and enhance liquidity management strategies aligned with long-term financial stability.

2.4. Empirical Evidences of the Drivers of Liquidity Risk

This empirical review aims to identify and evaluate the primary drivers of liquidity risk in Ethiopian banks. This research aims to provide a comprehensive insight into the elements affecting liquidity risk in the Ethiopian banking industry by examining factors like regulatory structures, market circumstances, bank-specific characteristics, and macroeconomic impacts. Findings from this analysis will both enrich academic literature and provide applicable guidance for policy makers and banking experts aiming to improve the resilience and effectiveness of Ethiopia's financial system.

2.3.1. Empirical Evidences – Global Level

Numerous studies were carried out to determine the factors which affecting liquidity risk in the banking industry. To meet their research objectives, various scholars use different techniques in their studies. Sukmana and Suryaningtyas (2016) employed panel fixed effect regression techniques to analyze the factors influencing liquidity risk with data spanning from 2010 to 2014, concluding that ROA and NPLs positively impacted banks' liquidity risk. However, liquidity risks negatively affected by CAR. In contrast, their findings revealed that Islamic banks in Indonesia demonstrate a positive relationship between CAR and liquidity risk at banks, while showing a negative relationship between ROA and liquidity risk.

Musa et al. (2021) examined the elements affecting the liquidity of Islamic and conventional banks in Europe and discovered that the net interest margin had no substantial impact on the liquidity ratio of Islamic banks, which is understandable given the prohibition on the usage of interest (riba). On the contrary, larger net interest margins resulted in insufficient liquidity in conventional banks. Capital sufficiency positively influences liquidity in both types of banks. Sita et al. (2016) used a panel data of 17 Islamic banks in Malaysia to examine the determinants of liquidity risk, measured by LCR and NSFR, and applied two groups of variables: microeconomic (size, capital adequacy ratio, profitability, asset quality, and bank specialization) and macroeconomic (GDP and inflation rate). The study's findings demonstrated a substantial association between liquidity risk and macro and microeconomic indicators such as GDP, inflation, CAR, and financing, prompting the suggested implementation of Basel III.

Using the GSL approach, Oussama and Mouna (2017) examined how macroeconomic and banking factors affected the liquidity risk of islamic and conventional banks between 2006 and 2013. They discovered that historical liquidity, ROA, and the capital-to-total-assets ratio of Islamic banks all had a positive and significant influence on bank liquidity. They also demonstrate a significance and negative relationship between liquidity risk and bank size. Additionally, they show that the inflation rate and the ratio of loan loss reserves to gross loans have a small but favorable effect on liquidity. Conversely, they found that bank liquidity was positively and significantly impacted by historical liquidity and return on assets. They also found that the size, age, capital-to-total-assets ratio, growth loans, and inflation rate all significantly and negatively impacted banks' liquidity. Liquidity is impacted by the deposit interest rate in a somewhat significant way. On the other hand, they demonstrate that GDP growth is negligible and detrimental to liquidity.

Faruque (2021) aims to identify the elements that affect liquidity risk in Bangladesh commercial bank’s by examining both external and bank-specific variables that could affect liquidity risk within these institutions. This study examined data from twenty three commercial banks collected from 2005 to 2018, with analysis of regression performed using the panel random effect technique. He discloses that asset size measure as total assets, which is one of bank specific factor that has been shown to be negatively associated with liquidity risk. There is a significant relationship between the CAR, and ROE and the risks associated with liquidity. In terms of macroeconomic factors, the study found that while inflation negatively affects liquidity risks, GDP and domestic credit positively influence bank liquidity. Tariq (2017) conducted a panel data analysis involving 42 Islamic banks across 15 countries to examine the factors influencing liquidity risk from 2007 to 2014. According to the study, liquidity has a insignificant and negative relationship with the cash ratio, securities owned by the bank, bank size, and equity.

Furthermore, the studies found a significant relationship between profit generating assets and weak financing provision with bank liquidity risk.

Agnieszka and Marek (2015) compare the dependencies of two groups of banks: those operating in the original Western European EU member states (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Portugal, Spain, and the United Kingdom) and those operating in the so-called New European Union (Bulgaria, Czech Republic, Hungary, Poland, Romania, Slovenia, and Slovakia). They reveals that, banks operating in the so-called Old European Union have slightly different liquidity risk characteristics than banks operating in the New European Union. However, the researchers uncovered a set of bank specific elements (volume of margin, credit risk level, and inter-bank market action) that affect the level of liquidity risk, irrespective of the liquidity risk metric employed or the region in which they function.

Khalid et al., (2020) used an OLS estimator to conduct the study on the drivers of liquidity risk in Syria Bank with the goal of identifying elements that affect the liquidity risk of Islamic and Conventional banking during the years from 2011 to 2017. They discovered that there is no meaningful difference in liquidity between the two banks. The non-performing financial ratio, bank size, and liquidity predictors have a major influence on the liquidity risk in Islamic banking.

Zahidul et al. (2016) used a sample of thirty listed commercial banks in Bangladesh and employed the random effect estimation technique to assess the factors that influence liquidity. They discovered that the development of the capital market, bank size, and asset quality of banks all had a significant impact on the liquidity risks faced by Bangladeshi banks. Furthermore, the study shows that there are no significant effects of capital adequacy, profitability, managerial quality, GDP growth, or inflation on liquidity risk at Bangladeshi banks. They also revealed that there is a negative relationship between liquidity at Bangladeshi banks and GDP growth, capital market development, inflation, and profitability. However, it is evident that asset quality, bank size, management quality, and capital sufficiency all positively related with bank liquidity risk. They noted that while banks with strong capital adequacy may have been more liquid overall, larger banks will likely absorb more liquidity issues than smaller banks, and as the nation's capital market develops, banks will become less liquid.

The literature review has established that Tisa (2023) explores the Determinants of Liquidity Risk in Indian Commercial Banks, highlighting the factors that impact liquidity risk from 2013 to 2022 using pooled OLS, fixed effects, and random effects techniques. The study indicates that the age of banks significantly and adversely affects liquidity risk across all estimation methods, according to bank-specific factors. Conversely, bank capitalization and size had a positive effect on liquidity risk. Nonetheless, by employing both the loan to deposit ratio and the liquid asset to total assets ratio, it was found that banks' operational efficiency had no notable impact on liquidity risk. Moreover, the results indicate that macroeconomic elements such as GDP and inflation have a favorable effect on liquidity risk.

Acar and Karakas (2022) additionally examined the factors that affect liquidity risk in the Turkish banking industry. The research intends to analyze the macroeconomic and bank-specific variables from 2002 to 2022 by utilizing the OLS estimation method. The study indicates that the liquidity ratios exhibit a negative correlation with the ratio of loans to assets, net interest margin, economic growth rate, central bank interest rate, financial asset ratio, fixed asset ratio, and the deposits to liabilities ratio. A positive relationship is observed when comparing liquidity ratios with the equity ratio, inflation rate, foreign exchange rate, and the natural logarithm of asset size. They observed that foreign exchange and liquidity ratios showed no statistically significant correlation

Vodova (2013) analyzed Hungary's commercial banks to explore the factors affecting liquidity risks within banks between 2001 and 2010 through panel data regression analysis. The study's findings suggest a positive correlation exists between bank profitability, loan interest rates, and banks' capital adequacy. Conversely, a negative relationship exists among the interest rate for inter-bank dealings, bank size, interest margin, and the monetary policy interest rate. The analysis, nonetheless, indicates that there is no notable correlation between bank liquidity and GDP growth rates. The researcher additionally indicates that bank liquidity diminishes with the bank's size since large banks depend on the inter-bank market or the liquidity support of the Lender of Last Resort, whereas small and medium-sized banks maintain a reserve of liquid assets. When the interest rate margin and monetary policy rise, liquidity risk decreases because of increased lending activity.

Naseem (2021) gathered data from 2012 to 2020 employing fixed effect and random effect methods to analyze the determinants of liquidity risk in commercial banks in Pakistan. He discovered that the capital adequacy ratio, liquid assets ratio, and the size of the bank—all measured as a logarithm of total assets—had a statistically significant and negative effect on the liquidity ratio of commercial banks in Pakistan. Conversely, it appears that leverage has a positive and statistically significant impact on liquidity risk. He concluded that although higher leverage at banks during the expected term will elevate liquidity risk, non-performing loans—indicated by the ratio of non-performing loans to total advances—exhibit a negative and statistically insignificant relationship with liquidity risk in Pakistani banks.

Ultimately, after examining relevant literature beyond Ethiopia, Addou and Bensghir (2021) performed a study by collecting data from annual reports of chosen banks for the years 2014 to 2020, employing the multiple regression analysis technique to determine the key elements that influence liquidity risk in Islamic banking within the United Arab Emirates. They found that ROA, representing profitability, and NPL, indicating asset quality, negatively influenced the liquidity gap, calculated as the natural logarithm of the difference between total assets and total liabilities. Consistent with the study's findings, they determined that effective liquidity risk management is essential in the U.A.E. for two reasons: to ensure the stability of the banking industry and to reinforce the overall financial and banking system, particularly to prevent bank failures and liquidity crises among banks.

2.3.2. Empirical Evidences – Researches in Ethiopia

Over the years, numerous empirical studies have been conducted to understand the multifaceted nature of determinants of liquidity risk on the bank industry of Ethiopia, exploring its underlying mechanisms, influencing factors, and broader implications. This section of the review aims to synthesize the empirical evidence on determinants of liquidity risk on the bank, providing a comprehensive analysis of the existing research to highlight key findings, methodological approaches, and areas for future investigation. There are different researchers try to identify factors affects liquidity risk in the banking industry of Ethiopia and they revealed different results based on methodologies used and data used. The next parts will be present the empirical studies conducted within Ethiopia.

Mesfin (2019) used a panel data for 10 major banks over the period of 2010 to 2018 to identify the key factors influencing liquidity risk. The result of the analysis indicated that capital adequacy, asset quality, bank size, and profitability are significant determinants of liquidity risk. Wubetu (2014) made comparison between the determinants of Asset Quality and Bank Liquidity in Ethiopia using data for the period of 2008 to 2013, and found that higher levels of NPLs are associated with increased liquidity risk, as poor asset quality impairs a bank's ability to generate cash flows. The study also revealed that there are differences in how banks manage liquidity based on their size and operational strategies. Teshome (2017), on the other hand, explored the impact of bank size on liquidity risk within the Ethiopian commercial banking sector. He used financial information from various commercial banks over the period of 2012 to 2016, and the research employed quantitative methods to analyze how bank size influences liquidity risk. The research results indicate that larger banks tend to have lower liquidity risk compared to their smaller counterparts.

Getahun (2015) investigated the market and macroeconomic factors that affect liquidity risk in Ethiopia's banking industry. The study used panel data analysis to determine the major variables impacting liquidity risk using information from several commercial banks and macroeconomic indicators from 2010 to 2014. The results show that market-related variables have a major influence on banks' liquidity risk, including financing availability and market liquidity. Furthermore, a number of macroeconomic factors, including interest rates, GDP growth, and inflation, are very important in assessing liquidity risk. The research emphasizes how Ethiopian banks' exposure to liquidity risk is made worse by weak market liquidity and unstable macroeconomic circumstances.

Adugna and Kebede (2019) explored the factors that influence liquidity in Ethiopian commercial banks, with a particular emphasis on a number of significant banks. The study uses multiple regression analysis to determine the major determinants influencing bank liquidity using data from 2010 to 2018. They discovered that important factors influencing liquidity risks at banks include capital adequacy, asset quality, bank size, profitability, and the loan-to-deposit ratio. Furthermore, the study emphasizes how macroeconomic factors like economic expansion and changes in interest rates affect bank liquidity.

Fikadu (2020), which focused on a few banks, examined the variables that influence liquidity in Ethiopian commercial banks. Using data from 2010 to 2018, the study employs multiple regression analysis to identify the key factors driving bank liquidity. The findings indicate that significant variables influencing liquidity include the loan-to-deposit ratio, bank size, profitability, asset quality, and capital sufficiency. Furthermore, the data shows that banks with larger sizes and lower loan-to-deposit ratios generally have better liquidity conditions. The study also highlights the impact of macroeconomic variables on bank liquidity, such as changes in interest rates and economic expansion.

Woldemichael (2018) investigated the factors that influence liquidity risk in Ethiopian commercial banks, using data from a few chosen banks between 2010 and 2017. The findings demonstrate that important factors influencing liquidity risk in Ethiopia's banking sector include the capital adequacy ratio, asset quality, bank size, profitability, and the loan to deposit ratio. Liquidity risk is particularly reduced by increased capital adequacy ratios and profitability; on the other hand, poor asset quality, as demonstrated by a large percentage of non-performing loans, raises liquidity risk. Larger banks are also found to be less vulnerable to liquidity risk. Liquidity risk is further influenced by macroeconomic variables, such as the expansion and growth of the GDP.

Kassa (2019) intended to investigate how monetary policy affects Ethiopia's commercial banks' liquidity. The study aimed to analyze how changes in monetary policy tools, such as reserve requirements and interest rates, affect the liquidity situation of commercial banks in Ethiopia. It did this by combining quantitative analysis and econometric modeling. According to the research, monetary policy significantly affects the liquidity concerns faced by Ethiopia's commercial banks. The study found that adjustments to interest rates and reserve requirements had no impact on the bank's liquidity. Moreover, they delineate diverse pathways via which monetary policy measures influence the liquidity status of commercial banks, encompassing their lending conduct, deposit mobilization strategies, and overall risk management practices.

Tesfaye (2020) looked into Ethiopian commercial banks in particular while examining the factors that affect bank liquidity. The goal of the research is to pinpoint the major variables affecting the liquidity positions of commercial banks in the banking industry in Ethiopia. Based on the research's findings, bank liquidity in Ethiopia is determined by a number of important factors. Firstly, it was discovered that bank liquidity concerns are significantly impacted by macroeconomic factors including GDP growth, inflation rates, and exchange currency volatility. Regulations, like as capital adequacy ratios and reserve requirements also have a significant impact on liquid commercial banks. Furthermore, the liquidity fluctuations inside particular banks are greatly influenced by bank-specific characteristics such asset composition, funding structure, and management policies.

Mekonnen (2017) looks into how the different internal and external factors affect the risk of liquidity in private commercial banks in Ethiopia. A number of variables are examined in the analysis, including market conditions, bank size, asset quality, funding structure, and regulatory environment. The study discovered that a number of variables greatly affect the liquidity risk of Ethiopian private commercial banks. First, observe that factors unique to banks such as capital adequacy, deposit structure, and asset composition have a significant impact on the profiles of liquidity risk. Furthermore, macroeconomic variables like GDP growth, inflation rates, and exchange rate volatility have a big influence on the degree of liquidity risk. Moreover, regulatory factors that affect banks' strategies for managing liquidity risk and their capacity to reduce it include supervisory rules and reserve requirements.

Wubetu (2020) employed secondary unbalanced panel data to investigate the macroeconomic and bank-specific variables affecting commercial bank liquidity in Ethiopia. The empirical analysis relies on a generalized method of moments (GMM) estimation of dynamic panel data from 15 commercial banks during the period from 2009 to 2019. Based on the model's findings, the previous value of deposits and liquidity positively and significantly influenced the liquidity of commercial banks. Nonetheless, capital adequacy, bank scale, interest rate spread, and GDP all exerted a negative and statistically significant influence on the liquidity of commercial banks.

Aleyanesh (2021) found that bank size, profitability, asset quality, lending interest rate, money supply growth, and GDP growth rate have a significant impact on the liquidity risk of private commercial banks in her paper, Determinants of Liquidity Risk in Selected Private Banks of Ethiopia for the Period of 2012 to 2020. The study used balanced panel data from 14 private commercial banks and the random effect regression method. The GDP growth rate, bank size, asset quality, and lending interest rate all have a negative impact on the liquidity risk of commercial banks; in contrast, profitability and money supply have a statistically favorable impact. The study found that the cost of funds and deposit rate had no bearing on the liquidity risk of Ethiopia's private commercial banks.

Wassihun (2020) employed panel regression techniques to analyze data covering the years 2000–2018 for a sample of 7 chosen commercial banks in order to determine the factors influencing the liquidity of commercial banks in Ethiopia. According to the study, there is a statistically significant and negative correlation between loan growth, inflation, NPLs', bank size, and liquidity problems at banks. According to the finding, Liquidity is positively and statistically significantly impacted by interest rate spread and asset quality. Ayele (2018) uses the dynamic panel approach to examine datasets from 2000 to 2016 in an attempt to determine the factors that influence banks' liquidity empirical evidence through panel regression analysis on a selection of big asset commercial banks in Ethiopia. According to the research, the three liquidity measurements—L1, L2, and L3—that evaluate the risk of large asset size commercial banks' liquidity are significantly impacted by the bank's size, loan growth, ROA, and interest rate margin. Furthermore, the study discovered that real deposit interest rate, a macroeconomic indicator, had a statistically significant effect on liquidity. Government policy and the preceding lag variable also had statistically significant effects on liquidity as dummy variables.

In their study, "Determinants of Commercial Banks Liquidity in Ethiopia," Bayileyegn et al. (2022) utilized the fixed effect model technique to determine the determinants by considering the years 2000 to 2009. The study's findings showed that the following factors statistically significantly increase the risk of commercial banks' liquidity in Ethiopia banking industry: NPLs', exchange rate fluctuations, loan growth, interest rate spreads, and bank size. Fentaw (2016) employed a fixed effect unbalanced panel data estimation method to examine data from Ethiopia between 2005 and 2014, revealing that the CAR, total loan to total asset ratio, and total deposit to total asset ratio negatively and significantly influence the liquidity risk of commercial banks.

Zelalem (2020) utilizes a two-stage least squares (2SLS) balanced panel estimation approach to examine the connection between profitability and liquidity risks in Ethiopia's banking sector from 2014 to 2019. The first equation in the analysis found that, that net loans and advances negatively affect bank liquidity, whereas bank profitability, foreign exchange supply, and real GDP growth positively influence bank liquidity. The empirical result of the second equation reveals that, although overall non-interest income and expectation positively and significantly effects bank profitability, bank liquidity has also a positive effect on bank profitability, even if it is small. Furthermore, Kinfe (2019) used data from thirteen private commercial banks' financial statements from 2000 to 2017, as well as unbalanced panel data and the random effect regression technique, to attempt to examine the drivers that influence liquidity risks in Ethiopia's banking industry. He discovered that operational inefficiencies, leverage, loan growth, and ROA all had a an impact on private commercial banks' liquidity risk. Liquidity risk is also heavily influenced by the expansion of the money supply and lending rates. However, the study discovered that the real GDP growth rate, tangibility, and bank size are not the only factors influencing Ethiopian private commercial banks' liquidity concerns.

Mekbib (2016) sought to determine the factors by using a balanced panel fixed effect regression model to examine data from a sample of six private commercial banks in Ethiopia spanning the years 2000 to 2015. The research findings indicated that although non-performing loans, profitability, and inflation positively and significantly influence the liquidity of Ethiopian private commercial banks, both bank size and loan growth negatively and significantly affect it. However, there exists no statistically significant relationship between the liquidity of Ethiopian private commercial banks and capital adequacy, interest rate margin, real GDP growth rate, loan interest rates, or short-term interest rates. Nigist (2015) analyzed data from ten Ethiopian commercial banks between 2007 and 2013 to assess the factors driving liquidity problems. Employing the balanced panel fixed effect regression model, she discovered that although bank size positively and significantly affects liquidity, capital adequacy, profitability, and the real GDP growth rate negatively and significantly influence the liquidity of Ethiopian commercial banks. On the other hand, it was found that nonperforming loans, loan growth, the inflation rate, and the interest rate margin had a statistically insignificant or no impact on the liquidity of Ethiopian commercial banks during the study period.

Tigist (2019) applied a balanced panel fixed effects regression model to examine data she collected from 2008 to 2018. She discovered that private commercial banks have a reduced ability to withstand shocks to liquidity. The research additionally revealed that the size of a bank negatively and significantly influences liquidity, whereas loan loss provisions, the unemployment rate, and capital adequacy positively and significantly affect liquidity. Nonetheless, loan growth, nonperforming loans, and the growth rate of real GDP do not have a statistically significant impact on the liquidity of private commercial banks in Ethiopia. Tseganesh (2012) discovered that the CAR, bank size, proportion of non-performing loans, interest rate margin, inflation rate, and short-term interest rates positively and significantly affect liquidity risk. These results were derived from data spanning 2000 to 2011 and employed the balanced fixed effect panel regression method. Additionally, the analysis revealed that the real GDP and loan growth had minimal impact on the liquidity issues within Ethiopia's banking sector.

2.5. Conceptual Framework for the Determinants Liquidity Risk

Building upon the conceptual framework outlined, which integrates various theories and empirical findings regarding liquidity risk management in the banking sector, it becomes evident that effective management is essential for banks to sustain their ability to meet financial obligations without incurring significant losses. Within the realm of the Ethiopian banking sector, this framework is especially relevant considering the distinct economic and regulatory landscape in which Ethiopian banks function Liquidity risk in banking arises primarily from discrepancies between the durations of assets and liabilities, potentially leading to a liquidity crisis if not managed prudently (Basel III). The conceptual framework analyzes insights from theories such as those on market liquidity, financial inter mediation, and risk management, which emphasize the importance of ensuring sufficient liquidity reserves, assessing asset quality, and adhering to the regulatory standards established by the NBE.

NBE has been essential in monitoring liquidity risk management procedures for banks in Ethiopia, ensuring they adhere to regulatory guidelines that promote strength and robustness in the financial system. Moreover, the conceptual model posits that liquidity risk in Ethiopian banks is shaped by a combination of internal and external influences. Internal elements include bank-specific variables like, CAR, asset quality metrics (including NPLs'), and management strategies. These elements directly influence a bank's capacity to handle liquidity efficiently and react to evolving market circumstances. Conversely, external elements comprise macroeconomic conditions like GDP growth rates, inflation rates, and stability of interest rates.

The financial industry in Ethiopia is highly dependent on the dynamic interaction of macroeconomic variables, regulatory actions, and bank-specific attributes as drivers of liquidity risk. Macroeconomic factors like inflation and economic development have a big impact on regulatory reactions. For instance, banks generally experience increased deposit amounts and reduced default rates in times of robust economic expansion, potentially leading regulators to enforce more relaxed liquidity regulations. This highlights a crucial connection between prevailing economic conditions and regulatory frameworks. Regulations directly affect how banks handle particular liquidity issues as well. NBE and other regulatory frameworks impose minimum liquidity norms on banks, forcing them to use prudent asset and liability management techniques. Agency theory is relevant here because well-crafted rules make banks' operations more aligned with the requirements of depositors and the broader economy, which improves the banks' overall liquidity positions.

Furthermore, it is impossible to ignore the connection between macroeconomic variables and bank-specific procedures. Liquidity risk could be exacerbated, for example, if a bank has a large maturity mismatch between its long-term assets and short-term liabilities and finds it difficult to fulfill its obligations during a recession. The general condition of the economy greatly influences the quality of a bank's loan portfolio as well. During times of economic hardship, high percentages of non-performing loans can severely restrict cash flows, making liquidity issues worse.

By integrating these diverse factors into the conceptual framework, the research seeks to offer a thorough comprehension of the drivers of liquidity risk specific to the Ethiopian banking industry. This comprehensive method enables the recognition of essential risk factors and the formulation of strategies that improve banks' ability to withstand liquidity shocks, thus fostering financial stability and promoting sustainable economic growth in Ethiopia.

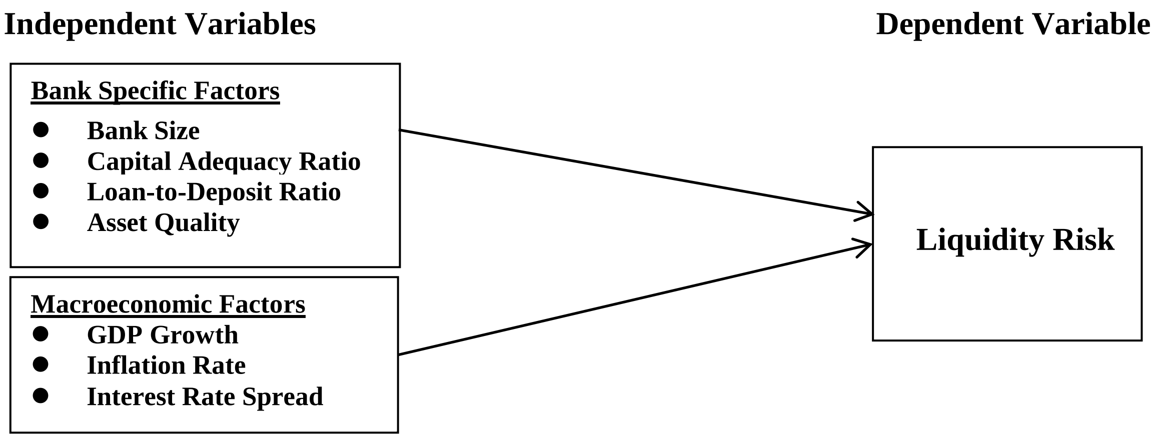

Figure 1: Conceptual Framework adopted from theoretical and empirical evidence

CHAPTER THREE: RESEARCH METHODOLOGY

3.1. Introduction

In this section, efforts will be made to develop a research design, identify data sources, and describe variables and methods of data analysis to address research questions and achieve research objectives. In this case, the researcher must select from a variety of processes, models, and study methodologies. In addition, the researcher will describe the steps and methodologies used to analyze the data. Furthermore, the subject of how to gather data, the reasons for selecting a specific method of data collection, techniques used to analyze data sets, and other questions will be addressed, allowing the researcher to simply choose and make decisions on the ways to answer the questions of the study.

3.2. Description of the Study Area

This study tried to identify potential drivers of liquidity risk on banking industry in Ethiopia for the period of 2000-2023. Ethiopia can be found in the eastern part of Africa, features diverse landscapes including highlands and plateaus, with Addis Ababa as its capital and financial hub. The economy is rapidly growing, driven by agriculture, manufacturing, and services. The banking sector includes commercial banks, a development bank, and microfinance institutions, operating under the regulatory oversight of the NBE. Macroeconomic indicators like GDP growth, inflation rates, and FDI trends impact banking operation. Political stability, demographic trends, and the legal environment also influence banking operations. This context underscores Ethiopia's relevance for studying liquidity risk in banks, seeking to address gap in the current literature and provide meaningful perspectives to the discipline .

3.3. Research Approach

The benefits of generalizing results stem from the representation of the population through large sample sizes, the ability to share and replicate the documentation of methods and frameworks, the potential for conducting the study over time using standardized methods, and overall time efficiency. Therefore, the quantitative research approach helps the researcher to observe the connection between the liquidity of commercial banks and the important bank-specific and macroeconomic factors affecting banks liquidity in Ethiopia by establishing causal relationship.

3.4. The Research Design

This study adopts a quantitative research approach due to its ability to systematically evaluate extensive datasets and generate statistically significant results. The quantitative method enables the application of rigorous statistical techniques to identify patterns, trends, and causal relationships that enhance the understanding of liquidity risks in Ethiopian banks. By analyzing secondary data from bank financial statements and regulatory reports, this research design provides an empirical foundation for examining liquidity risk determinants. The quantitative approach ensures objectivity and replicability while allowing for robust hypothesis testing through econometric models. Ultimately, this methodology facilitates a comprehensive, data-driven analysis of liquidity risks in the Ethiopian banking sector.

This research employs a causal approach. A causal research strategy is employed to identify the extent and nature of cause-and-effect relationships (Zikmund, 2012). As a result, the variables chosen, the sample plan, the data collection and analysis strategy, and other research design aspects will be discussed in the following section to to address research questions and achieve research objectives..

3.5. Description of Variables

In conducting a thorough examining of liquidity risks it is essential to precisely define and describe the variables to be examined. Variables in this context refer to the measurable factors that may influence liquidity risks, thereby forming the foundation upon which this research is built. Thus, the next section will present both dependent and independent variables operational definition accordingly.

A. Dependent Variable

Liquidity Ratio (LR): Based on the Basel standard liquidity assessment, the LCR and NSFR are key indicators; additionally, the ratio of a bank's liquid assets to its total assets serves as another common metric. In align with this NBE calculates liquidity as the ratio of total liquid assets held to net current liabilities (Deposits), the total liquid assets consist of cash on hand, deposits with other banks, foreign and local currency, T-bills, deposits with NBE, and net-due from other banks. Thus, choosing the appropriate measurement of the variable is essential for addressing research questions and meet research objectives.

Based on the availability of the data the study was used the measurement of liquidity as ratio of total liquid asset held to net current liability.

B. Independent Variables

A number of independent variables was taken into consideration in order to thoroughly examine liquidity concerns. These variables include both external and internal factors that are thought to affect Ethiopian banks' liquidity risk.

i) Bank Specific Variables

Bank Size (BS): Measured by the bank's overall assets. To decrease the size of the bank size, the paper was taken the natural log of the total assets collected from chosen banks.

Capital Adequacy Ratio (CAR): This is the proportion of a bank's capital compared to its risk-weighted assets. Regulatory frameworks like Basel III recognize this dynamic and establish criteria that address both components to enhance the overall the strength of the financial sector. Effective management of all elements is critical to financial institutions' long-term stability and performance. As a result, the study utilized the proportion of a bank's capital compared to its risk-weighted assets ratio to measure the selected banks' capital adequacy.

Asset Quality (AQ): It is measured as loan provision to loan and advance. It indicates how much of the loans are set aside as provisions to cover potential losses due to defaults or NPLs'. A greater ratio signifies that the bank has allocated a bigger share of its loans as provisions, which could signal higher credit risk or a deteriorating loan portfolio. A smaller ratio implies that the bank allocates a lesser share of its loans for provisions, possibly signifying a more robust loan portfolio with reduced credit risk. Effective management of asset quality and liquidity risk, including rigorous monitoring, diversification, and regulatory compliance, is critical for a the financial well-being of the bank and stability. The paper used loan provision to loan and advance as measurement of asset quality of the banks.

Loan-to-Deposit Ratio (LDR): Measured as as the proportion of a bank's overall loans to its total deposits. Higher ratios may indicate increased liquidity risk. The LDR ratio is an essential indicator of a bank's liquidity risk. A high LDR can imply more liquidity risk due to the widespread usage of deposits for loans, whereas a low LDR signals stronger liquidity but possibly at the expense of profitability. Effective LDR management requires combining profitability with the requirement to maintain sufficient liquidity to satisfy obligations. Banks must employ robust liquidity management strategies, including diversifying funding sources, maintaining liquidity buffers, and aligning asset and liability maturities, to mitigate the risks associated with both high and low LDR. In this paper Loans to deposit ratio collected from the banks will be taken as measurement of LDR.

ii) Macroeconomic Variables

GDP Growth Rate (GDPR): Represents the nation's growth rate and economic performance. Liquidity risk in the banking industry is strongly impacted by GDP growth. In general, positive GDP growth improves liquidity through raising deposits, strengthening asset quality, and enhancing market confidence. In contrast, low GDP growth can increase the risk of liquidity problems by lowering trust, increasing loan default rates, and creating funding difficulties. To effectively manage the liquidity risks associated with fluctuating economic situations, banks must implement effective management methods such as creating liquidity buffers, diversifying financing sources, and preserving asset quality. Maintaining financial stability and resilience requires an understanding of the connection between GDP growth and liquidity risk. At all GDP Growth (GDPR) represents a nation's economic performance and is crucial for managing liquidity risk in the banking industry. Positive GDP growth boosts deposits, asset quality, and market confidence, while low growth can increase risk. Banks must implement liquidity buffers, diversify financing, and preserve asset quality for financial stability.

Inflation (INFR): Measures the rate at which the overall prices for goods and services rise. The rate of inflation each year. A high rate of inflation may affect an asset or liability's true value. Via a number of channels, including depositor behavior, interest rate volatility, and funding costs, inflation significantly influences liquidity risk within the banking sector. Because high inflation raises funding costs, distorts interest rates, and reduces the real value of deposits, it generally increases the risk of liquidity. On the other hand, low and steady inflation promotes loan demand, preserves depositor confidence, and stabilizes interest rates in order to provide liquidity. To successfully manage the impact of inflation on liquidity risk, banks must implement effective management methods, such as strengthening liquidity buffers, controlling interest rate risk, and preserving cost effectiveness. In conclusion, inflation influences the typical pricing of goods and services, impacting the genuine value of assets or liabilities. High inflation increases liquidity risk due to increased funding costs, interest rate distortion, and reduced deposit value. Low inflation promotes loan demand and stabilizes interest rates. Effective management methods include strengthening liquidity buffers and controlling interest rate risk.

Interest Rate Spread (INTR): Calculated as the difference between the average interest rates for lending and deposits. It calculates the gap between the typical interest rate a bank receives on its loans (lending) and the average interest rate it paid on its deposits. This spread serves as a crucial measure of a bank's profitability from its core lending and deposit-taking activities. The central bank determines the borrowing costs and the interest rates on deposits, influencing the overall economy. Interest rates significantly influence liquidity risk in the banking industry through a number of different processes, such as depositor behavior, financing costs, asset-liability mismatches, and loan demand. Because of higher borrowing costs and possible mismatches in asset and liability repricing, high interest rates typically raise the risk of liquidity problems. On the other hand, while low interest rates might stimulate demand for loans and minimize funding costs, they can also cause depositors to leave in search of better returns. Grasping the connection between interest rates and liquidity risk is essential for preserving banks' financial stability and robustness.

Table 3.1: Dependent and Independent variable unit measurement, sing and source

Variable	Unit of Measurement	Expected Sign
Liquidity Ratio (LR)	Total Liquid Asset/Current Liability	
Bank Size (BS)	Log of Total Bank Asset	+
Capital Adequacy Ratio (CAR)	Bank's capital to risk-weighted assets	+
Asset Quality (AQ)	Loan Provision/Total loans	-
Loan-to-Deposit Ratio (LDR)	Total loans to Deposit ratio	-
GDP Growth (GDPG)	GPD growth rate	+
Inflation (INFR)	Inflation rate	-
Interest Rate Spread (INTR)	Average Lending minus Average Deposit Rate	-

3.6. Population, Sampling Design, and Sample Size

3.6.1. Population of the Study

The research populations include all commercial banks that have been in operation up to the fiscal year 2022/23. According to the NBE, as of 2023, there are 31 commercial banks and 1 Development Bank within the country. From 31 commercial banks 30 banks are private commercial banks and 1 bank is state bank. These are; Commercial Bank of Ethiopia, Awash Bank S.C., Dashen Bank S.C., Bank of Abyssinia, Wegagen Bank S.C., Hibret Bank S.C., Nib Int. Bank S.C., Cooperative Bank of Oromia, Lion Int. Bank S.C., Oromia Bank S.C., Zemen Bank S.C., Bunna Bank S.C., Berhan Bank S.C., Abay Bank S.C., Enat Bank S.C., Addis Int. Bank S.C., Global Bank S.C., ZamZam Bank S.C., Shabelle Bank S.C., Goh Betoch Bank S.C., Hijra Bank S.C., Ahadu Bank S.C., Siinqee Bank S.C., Tsehay Bank S.C., Gadaa Bank S.C., Omo Bank S.C., Amhara Bank S.C., Tsedey Bank S.C., Rammis Bank S.C., Sidama Bank S.C., Siket Bank S.C.

3.6.2. Sampling Design

The sampling method enables researchers to draw conclusions about the population from the findings of a chosen sample, instead of including everyone. Decreasing the participant count in a study reduces expenses and effort and can facilitate obtaining high-quality data, but this needs to be weighed against ensuring the sample size is large enough to possess adequate power to identify a genuine relationship.

The method of sampling employed in this research will be purposive sampling method where researcher choose to examine banks operated more than five years in the industry (i.e., purposive sample) that have a particular set of characteristics. The researchers choose this method for two reasons first, to get detail information for analysis, secondly, the characteristic shared by the banks, considered to be common.

3.6.3. Sample Size

The study examines 17 established commercial banks in Ethiopia that have been operational for at least five years as of 2023. While the country currently has 31 licensed commercial banks, the analysis focuses on this subset of more mature institutions to ensure data reliability and analytical depth. The five-year operational threshold was applied because younger banks often lack sufficient historical financial data for meaningful liquidity risk assessment, as noted in the NBE 2023 banking sector report.

This approach aligns with established banking research methodologies that prioritize analyzing institutions with adequate operational history to identify meaningful trends. According to the NBE 2024 Financial Stability Report, these 17 banks collectively hold over 90% of the banking sector's assets, making them particularly significant for understanding systemic liquidity risks. The study period from 2000 to 2023 was selected to capture multiple economic cycles and regulatory changes, providing a comprehensive view of liquidity management practices over time.

While this focused approach provides robust insights into Ethiopia's core banking sector, it does exclude newer market entrants that collectively account for less than 10% of deposits. Future research could expand the analysis as these younger banks develop longer operational track records and accumulate more substantial market shares. This methodological choice follows precedents set by similar banking studies in emerging markets, such as those by Faruque (2021) and Aleyenesh (2021), which have demonstrated the value of concentrating on established institutions when analyzing financial stability issues.

3.7. Source and Types of Data

Conducting suitable data collection technique assist researchers to address the shortcomings of any source of data in order to reduce the risk of an irrelevant result. Consistent and reliable research implies that research conducted with adequate data collection equipment increases the reliability and worth of study findings (Koul 2006). To meet the study's objectives, quantitative data is gathered from secondary data sources.. The study collects bank-specific data from audited financial statements of banks, as well as industry-specific and macroeconomic data from NBE annual reports from 2000 to 2023, to ensure credibility and reliability.

3.8. Data Presentation and Methods of Data Analysis

In examining the factors contributing to liquidity risks in Ethiopia's banking sector, rigorous data presentation and robust methods of data analysis are essential to derive meaningful understanding and add to the current body of knowledge. This section outlines the approach taken to present, and analyze data pertaining to the variables identified on the study, providing a transparent framework for understanding the methodologies employed in this study. The researcher utilized both descriptive and multiple regression data analysis techniques to assess the influence of independent variables on the dependent variable..

In descriptive statistics, which is calculated over the raw data, help to have a clear understanding of the dataset. It provides the average, highest, lowest, and standard deviation for every variable. The presentation of data serves as the foundation for assessing and interpreting liquidity risks in Ethiopian banks. Comprehensive datasets sourced from NBE provide the empirical basis for analysis. These datasets encompass quantitative measures of identified dependent and independent variables. Through precise organization and systematic presentation, this section aims to provide clarity and transparency in setting the underlying trends and patterns relevant to liquidity risks.

In data analysis, the research thoroughly investigates the connections between dependent and independent variables, providing insights into the elements contributing to liquidity risks in Ethiopian banks. Due to the quantitative aspect of the research and reliance on secondary data, statistical methods will be crucial for extracting significant conclusions.

3.9. Panel Unit Root

A panel unit root test is a statistical method employed to investigate the existence of a unit root in a panel data set, which consists of multiple time series observations (cross-section units) and multiple time points (time series). The test assesses whether each individual series exhibits a unit root, indicating non-stationary, or if they are stationary. Due to the nature of the data type thus, it is needed to test unit root test.

The panel unit root test reduces the possibility of false regression and verifies that the model's variables are stationary (Breitung and Pesaran 2005). The study employed the Im-Pesaran-Shin (IPS) panel unit root test due to its methodological advantages in addressing the specific characteristics of the dataset and research objectives. Unlike first-generation unit root tests that assume cross-sectional independence, the IPS test accommodates heterogeneity across panel units a critical feature given the varying operational scales and liquidity profiles of the 17 sampled Ethiopian commercial banks (Im et al., 2003). This aligns with Breitung and Pesaran's (2005) emphasis on tests that mitigate false regression risks in panel analyses.

The IPS test is particularly suitable for this study because it: (1) allows for individual-specific autoregressive coefficients, recognizing that banks may exhibit distinct liquidity adjustment dynamics; (2) provides greater power in finite samples compared to alternatives like the Levin-Lin-Chu test, which imposes restrictive homogeneity assumptions (Baltagi, 2008); and (3) effectively handles unbalanced panels—a potential issue given Ethiopia's evolving banking landscape over the 2000–2023 period. These advantages are consistent with recent applications in banking research (e.g., Faruque, 2021) where institutional heterogeneity is empirically significant. The test's null hypothesis of non-stationarity will be evaluated at conventional significance levels, with any unit root findings necessitating appropriate differencing to ensure valid inference. Consequently, the stationary of the variables is tested using the model that follows.

$$\Delta \boldsymbol{y}_{i,t} = \boldsymbol{\alpha}_i + \boldsymbol{\theta}_t + \boldsymbol{\delta}_i \boldsymbol{t} + \boldsymbol{\rho}_i \boldsymbol{y}_{t-1} + \sum \mathrm{a}_i \Delta \boldsymbol{y}_{t-i} + \boldsymbol{v}_{i,t} \text{ ....1}$$

Where: $\Delta \boldsymbol{y}_{t-i}$ is The initial difference operator refers to the sequence of observations for banks i from t=1 to n periods. The panel unit root test presents the null hypothesis H0: = 0 for every i, which assumes that all series exhibit stationary.

The researcher analyzed the data using inferential statistics, to visualize the association between variables. The researcher employed a multivariate regression model to estimate categorical variables using an econometric approach. The researcher conducted diagnostic tests to determine if the assumptions of the classical linear regression model (CLRM) were upheld or not. Brook (2008) contends that panel data presents more intricate difficulties than both time-series and cross-sectional data. It can increase the degrees of freedom by utilizing data on the dynamic behavior of many entities simultaneously, as well as aid to alleviate problems of multicollinearity among explanatory variables that may develop if time series are modeled separately.

3.10. Estimation Techniques

Considering the panel structure of the data, suitable econometric methods have been used to estimate the model. Various estimation methods exist including dynamic estimation like First difference estimator, Pooled OLS, Seemingly Unrelated Regression (SUR) and other dynamic estimators are available to estimate panel data analysis however, In financial research, there are typically two kinds of panel estimator techniques: fixed effects models and random effects models. The fixed effect refers to a non-random, constant quantity that affects the outcome of a model. It is a characteristic that remains unchanged across observations, such as a group mean or a unit-specific attribute. In contrast, random effects are assumed to be drawn from a probability distribution and vary randomly. In a fixed effects model, the model parameters are fixed or non-random quantities, whereas in random effects models, some or all of the model parameters are random variables. Fixed effects models are utilized to manage unobserved differences or individual-specific effects that remain constant over time or among various levels of a categorical variable. In a random effects model, it is assumed that there is variation between studies or entities, and the calculated effect size has a more conservative value. This model is appropriate when there is heterogeneity between studies or entities, and it allows for unconditional inferences to be made, meaning that the results can be generalized beyond the individual studies or entities included in the analysis.

The Hausman test is a statistical hypothesis examination that assesses the consistency between the chosen model (random effects or fixed effects) and an alternative model. The null hypothesis posits that the favored model (random effects) is stable, whereas the alternative hypothesis suggests that the fixed effects model is unstable. If the p-value of the test exceeds 0.05, the null hypothesis is accepted, showing that the random effects model is reliable and favored. If the p-value is below 5 percent, the null hypothesis is discarded, suggesting that the fixed effects model is reliable and favored.

3.11. Regression Model Specification

Comprehending the factors behind liquidity risk is crucial for both bank management and policy makers to mitigate potential risks and ensure a stable banking sector. This section outlines the specification of the econometric model used to analyze the factors influencing liquidity risk in the Ethiopian banking industry. On the basis of the literature review and theoretical considerations, the conceptual framework for this study includes both bank specific and external factors that influence liquidity risk. Internal factors include bank-specific characteristics such as size, CAR, asset quality, and LDR. External factors include GPD growth, Inflation rate and Interest rate spread.

Regression analysis assists in measuring the connection between dependent variables and independent variables. Systematically modeling these relationships enables easy identification of the key determinants of liquidity risks in Ethiopian banks. This approach not only provides empirical evidence but also informs strategic decision-making and risk management practices within the banking sector.

Consistent with the nature of the data used, which was panel data, this study follows a panel data model, which is thought to offer advantages over cross-sectional and time series data methodologies. On the basis of the objective of the research and data, the study used the equation stated below to analyze the drivers of liquidity risks in Ethiopia banking industry.

$$\boldsymbol{LR_{it} = \sum_{i=1}^{n} B_i\,(BSV_{it}) + \sum_{i=1}^{n} B_i\,(MEV_{it})} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 2$$

Where:

$\sum_{i=1}^{n} B_i\,(BSV_{it})$ is sum of bank specific variable of liquidity determinant and
$\sum_{i=1}^{n} B_i\,(MEV_{it})$ is sum of macro economic variable of liquidity determinant.

In accordance with the aims of the research, the above general regression equation further decomposed into bank specific factors and their relationship with liquidity risk, which is expressed in equation two below.

$$\boldsymbol{LR_{it} = \alpha + \Sigma\beta_1\,(BS_{it}) + \Sigma\beta_2\,(CAR_{it}) + \Sigma\beta_3(AQ_{it}) + \Sigma\beta_4\,(LDR_{it}) + \varepsilon_{it}} \ldots\ldots\ldots\ldots 3$$

Where:

- LR_{it} is the dependent variable representing liquidity risk for bank i at time t;
- BS_{it} is the size of bank i at time t;
- CAR_{it} is the capital adequacy ratio of bank i at time t;
- AQ_{it} is the asset quality of bank i at time t;
- LDR_{it} is the loan-to-deposit ratio of bank i at time t;
- α is the intercept term;
- $\beta_1\ \beta_2\ \beta_3\ \beta_4$ are the coefficients of the independent variables, and
- ε_{it} is the error term.

In the second model, liquidity risk is associated with both bank specific and macroeconomic variables so as to identify the impact of each variable on liquidity risks of banks and it is expressed as:

$$\boldsymbol{LR_{it}} = \boldsymbol{\alpha} + \Sigma\, \boldsymbol{\beta_1}\, (\boldsymbol{BS_{it}}) + \Sigma\, \boldsymbol{\beta_2}\, (\boldsymbol{CA_{it}}) + \Sigma\, \boldsymbol{\beta_3} (\boldsymbol{AQ_{it}}) + \Sigma\, \boldsymbol{\beta_4}\, (\boldsymbol{LDR_{it}}) + \Sigma\, \boldsymbol{\beta_5}\, (\boldsymbol{GDPR_t}) + \Sigma\, \boldsymbol{\beta_6}\, (\boldsymbol{INFR_t}) + \Sigma\, \boldsymbol{\beta_7} (\boldsymbol{INTR_t}) + \boldsymbol{\varepsilon_{it}} \ldots\ldots\ldots 4$$

Where:

- LR_{it} is the dependent variable representing liquidity risk for bank i at time t;
- BS_{it} is the size of bank i at time t;
- CAR_{it} is the capital adequacy ratio of bank i at time t;
- AQ_{it} is the asset quality of bank i at time t;
- LDR_{it} is the loan-to-deposit ratio of bank i at time t;
- $GDPR_t$ is the GDP growth rate at time t;
- $INFR_t$ is the inflation rate at time t;
- $INTR_t$ is the interest rate spread at time t;
- α is the intercept term;
- β_1 β_2 β_3 β_4 β_5 β_6 β_7 are the coefficients of the independent variables, and
- ε_{it} is the error term.

CHAPTER FOUR: DATA ANALYSIS, PRESENTATION AND DISCUSSION

4.1. Introduction

This chapter will reveal the results of the empirical study performed to determine the factors influencing liquidity risk in Ethiopia's banking sector from 2000 to 2023. This section is organized to offer a precise and thorough explanation of the findings, connecting them to the research goals and current literature. The study utilizes panel data regression models to explore the connection between liquidity risk and various bank-specific and macroeconomic factors. The results are divided into two sections: initially, the descriptive statistics give an outline of the data and major trends, while subsequently, the regression findings reveal factors influencing liquidity risk.

The conversation situates the findings within the wider theoretical and empirical context, emphasizing their significance for liquidity risk management, regulatory policy, and financial stability in Ethiopia. This section, by put the results with earlier research, also highlights areas of agreement and disagreement, adding to the continuous discussion on liquidity risk within the banking industry. In conclusion, this section seeks to deliver practical recommendations for policymakers, banking executives, and various stakeholders, while also establishing a foundation for subsequent research.

4.2. Descriptive Statistics

Descriptive statistics offer an overview of the main features of the data utilized in this research, giving an initial insight into the variables and their distributions. This part demonstrates the general patterns of the bank-specific and macroeconomic factors featured in the analysis. This section focuses on the overall behavior of the data and identifies significant patterns or outliers by analyzing metrics like mean, standard deviation, minimum, and maximum values. These insights are essential for framing the following regression analysis and guaranteeing the strength of the empirical results. Additionally, the descriptive statistics provide a basis for comprehending the dynamics of liquidity risk in the Ethiopian banking industry, preparing for a more in-depth investigation of its factors. Based on collected secondary data the study present descriptive statistic of both dependent and independent variables for the period from 2000 to 2023 as follow on the table 4.1.

Table 4.1: Descriptive Statistic

	Mean	Median	Maximum	Minimum	Std. Dev.	Observations
LR	0.37138	0.3169	1.3784	0.0265	0.202668	307
BS	3.946958	3.9882	6.1159	2.1553	0.76064	307
CAR	0.251427	0.208	1.3743	0.0766	0.13836	307
LDR	0.637888	0.6506	1.2857	0.1362	0.181976	307
AQ	0.031629	0.018	0.4079	0.000	0.044431	307
GDPR	0.085072	0.09	0.126	-0.021	0.028199	307
INFR	0.15742	0.135	0.364	-0.106	0.109692	307
INTR	0.070945	0.0688	0.0825	0.06	0.00558	307

The table 4.1 above displays the fundamental descriptive statistics of the variables derived from EViews data for the period ranging from 2000 to 2023 across 17 Ethiopian commercial banks. Based on the findings, dependent variable liquidity ratio for the period has mean 37.14% with standard deviation of 20.27% this suggests that, on average, Ethiopian banks sustain a moderate liquidity ratio, reflecting a stable capacity to fulfill short-term liabilities. However, median shows that LR has 31.69% which indicate most of banks are maintain below average. Throughout this timeframe, the bank size, indicated by the logarithm of total assets, has an average of 3.95, which shows that the Ethiopian banks moderate size in terms of total assets with standard deviation of 76.06%. The median shows that 3.98, which is close to the mean, indicating that many of the banks are near the average size, with a slight concentration around the mid-range of the size distribution.

During this time, Ethiopian banks typically hold a CAR of 25.14%, with a standard deviation of 13.84% concerning their risk-weighted assets, signifying a satisfactory level of financial resilience and exceeding the minimum capital adequacy ratio of 8%.

LDR shows mean 63.79% with standard deviation of 18.20%, on average, Ethiopian banks lend out about 63.79% of their deposits, which suggests that they maintain a high level of lending activity relative to deposits. Asset quality measured as provision of loan and advances shows mean of 3.1% with standard deviation 4.4% on average, Ethiopian banks hold a relatively small proportion of non-performing or risky assets. During the study period Ethiopian's GDP growth rate has averaged 8.6% with standard deviation of 2.8%, with range of -2.1% and 12.6%. Inflation Rate shows mean of 16.7% Ethiopia's average inflation rate has been relatively high at 16.7%, indicating significant price increases over the period. Interest rate margin has mean 7.1% with standard deviation 0.6%.

4.3. Normality Test

In the context of examining the main drivers of liquidity risk in Ethiopia's banking industry using panel data from 2000 to 2023, the normality test is an important step in validating model assumptions. The normality of the standardized residuals ensures the reliability of the model's statistical inferences. The following figure present the normality test of the model estimation.

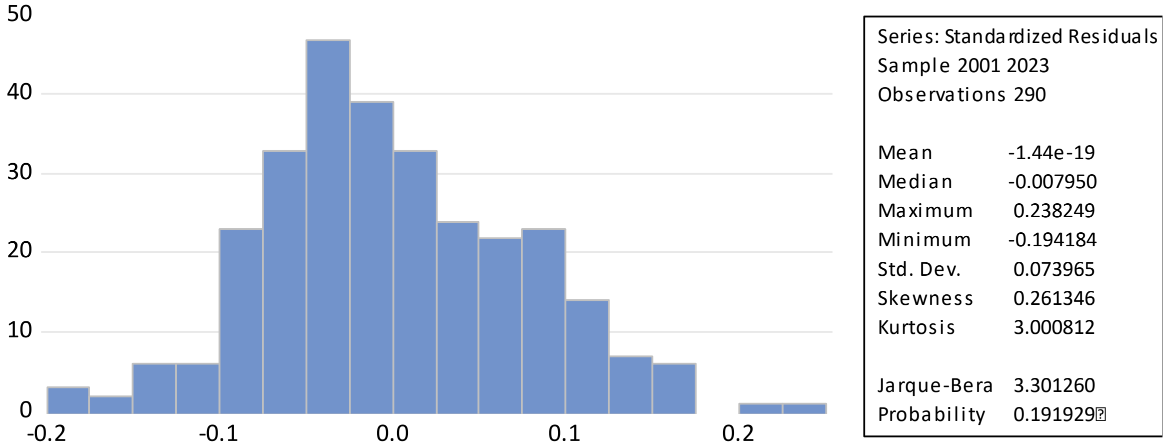

Figure 2: Normality Test based on EVeiws 12

The test was conducted to determine whether the estimated model standardized residuals are distributed normally, which is a one of an assumption for many statistical approaches. The residual skewness is 0.261346, it indicates that the distribution is somewhat skewed to the right. This low skewness indicates that the distribution is about symmetric. The kurtosis value is 3.000812, which is quite similar to the kurtosis of a normal distribution, which is 3. This indicates that the residuals do not have large tails or outliers, which supports the assumption of normality. The Jarque-Bera test, which assesses the joint hypothesis of normality using skewness and kurtosis, returned a test statistic of 3.301260. The corresponding p-value of 0.191929 exceeds the standard significance level of 0.05. This conclusion indicates that do not reject the null hypothesis of normality, verifying that the residuals are normally distributed.

4.4. Correlation

The correlation coefficient quantifies the degree of association among variables, and the significance of this correlation helps determine whether these relationships are likely to be real or due to random chance. Table 4.2 indicates that the output of correlation among all independent variables and dependent variables.

Table 4.2: Correlation Table -Output of EViews 12

Correlation Probability	Variables							
	LR	**BS**	**CAR**	**LDR**	**AQ**	**GDPR**	**INFR**	**INTR**
LR	1							
BS	-0.73922	1						
	0.0000							
CAR	0.69981	-0.544115	1					
	0.0000	0.0000						
LDR	-0.095802	-0.170802	0.014327	1				
	0.0938	0.0027	0.8026					
AQ	0.007114	0.119608	-0.1861	-0.249307	1			
	0.9012	0.0362	0.0011	0.0000				
GDPR	0.239793	-0.095757	0.21598	-0.223179	-0.104424	1		
	0.0000	0.094	0.0001	0.0001	0.0677			
INFR	0.099135	0.335839	0.028709	0.110253	-0.125738	-0.024998	1	
	0.0829	0.0000	0.6163	0.0536	0.0276	0.6626		
INTR	0.095149	0.124094	0.036428	-0.035976	-0.105731	0.31227	0.217393	1
	0.0981	0.0297	0.5249	0.53	0.0643	0.0000	0.0001	

The correlation table above presented the result of EViews on correlation. The result indicates that there are no correlation problems among independent variables. The results shows that there is strong correlation between liquidity ratio and CAR during the study period.

4.5. Heteroskedasticity Test

It refers to the occurrence where the variance of error terms in a regression model varies across observations, creating considerable difficulties in econometric analysis. If not dealt with, it may result in ineffective coefficient estimates and distorted standard errors, compromising the validity of hypothesis tests and confidence intervals. Identifying and adjusting for heteroskedasticity is especially important in panel data models, as differences among cross-sectional units or time periods can lead to inconsistent volatility in residuals.

Table 4.3: Heteroskedasticity Table -Output of EViews 12

Panel Cross-section Heteroskedasticity LR Test
Equation: UNTITLED
Specification: LR DBS CAR DLDR DAQ GDPR INFR INTR C
Null hypothesis: Residuals are homoskedastic

Likelihood ratio	Value	df	Probability
	39.69957	17	0.0014
LR test summary:			
	Value	df	
Restricted LogL	196.0893	282	
Unrestricted LogL	215.919	282	

This report examines the presence of heteroskedasticity in a panel regression model using a Likelihood Ratio (LR) test. The test evaluates whether the residuals exhibit homoskedasticity (constant variance) or heteroskedasticity (varying variance across groups), which has critical implications for the robustness of the estimation. The findings will inform whether remedial measures, such as heteroskedasticity consistent standard errors or weighted least squares estimation, are necessary to ensure reliable statistical inference. The analysis covers 17 cross-sectional units over 23 years (2001–2023), providing a comprehensive assessment of variance stability in the model.

4.6. Cross Section Dependence

Cross-section dependence is a critical issue in panel data analysis that occurs when residuals across different units (e.g., countries, firms) are correlated. This dependence often arises from common shocks, spatial linkages, or global economic factors that simultaneously affect multiple units. Ignoring Cross-section dependence can lead to biased standard errors and invalid statistical inferences. This study examine Cross-section dependence in a panel model spanning 17 cross-sectional banks over 23 years (2001-2023), comprising 290 unbalanced observations. The presence of non-zero cross-section means in the data suggests potential interdependencies among units, necessitating formal testing for residual cross-section dependence.

Table 4.4: Cross section dependence Table -Output of EViews 12

Residual Cross-Section Dependence Test			
Null hypothesis: No cross-section dependence (correlation) in residuals			
Equation: Untitled			
Periods included: 23			
Cross-sections included: 17			
Total panel (unbalanced) observations: 290			
Note: non-zero cross-section means detected in data			
gest employs centered correlations computed from pairwise samples			
Test	**Statistic**	**d.f.**	**Prob.**
Breusch-Pagan LM	750.3603	136	0.0000
Pesaran scaled LM	37.25106		0.0000

Pesaran CD	23.88456		0.0000

All three tests overwhelmingly reject the null hypothesis of no cross-section dependence at the 1% significance level, indicating strong residual correlations across units. This finding implies that the model errors are influenced by common factors affecting all cross-sections, violating the standard assumption of error independence. These results highlight the importance of properly accounting for cross-section dependence to ensure the validity of empirical findings and policy conclusions derived from the panel data analysis. The next section discusses the appropriate econometric strategies to address this issue.

4.7. Endogenous Test

In econometric analysis, the issue of endogeneity poses a significant challenge to establishing causal relationships between variables. Endogeneity problem arises when explanatory variables of the study are correlated with the error term of the model, this leads to biased and inconsistent parameter estimates in OLS regression models. To address this, endogenous tests—also known as tests for endogeneity—are employed to detect the presence of endogeneity and to determine whether instrumental variable IV techniques are necessary. This paper explores the theoretical foundations, implementation, and interpretation of endogenous tests, with a focus on common methodologies such as the Hausman test and the Durbin-Wu-Hausman (DWH) test. Understanding and correctly applying these tests is critical in ensuring the reliability and validity of econometric models, particularly in empirical research involving observational data.

Table 4.5: Endogenous Test Table -Output of EViews 12

Dependent Variable: LR				
Method: Panel Least Squares				
Sample (adjusted): 2001 2023				
Periods included: 23				
Cross-sections included: 17				
Total panel (unbalanced) observations: 290				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
RESID_DBS	0.628268	0.126564	4.96405	0.0000
RESID_CAR	0.753852	0.082244	9.16608	0.0000
RESID_DLDR	-0.540046	0.811356	0.509604	0.0000
RESID_DAQ	7.92E+15	-0.607316	0.82532	0.4449
RESID_GDPR	0.624658	0.309619	2.017507	0.0446
RESID_INFR	-0.067145	0.070338	-0.954596	0.3406
RESID_INTR	2.381642	1.471286	1.618749	0.1066
RESID_LDR	-1.28E+14	1.12E+14	-1.139957	0.2553

4.8. Unit Root Test

The unit root test is the firstly step, which should have to be taken before using any time series data to solve the problem of non-stationary (if any) before moving on to further regression work; otherwise, the regression would produce incorrect regression results. So, if standard regression techniques are applied to non stationary data, the final result may be a regression that looks acceptable by standard criteria (with significant coefficient estimates and it become a high R^2) but has little practical value. This type of model is known as a spurious regression. As a result, to determine whether the variables under examination are non-stationary (unit root test) or stationary, different assumptions are used. There are different methods of testing whether the series has unit root or not based on the nature of the data. Due to the nature of panel data, this research used Im, Pesaran and Shin W-stat method for unit root test, for each variable based on null hypothesis of variable has a unit root.

Table 4.6: Unit root test-Output of EViews 12

Null Hypothesis: Unit root (individual unit root process)		
Sample: 2000 2023		
Exogenous variables: Individual effects		
Cross-sections included: 17		
Method: Im, Pesaran and Shin W-stat		
Variables	**Statistic**	**P Value**
LR	-3.38971	0.0003
BS	0.22238	0.5886
DBS	-3.1761	0.0007
CAR	-2.14954	0.0158
LDR	2.71159	0.9967
DLDR	-6.04224	0.0001
AQ	-1.50838	0.0657
DAQ	-8.9362	0.0000
GDPR	-3.87928	0.0001
INFR	-2.60575	0.0046
INTR	-7.58435	0.0000

The above table 4.3 shows the result of EViews for unit root test of dependent and independent variables. The test was taken as, null hypothesis; the series has unit root test (non-stationary) and alternatively, alternate hypothesis tests; the series has not unit root test or the series is stationary, accordingly, if the test result is more than 5% we don't reject the null hypothesis and if the result is less than 5% we reject the null hypothesis. Table 4.3 above shows the test results, based on p value LR, CAR, GDPR, INFR and INTR have not unit root test problem. Contrary, BS, LDR and AQ have problem of non-stationary as their p value more than 5% based on the test result. Using those variables for estimation of the model will make the regression spurious regression. To solve the problem of non-stationary of the variables first difference is applied, it is a transformation applied to a time series to make it stationary. Accordingly, DBS, LDR and DAQ was taken as first difference of the variable and ensure that the results make the variable stationary. Thus, for the estimation of the model the first difference of those variables will be used.

4.9. Model Estimation Test

Panel data analysis has different option of estimation techniques like POLS (Pooled Ordinary Least Square), FEM and REM. Choosing appropriate technique is vital to reach on unbiased conclusion. All techniques have on their characteristics-based nature of the data provided. There is different selection techniques based on the data of the research. The following section will provide the tests performed for selection of appropriate estimation technique.

4.9.1 Lagrange Multiplier

The Lagrange Multiplier (LM) Tests for Effects are a series of diagnostic tools that help identify whether an Effects model is more suited than a Pooled OLS model. These tests evaluate the presence of effects in the data, which arise from unobserved heterogeneity across cross-sectional units or time periods. If effects are present, the Pooled OLS model, which assumes homogeneity, may produce biased and inefficient estimates. In such cases, a Effects model, which accounts for this heterogeneity, is preferred. The below Breusch-Pagan test checks for effects in the cross-section, time, or both dimensions. The p-values are all less than 5%, indicating strong evidence against the null hypothesis of no effects. This suggests that effects are present in your data. With this result Fixed effect or Random Effect selected for further test from the two estimations.

Table 4.7: Lagrange Multiplier output of EViews 12

Lagrange Multiplier Tests for Random Effects			
Null hypotheses: No effects			
Alternative hypotheses: Two-sided (Breusch-Pagan) and one-sided (all others) alternatives			
	Test Hypothesis		
	Cross-section	Time	Both
Breusch-Pagan	11.92076	578.9335	590.8542
	(0.0006)	(0.0000)	(0.0000)
Honda	3.452646	24.06104	19.45511
	-0.0003	(0.0000)	(0.0000)
King-Wu	3.452646	24.06104	18.30742
	(0.0003)	(0.0000)	(0.0000)
Standardized Honda	4.16686	26.87043	17.58648
	(0.0000)	(0.0000)	(0.0000)
Standardized King-Wu	4.16686	26.87043	16.32982
	(0.0000)	(0.0000)	(0.0000)
Gourieroux, et al.			590.8542
			(0.0000)

4.9.2 Hausman Test

In this analysis, the researcher aims to determine the more appropriate modeling technique for panel data. Specifically, the paper comparing the fixed effects and random effects models, which are common methods used to analyze panel data for intended purposes of research. The test is a statistical test helps to decide between these two models. It tests whether the unobserved individual effects in a random effects model are correlated with the explanatory variables. If the random effects are uncorrelated with the regressors, the random effects model is efficient and appropriate. However, if there is a correlation, the fixed effects model, which controls for these individual-specific effects, would be a more reliable choice.

The test conducted based on Null Hypothesis (H_0): The random effects model is consistent and efficient (i.e., the individual effects are uncorrelated with the regressors). On the other hand, Alternative Hypothesis (H_1): The fixed effects model is preferred (i.e., the individual effects are correlated with the regressors). Accordingly, if the p-value of the Hausman test is small (typically less than 0.05), we reject the null hypothesis, indicating that the fixed effects model is more appropriate because there is significant correlation between the individual effects and the regressors. In contrast if the p-value is large (greater than 0.05), we fail to reject the null hypothesis, meaning the random effects model is preferred because the individual effects are uncorrelated with the regressors. The output of test is presented below on table 4.5.

Table 4.8: Hausman Test output of EViews 12

Correlated Random Effects - Hausman Test				
Equation: Untitled				
Test cross-section random effects				
Test Summary		Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random		34.486984	7	**0.0000**
Cross-section random effects test comparisons:				
Variable	**Fixed**	**Random**	**Var (Diff.)**	**Prob.**
DBS	0.590147	0.456976	0.002023	0.0031
CAR	0.940825	0.769509	0.003184	0.0024
DLDR	-0.430935	-0.546896	0.00092	0.0001
DAQ	-0.047287	-0.263821	0.005108	0.0024
GDPR	0.483872	0.644083	0.00168	0.0001
INFR	-0.026161	-0.066739	0.000103	0.0001
INTR	2.527657	2.371941	0.015385	0.2093

On the basis analysis of the 17 Ethiopian commercial banks from 2000 to 2023, the research used a Hausman test to examine whether the fixed effects or random effects model would be better suited to the panel dataset. By considering that the data is unbalanced panel data, the Hausman test is crucial for testing whether the individual effects are correlated with the aggressors. The Hausman test above on the table 4.5 indicates that p-value is 0.0000, which is below the typical threshold of 0.05. Thus, it leads to reject the null hypothesis that the random effects model is consistent. Accordingly, the test suggests that the individual-specific effects are correlated with the regressors, meaning the fixed effects model is the more appropriate choice for our analysis. Therefore, the paper will use fixed effect model for the panel data analysis.

4.10. Panel Regression Results

This study aims to examine the determinants of liquidity in commercial banks in Ethiopia using panel data regression analysis. The focus is on understanding how various bank-specific and macroeconomic factors influence the liquidity ratio, which serves as the dependent variable in the model. The analysis covers 17 commercial banks in Ethiopia over the period from 2000 to 2023.

The independent variables include: Bank Size BS A common indicator of a bank's scale and market presence, measured by total assets. CAR, This variable reflects the financial strength of banks, indicating the proportion of capital to risk-weighted assets. LDR, Measures a bank's liquidity by comparing the loans it extends to the deposits it receives. AQ, represented by the ratio of loan provision to total loans, indicating the soundness of a bank's loan portfolio. GDPR, it is macroeconomic variable capturing the overall economic growth and its potential impact on bank liquidity. INFR, This macroeconomic indicator captures the general price level increase in the economy, which could affect bank operations and liquidity. INTR, The difference between lending and deposit rates, affecting bank profitability and liquidity.

To analyze the impact of these factors on the liquidity ratio, a FEM is employed. The fixed effects approach accounts for unobserved heterogeneity across banks by controlling for time-invariant characteristics specific to each bank that could potentially influence the liquidity ratio. Before deciding on estimation technique test of unit root was tested to check whether there is unit root problem or not. A Hausman test was also used to determine the superiority of the fixed effects model over the random effects model.

The selection of the FEM over alternative estimation methods was based on both statistical tests and the nature of the banking data. Diagnostic tests revealed significant unobserved heterogeneity in the data, making FEM the most appropriate choice. The Breusch-Pagan test ($p < 0.05$) confirmed the presence of bank-specific effects, rejecting the simpler Pooled OLS approach which assumes homogeneity across all banks. More importantly, the Hausman test ($p = 0.0000$) provided strong evidence that these individual bank effects are correlated with the explanatory variables, decisively favoring FEM over the Random Effects Model. This finding makes theoretical sense, as unobserved bank-specific characteristics like management strategies and risk cultures likely influence both liquidity positions and their determinants.

FEM offers several advantages for this study of Ethiopian commercial banks. First, it effectively controls for time-invariant heterogeneity across banks by allowing each to have its own intercept, eliminating potential bias from unobserved factors. Second, the model's focus on within-bank variation aligns well with the study's objective of identifying controllable liquidity risk factors at the institutional level. Third, with 23 years of data across 17 banks, there is sufficient within-bank variation to support the fixed effects approach. While FEM does have the limitation of not estimating coefficients for time-invariant variables, this trade-off is justified by the model's ability to produce consistent estimates in the presence of correlated effects - a critical requirement given the research objectives. This methodological choice follows established practice in banking studies for emerging markets, where institutional heterogeneity is typically significant.

Moreover, the study employed FEM to control for unobserved heterogeneity across banks. To address the issue of heteroscedasticity and cross section dependence, which are common in unbalanced panel data, cross-sectional weights were applied. This approach is supported by several studies, including Baltagi (2008), Wooldridge (2010), and Greene (2018), who recommend using cross-sectional weights to correct for heteroscedasticity in panel data regression models. Additionally, Hsiao (2014) and Arellano (2003) emphasize the importance of weighting techniques in unbalanced panels to ensure robust standard errors. The use of FEM with cross-sectional weights is further validated by Petersen (2009) and Hoechle (2007), who demonstrate its effectiveness in addressing heteroscedasticity in financial and economic panel data. In line with the objectives of the study, the regression equation further decomposed into bank specific factors and their relationship with liquidity risk, on the other hand model two express the overall bank specific and macroeconomic factors of liquidity risks.

4.10.1 Model 1 Bank specifc factors

In this study, the researcher investigated the impact of numerous bank-specific characteristics on liquidity risk, with a focus on key variables such as bank size, capital adequacy ratio, asset quality, and loan-to-deposit ratio. These elements are critical for understanding banks' liquidity status because they determine the institution's ability to handle short-term liabilities and limit the risks associated with liquidity crises. This study defines liquidity risk as a bank's possible inability to satisfy its financial obligations on time without suffering severe losses.

Table 4.9: Regression Analysis output Model 1 of EViews 12

Dependent Variable: LR			
Method: Panel EGLS (Cross-section weights)			
Sample (adjusted): 2001 2023			
Periods included: 23			
Cross-sections included: 17			
Total panel (unbalanced) observations: 290			
Linear estimation after one-step weighting matrix			
Variable	**POLS**	**FEM**	**REM**
DBS	-0.134022	-0.05668	-0.008972
	(-2.212743)	(-0.836675)	(-0.115845)
	0.0277**	0.4035	0.9079
CAR	0.068746	0.137175	0.089245
	(1.43557)	(2.052897)	1.458494
	0.1522	0.0411**	0.1458
DLDR	-0.586393	-0.556673	-0.554192
	(-11.17349)	(-9.749977)	(-9.604183)
	0.0000***	0.0000***	0.0000***
DAQ	-0.482873	-0.474282	-0.505735
	(-1.780711)	(-1.765349)	(-1.768969)
	0.0760*	0.0786*	0.078*
LR(-1)	0.678888	0.636009	0.645186
	(25.48843)	(20.49358)	(20.97067)
	0.0000***	0.0000***	0.0000***
C	0.090548	0.083244	0.085066
	(8.406196)	(6.697156)	(6.360421)
	0.0000***	0.0000***	0.0000***
R-squared	0.852992	0.863001	0.787403
Adjusted R-squared	0.850403	0.852266	0.78366
F-statistic	329.5723	80.39127	210.3723
Prob(F-statistic)	0.0000	0.0000	0.0000
Durbin-Watson stat	1.845032	1.859383	1.833763

The analysis reveals several key bank specific factors influencing the LR of Ethiopian commercial banks from 2000 to 2023. The analysis of liquidity risk in the Ethiopian banking industry from 2000 to 2023 was conducted using two estimation methods: POLS and FEM. The dependent variable is liquidity ratio, and the independent variables include the first difference of BS, CAR, first difference of AQ, LDR, and lagged liquidity ratio (LR(-1)).

The coefficient for DBS on POLS is -0.134022, which is statistically significant at the 5 percent level (p-value: 0.0277). This suggests that an increase in bank size is associated with a increases in liquidity risk, as their relationship is negative. On the other hand The coefficient for DBS on FEM is -0.056680, which is not statistically significant (p-value: 0.4035). This indicates that, after accounting for fixed effects, bank size does not have a significant impact on liquidity risk. The significance of DBS in POLS but not in FEM suggests that the relationship between bank size and liquidity risk may be influenced by unobserved heterogeneity across banks, which is controlled for in the FEM.

The coefficient for CAR on POLS is 0.068746, which is not statistically significant (p-value: 0.1522). This implies that capital adequacy does not have a significant impact on liquidity risk in the OLS model. The coefficient for the variable on FEM is 0.137175, which is statistically significant at the 5% level (p-value: 0.0411). This suggests that higher capital adequacy is associated with increased liquidity risk when controlling for fixed effects, as their relationship is positive. The significance of CAR in FEM but not in POLS indicates that capital adequacy plays a more critical role in explaining liquidity risk when bank-specific characteristics are accounted for.

The coefficient for DLDR on POLS is -0.566393, which is statistically significant (p-value: 0.0000). This indicates that an increase (by 1 percent) in the loan-to-deposit ratio is associated with a significant decreases (by 56 percent) in liquidity risk, as their relationship is negative. The coefficient for DLDR on FEM is -0.556673, which is also highly statistically significant (p-value: 0.0000). This shows that the robustness of the negative relationship between DLDR and liquidity risk. The consistency of DLDR significance across both methods suggests that it is a key driver of liquidity risk, regardless of the estimation method used.

The coefficient for DAQ is -0.482873, which is significant at the 10 percent significance level (p-value: 0.0760). This suggests that an increases in asset quality decreases liquidity risk , as their relationship is negative. On the other hand the coefficient for the variable on the FEM method is -0.474282, which is also significant at 10 percent significance level (p-value: 0.0786). This indicates that asset quality remains an important factor in explaining liquidity risk when fixed effects are considered. The marginal significance of DAQ in both methods suggests that asset quality has a consistent but relatively weak impact on liquidity risk.

The coefficient for LR(-1) is 0.678888, which is statistically significant (p-value: 0.0000). This indicates strong persistence in liquidity ratio over time. The coefficient for LR(-1) on FEM is 0.636009, which is also highly statistically significant (p-value: 0.0000). This confirms the persistence of liquidity risk when controlling for fixed effects. The significance of LR(-1) in both methods highlights the importance of historical liquidity risk in predicting current liquidity risk.

4.10.2 Model 2 Bank Specific and Macroeconomic factors

The following empirical model was employed to uncover determinants that potentially affect the liquidity risk of Ethiopian commercial banks, including both bank-specific and macroeconomic factors.

Table 4.10: Regression Analysis output Model 2 of EViews 12

Dependent Variable: LR			
Method: Panel EGLS (Cross-section weights)			
Sample (adjusted): 2001 2023			
Periods included: 23			
Cross-sections included: 17			
Total panel (unbalanced) observations: 290			
Linear estimation after one-step weighting matrix			
Variable	**POLS**	**FEM**	**REM**
DBS	-0.157164	-0.08345	-0.025171
	(-2.576101)	(-1.214297)	(-0.329523)
	0.0105**	0.2257	0.742
CAR	0.066744	0.147962	0.093972
	(1.445186)	(2.221501)	(1.559265)
	0.1495	0.0272**	0.1201
DLDR	-0.583862	-0.550673	-0.546647
	(-11.05498)	(-9.701989)	(-9.453679)
	0.0000***	0.0000***	0.0000***
DAQ	-0.478463	-0.453177	-0.477445
	(-1.638642)	(-1.558654)	(-1.560019)
	0.1024	0.1203	0.1199
LR(-1)	0.689285	0.647429	0.649504
	(25.38691)	(20.78722)	(20.9694)
	0.0000***	0.0000***	0.0000***
GDPR	-0.187303	-0.1862	-0.155662

	(-1.069615)	(-1.043244)	(-0.79798)
	0.2857	0.2978	0.4256
INFR	-0.039555	-0.023888	-0.032358
	(-1.093104)	(-0.64797)	(-0.739874)
	0.2753	0.5176	0.4600
INTR	2.804429	2.718083	3.184764
	(3.68055)	(3.538696)	(3.458658)
	0.0003***	0.0005***	0.0006***
C	-0.086434	-0.093825	-0.12363
	(-1.605846)	(-1.700519)	(-1.941913)
	0.1094	0.0902*	0.0531*
R-squared	0.858784	0.867499	0.796058
Adjusted R-squared	0.854764	0.855498	0.790251
F-statistic	213.6080	72.29078	137.1049
Prob(F-statistic)	0.0000	0.0000	0.0000
Durbin-Watson stat	1.856474	1.857659	1.874404

The analysis of liquidity risk in the Ethiopian banking industry from 2001 to 2023 (after taking first difference of some variables) was conducted using two POLS and FEM models, incorporating both bank-specific and macroeconomic variables.

In the first method POLS on the above 4.7 table, several variables were found to be significant in explaining liquidity risk. The DBS has a significant negative coefficient (-0.157164, p-value: 0.0105), indicating that larger banks tend to have higher liquidity risk. This suggests that larger banks have more risk apatite than smaller banks in Ethiopia commercial banks. The DLDR also shows a highly significant negative relationship (-0.663862, p-value: 0.0000), implying that higher loan-to-deposit ratios increases liquidity risk. This indicates that as one of factor when LDR increases liquidity ratio will decreases which causes increases liquidity risk on banking industry. Additionally, the LR(-1) variable has a highly significant positive coefficient (0.689285, p-value: 0.0000), indicating strong persistence in liquidity risk over time. This underscores the need for banks to address historical liquidity challenges to manage current risk levels effectively. Finally, INTR has a significant positive coefficient (2.804429, p-value: 0.0003), suggesting that wider interest rate spreads increase liquidity ratio in turn decreases liquidity risk at banks. This reflects the impact of macroeconomic conditions on banking sector stability, emphasizing the need for careful monitoring of interest rate policies.

On other hand, on the above table 4.7, FEM , The second method, which includes cross-section fixed effects, provides additional insights into the drivers of the LR. The CAR has a significant positive coefficient (0.147962, p-value: 0.0272), indicating that higher capital adequacy ratios are associated with higher liquidity ratios. This suggests that well-capitalized banks may hold more liquid assets as a buffer against potential risks. DLDR remains significant but negative (-0.560573, p-value: 0.0000), strengthen the importance of efficient deposit utilization in determining liquidity ratios. The LR(-1) variable also remains significant positive effects (0.647429, p-value: 0.0000), confirming the persistence of liquidity ratios over time. INTR continues to show a significant positive relationship (2.718083, p-value: 0.0005), emphasizing the role of macroeconomic conditions in shaping liquidity ratios.

Both methods highlight the importance of the DLDR and LR(-1) as key drivers of the liquidity ratio, emphasizing the need for efficient deposit utilization and the influence of historical liquidity levels. The INTR is significant in both methods, underscoring the impact of macroeconomic conditions on liquidity ratios. However, the significance of the CAR only in the second model suggests that capital adequacy plays a more critical role in determining liquidity ratios when bank-specific characteristics are controlled for. The DBS is significant on POLS but not in the FEM, indicating that the impact of bank size on liquidity ratios may vary depending on the inclusion of fixed effects.

4.11. Analysis of the Results and Discussion

4.11.1 Bank Specific Factors

In this study, the researcher examined the impact of various bank-specific factors on liquidity risk using two models (model 1 bank specific and model 2 bank specific and macro economic factors), with a particular focus on key variables such as BS, CAR, AQ, LRD, and LR(-1). These factors are essential for understanding the liquidity positions of banks, as they determine the institution's ability to manage short-term obligations and mitigate the risks associated with liquidity risks. It is indicated in this study that liquidity risk is the potential unability of a bank to meet its financial obligations as they come due without incurring significant losses. The relationship between these internal factors and liquidity risk is complex and multifaceted. For example, bigger banks may enjoy economies of scale and access to diverse funding sources, while banks with stronger capital buffers and higher asset quality may be better positioned to absorb shocks to liquidity. In this section, we will explore the findings related to these key bank-specific factors and discuss how they influence liquidity risk.

A. Liquidity Ratio and Bank Size

In this section, focus on the relationship between bank size measures as natural log of total asset, and liquidity ratio, which is a critical aspect of a bank's capacity to meet its short-term financial obligations. Liquidity ratios are key indicators of financial health, showing the proportion of assets, a bank holds in liquid form relative to its liabilities.

The study reveals a negative relationship between the liquid LR and the DBS in both models (model 1 included only bank specific, and model 2 included both factors). The models were estimated based on POLS and FEM methods, based on POLS the results indicates that their relationship statistically significance at 5 percent level however, the study found that based on FEM estimation the relationship of the variables are insignificant. The result implies that larger banks hold proportionally fewer liquid assets relative to their total assets, increasing their vulnerability to liquidity risks. Larger banks may prioritize profitability over liquidity, relying on diversified funding sources and higher-yielding but less liquid assets. However, this can lead to systemic risks, especially during financial crises.

The finding is consistent with Aleyanesh (2021), which found that bank size negatively affects liquidity risk, implying that larger banks may face challenges in maintaining optimal liquidity levels. However, Nigist (2015) reveals that bank size positively affects liquidity, suggesting that larger banks may have better access to funding sources, which could mitigate liquidity risk. Laštůvková (2016) found that smaller banks are more sensitive to macroeconomic variables, which could explain why larger banks face higher liquidity risk as their operation increases become more complex. Mekonnen (2021) also noted that larger banks in Ethiopia tend to have higher liquidity risk due to their extensive loan portfolios and reliance on external funding. Wassihun (2020) found that bank size negatively impacts liquidity, suggesting that larger banks may have better liquidity management practices. Cucinelli (2013) found that larger banks in the Eurozone have higher liquidity risk due to their complex asset-liability structures, supporting the idea that size can exacerbate liquidity risk. On the other hand, Addou and Bensghir (2021) found that bank size positively impacts liquidity risk in United Arab Emirate Islamic banks, indicating that larger banks may face higher liquidity challenges in emerging markets.

The finding is against with studies conducted in other regions. For instance, Bordeleau and Graham (2010) found that larger banks going to maintain higher liquidity buffers due to their greater access to financial resources and diversified asset portfolios. Similarly, Aspachs et al. (2005) highlighted that larger institutions in Europe are better equipped to manage liquidity risks. In the Ethiopian context, this suggests that as commercial banks grow, they are more likely to enhance their liquidity management capabilities, which is crucial for financial stability.

The observed negative relationship between bank size and liquidity ratios in Ethiopian commercial banks reflects unique institutional and regulatory dynamics that differentiate the country's banking sector from those studied in other regions. Unlike findings from developed markets where larger banks typically maintain stronger liquidity positions (Bordeleau and Graham, 2010; Aspachs et al., 2005), Ethiopia's context reveals an inverse pattern that can be attributed to several key factors.

First, Ethiopia's regulatory framework creates distinct incentives for liquidity management. While the National Bank of Ethiopia mandates a 15 percent minimum liquidity ratio (NBE Directive, 2014), this uniform requirement fails to account for the differential risks and operational scales of larger versus smaller banks. In practice, larger banks may strategically minimize their liquidity buffers to maximize profitable lending opportunities, confident in their ability to meet regulatory minima without maintaining substantial excess liquidity. This behavior contrasts with findings from more developed banking systems where larger institutions typically maintain higher liquidity buffers as part of sophisticated risk management strategies.

Second, the structure of Ethiopia's financial system plays a crucial role. The absence of deep interbank markets and limited access to emergency liquidity facilities means that larger banks cannot rely on the same liquidity backstops available to their counterparts in more developed economies. While studies of European banks (Cucinelli, 2013) highlight the advantages of size in liquidity management, Ethiopian banks face a different reality where scale does not necessarily translate into better access to liquid funds during stress periods.

Third, macroeconomic conditions specific to Ethiopia influence bank behavior. Chronic foreign exchange shortages and inflationary pressures (NBE, 2023) create an environment where maintaining liquid assets becomes particularly costly. Larger banks, with their more complex operations and greater exposure to foreign currency needs, may find it especially challenging to maintain robust liquidity positions. This helps explain why the Ethiopian context produces results that differ from studies conducted in more stable macroeconomic environments.

Fourth, the dominance of traditional deposit-based funding in Ethiopia's banking sector affects liquidity dynamics differently than in markets with more diversified funding sources. While larger banks globally might use their size to access wholesale funding markets (Addou and Bensghir, 2021), Ethiopian banks of all sizes remain primarily dependent on deposits. This structural feature may reduce the liquidity advantage that size typically provides in other contexts.

B. Liquidity Ratio and Capital Adequacy Ratio

In this section, the researcher explore the relationship between liquidity and capital adequacy ratio, two key indicators of a bank's financial stability and resilience. The liquidity ratio measures a bank's ability to meet its short-term obligations, while the CAR assesses the financial strength of a bank by comparing its capital to its risk-weighted assets. Both ratios are integral in evaluating a bank's capacity to withstand financial stress, protect depositors, and maintain operations during times of market volatility.

The study reveals a positive relationship between the LR and the CAR in both models (model 1 bank specific, and model 2 bank specific and macro economic factors). The models were estimated based on POLS and FEM methods, based on FEM, the results indicates that their relationship statistically significance at 5 percent level however, the study found that based POLS estimation, the relationship of the variables are insignificant. This indicates that banks with higher capital buffers are better positioned to maintain liquidity. A strong capital base provides a cushion against financial shocks and ensures compliance with regulatory requirements, which in turn supports liquidity management. This result underscores the importance of maintaining adequate capital levels, as it not only enhances financial stability but also contributes to better liquidity management. The findings reinforce the idea that maintaining high capital levels is essential not only for absorbing losses but also for ensuring sufficient liquidity, ultimately contributing to the overall stability of the financial system. This has important implications for regulators, banks' internal strategies, and investor perceptions, all of which are crucial in fostering a resilient banking environment capable of withstanding financial challenges.

This finding is consistent with Wassihun (2020) found that capital adequacy positively impacts liquidity, reinforcing the importance of maintaining adequate capital levels to ensure financial stability. In contrast Fentaw (2016), who found that capital adequacy negatively affects liquidity risk, suggesting that well-capitalized banks are better positioned to manage liquidity. Cucinelli (2013) found that higher capitalization reduces liquidity risk in Eurozone banks, supporting the idea that well-capitalized banks are more resilient.

Addou and Bensghir (2021) also found that capital adequacy positively impacts liquidity in UAE Islamic banks, indicating that this relationship may hold across different banking systems. Ghenimi et al. (2020) found that capital adequacy is a key determinant of liquidity risk in both Islamic and conventional banks, emphasizing its universal importance. Mugenyah (2018) found that capital adequacy positively impacts liquidity risk in Kenyan banks, suggesting that well-capitalized banks are better able to manage liquidity. On the other hand, Antony (2023) found that capital adequacy negatively impacts liquidity risk in Indian banks, indicating that higher capital buffers can reduce liquidity risk.

The positive CAR liquidity relationship in Ethiopian banks stems from the NBE stringent capital regulations (8% minimum CAR) and underdeveloped financial markets, which force banks to maintain high capital buffers that simultaneously support liquidity. Unlike in more advanced economies where capital and liquidity management may diverge, Ethiopia's macroeconomic volatility (forex shortages, inflation) and concentrated risk exposures create strong interdependence between these buffers, as robust capitalization becomes essential both for absorbing losses and ensuring short-term liquidity stability under regulatory scrutiny. This explains why Ethiopia's results align with Wassihun (2020) but contrast with studies from more diversified banking systems where capital adequacy doesn't necessarily translate to liquidity strength.

C. Liquidity Ratio and Loan to Deposit Ratio

In this study, researcher also examined the relationship between the liquidity ratio and the loan-to-deposit ratio, which are both fundamental metrics in banking business. The liquidity ratio measures a bank's ability to meet its short-term obligations with its most liquid assets, while the loan-to-deposit ratio reflects the proportion of loans a bank has issued relative to its deposits, serving as an indicator of liquidity risk and lending activity.

The study reveals a negative relationship between the LR and the first difference of LDR in both models (model 1 bank specific, and model 2 bank specific and macro economic factors). The models were estimated based on POLS and FEM methods, based on both methods POLS and FEM the results indicates that their relationship statistically significance at 1 percent significance level. This negative relationship indicates that an increase in the loan to deposit ratio, reflecting higher lending relative to deposits, is associated with lower liquidity. Banks that extend more loans relative to their deposit base may face liquidity challenges, as a significant portion of their assets is tied up in less liquid forms. This highlights the trade-off between profitability through lending and the need to maintain sufficient liquidity to meet short-term obligations. Banks should carefully balance their lending activities with liquidity management strategies. The negative relationship between these two ratios is expected, as an increase in the loan-to-deposit ratio often signifies that banks are allocating a higher proportion of their deposits toward loans rather than holding liquid assets. While lending activity can be a sign of profitability and economic growth, it may also pose a risk to liquidity, especially if loan repayments are delayed or borrowers face financial difficulties.

Nevertheless, this finding contrasts with Kinfe (2019), who found that loan growth positively impacts liquidity risk, implying that excessive lending can strain liquidity. The difference in findings may be attributed to variations in the sample period and the specific characteristics of the Ethiopian banking sector. Tigist (2019) found that loan growth negatively impacts liquidity, suggesting that rapid loan expansion can strain liquidity reserves. Berhanu (2015) also found that loan growth negatively impacts liquidity, reinforcing the idea that excessive lending can lead to liquidity shortages. Rashid et al. (2017) found that loan loss provisions positively impact liquidity risk, indicating that the quality of loans is a critical factor in liquidity management. Mennaw and Ahmed (2020) found that loan growth positively impacts liquidity risk in Sudanese Islamic banks, suggesting that rapid loan expansion can strain liquidity. Zaghdoudi and Hakimi (2017) found that loan growth negatively impacts liquidity risk in Tunisian banks, indicating that the relationship between loan growth and liquidity risk may vary by region.

The negative relationship between LDR and liquidity in Ethiopian banks reflects the country's unique regulatory and operational constraints, where strict NBE directives (including the 15 percent liquidity requirement) force banks to carefully balance lending and liquidity buffers in an environment with limited alternative funding sources. Unlike more developed banking systems where diversified funding options can mitigate liquidity pressures from loan growth, Ethiopian banks' heavy reliance on deposit funding means that aggressive lending directly depletes liquid reserves, compounded by the sector's high NPL (averaging 13.4 percent in 2023 per NBE reports) which further immobilize assets. This dynamic is exacerbated by Ethiopia's underdeveloped interbank and capital markets, leaving banks without reliable liquidity backstops when loan portfolios expand rapidly, creating a stronger inverse LDR liquidity relationship than might appear in economies with more mature financial infrastructures.

D. Liquidity Ratio and Asset Quality

The relationship between the liquidity ratio and asset quality, as measured by the ratio of total provisions to total loans and advances, is a critical area of analysis in understanding a banking sector stability and risk management practices. A higher ratio of total provisions to total loans typically signals deteriorating asset quality, as it reflects increased provisioning for potential loan losses. This, in turn, can strain liquidity by reducing the availability of funds for other operational needs.

The study reveals a negative relationship between the LR and the first difference of AQ in both models (model 1 bank specific, and model 2 bank specific and macro economic factors). The models were estimated based on POLS and FEM methods, on the model 1 based on both methods found that their relationship statistically significance at 10 percent level however, the study found that on model 2 based on both methods reveals that the relationship of the variables are insignificant. As asset quality improves (lower loan loss provisions to total loans), the liquidity ratio tends to decrease, indicating that banks hold fewer liquid assets relative to their total assets. This happens because banks may shift from low-yielding liquid assets to higher yielding loans or investments, prioritizing profitability over liquidity. However, this increases liquidity risk, as the bank becomes more vulnerable to short-term obligations during financial stress. While improved asset quality boosts confidence in the loan portfolio, banks must carefully balance this with maintaining adequate liquidity buffers to ensure resilience. Regulators and managers should monitor this trade-off to mitigate risks.

This finding is against with Mekbib (2016), who found that non-performing loans positively impact liquidity, indicating that poor asset quality can exacerbate liquidity risk. However, Tseganesh (2012) found that non-performing loans negatively impact liquidity, highlighting the importance of maintaining high asset quality to ensure liquidity. Mennaw and Ahmed (2020) found that non-performing loans positively impact liquidity risk in Sudanese Islamic banks, suggesting that poor asset quality is a universal concern. Zaghdoudi and Hakimi (2017) found that asset quality is a key determinant of liquidity risk in Tunisian banks, emphasizing the importance of maintaining high-quality assets. Mugenyah (2018) found that non-performing loans negatively impact liquidity risk in Kenyan banks, indicating that the relationship between asset quality and liquidity risk may vary by region. Mehdi and Abderrassoul (2014) found that asset quality positively impacts liquidity in Moroccan banks, suggesting that high-quality assets can enhance liquidity. Antony (2023) found that non-performing loans negatively impact liquidity risk in Indian banks, reinforcing the idea that poor asset quality can strain liquidity.

The negative relationship between asset quality and liquidity ratios in Ethiopian banks reflects the sector's unique risk-return trade-offs under strict NBE oversight. While deteriorating asset quality (higher provisions) predictably reduces liquidity as impaired loans immobilize funds, the inverse relationship for improving AQ suggests Ethiopian banks prioritize profitable lending over liquidity buffers when loan portfolios strengthen - a behavior shaped by three contextual factors: (1) NBE's 15 percent liquidity requirement sets a floor but doesn't incentivize excess buffers, (2) limited high-yield investment alternatives beyond loans in Ethiopia's underdeveloped financial markets push banks to deploy freed-up funds into credit rather than liquid assets, and (3) the absence of active secondary loan markets means even performing loans remain illiquid, causing liquidity ratios to drop when provisions decrease. This explains why Ethiopia's results diverge from studies like Mekbib (2016) in more diversified banking systems where improved asset quality typically supports liquidity through better collateral values and asset marketability.

The findings highlight how emerging market constraints can alter conventional risk relationships observed in advanced economies.

E. Liquidity Ratio and Historical Liquidity

The relationship between a bank's current liquidity ratio and its lagged liquidity ratio is a critical area of study in banking. A positive and significant relationship between these two variables suggests that a bank's current liquidity position is strongly influenced by its past liquidity levels. This persistence in liquidity management reflects the bank's strategic approach to maintaining stability, managing risk, and meeting regulatory requirements. Understanding this relationship provides insights into how banks balance short-term obligations, long-term profitability, and regulatory compliance over time. This discussion explores the implications of this relationship, its drivers, and its significance for bank management and financial stability.

The study reveals a positive relationship between the LR and lagged LR in both models (model 1 bank specific, and model 2 bank specific and macro economic factors). The models were estimated based on OLS and FEM methods, on both models (POLS and FEM) the research found that their relationship statistically significance at 1 percent significant. The persistence of liquidity ratios is confirmed, highlighting the importance of historical liquidity levels in determining current liquidity ratios. This finding is supported by Mekonnen (2021), who found that lagged liquidity has a significant positive impact on current liquidity levels. Mamunur Rashid et al. (2017) also found that past liquidity conditions are a key determinant of current liquidity risk.

4.11.2 Macroeconomic Factors

The relationship between macroeconomic factors and liquidity risk in the banking sector is a critical area of study, as external economic conditions significantly influence banks' ability to manage their short-term financial obligations. Macroeconomic variables such as GDPR, INFR, and INTR play a pivotal role in shaping the liquidity landscape of banks. These factors affect banks' deposit inflows, loan demand, asset quality, and overall financial stability, thereby impacting their liquidity positions.

In this section, the study discusses the empirical findings related to the impact of macroeconomic factors on liquidity risk in the Ethiopian banking sector. The analysis focuses on how GDP growth, inflation, and interest rate spreads influence banks' liquidity ratios, drawing insights from the regression results. By examining these relationships, the study aims to extended knowledge of how macroeconomic conditions affect liquidity risk and offer recommendations for banks and policymakers to mitigate potential exposure. This discussion is particularly relevant in the context of Ethiopia, where economic fluctuations and regulatory frameworks have a direct bearing on the banking sector's stability and performance.

A. Liquidity Ratio and GDP Growth Rate

The relationship between the liquidity ratio and GDP growth rate is a crucial area of this study in understanding how macroeconomic conditions influence the financial health of Banking industry in Ethiopia. GDP growth rate reflects the overall economic performance and health of a country. A growing economy typically fosters higher business activity, increased credit demand, and improved asset quality, all of which can positively influence liquidity levels. Conversely, economic downturns may strain liquidity as loan defaults rise and funding becomes scarce. This discussion will investigate the relation between liquidity ratios and GDP growth rates, examining how economic cycles impact financial stability and how financial institutions. Understanding this relationship is essential for policymakers, financial managers, and economists aiming to promote sustainable economic development and financial resilience.

The study found that during the period, GDPR has a negative relationship with LR, but their relationship is statistically insignificance, the result is consistent between OLS and FEM of model 2. The results suggesting that GDPR does not have a significant impact on liquidity ratios in the Ethiopian banking industry context during the period. The lack of significance suggests that changes in GDP growth do not directly affect banks' decisions to hold liquid assets, indicating that Ethiopian banks may prioritize internal factors such as regulatory requirements, risk management, or institutional policies over macroeconomic conditions when managing liquidity. This decoupling of economic growth and banking sector liquidity could reflect structural characteristics of the Ethiopian banking sector, such as limited integration with the broader economy or conservative liquidity management practices. The insignificance of GDPR also highlights that regulatory and institutional factors likely play a more dominant role in shaping liquidity ratios than macroeconomic conditions. Policymakers should focus on strengthening regulatory frameworks to ensure banks maintain adequate liquidity buffers, while bank managers should prioritize internal liquidity management strategies and risk assessments rather than relying on macroeconomic trends. Potential reasons for this insignificance could include underdeveloped financial markets, conservative banking practices, or data limitations.

This finding against with Zelalem (2020), who found that real GDP growth positively impacts liquidity, indicating that economic expansion can lead to higher liquidity needs. However, Belay (2017) found that real GDP growth has an insignificant impact on liquidity, indicating that the relationship between economic growth and liquidity risk may vary depending on the context. Islam et al. (2021) found that GDP growth negatively impacts liquidity in Bangladeshi banks, suggesting that economic growth can lead to liquidity surpluses. Wysocka (2023) found that GDP growth positively impacts liquidity risk in European banks, indicating that economic expansion can strain liquidity reserves. Laurine (2013) found that GDP growth has an insignificant impact on liquidity risk in Zimbabwean banks, highlighting the variability of this relationship across different economies. Rashid et al. (2017) found that GDP growth positively impacts liquidity risk in Islamic banks in Malaysia and GCC countries, suggesting that economic expansion can increase liquidity needs. Yaacob et al. (2016) found that GDP growth positively impacts liquidity risk in Malaysian Islamic banks, reinforcing the idea that economic growth can strain liquidity.

B. Liquidity Ratio and Inflation Rate

The relationship between the liquidity ratio and the inflation rate is a critical area of study in understanding how macroeconomic factors influence financial stability. The liquidity ratio, which measures a firm's ability to meet short-term obligations, is a key indicator of financial health. On the other hand, the inflation rate reflects the overall price stability and purchasing power within an economy. High inflation can erode the value of money, increase borrowing costs, and create uncertainty, all of which may strain liquidity. Conversely, low and stable inflation can create a conducive environment for financial institutions to maintain healthy liquidity levels. This discussion investigates the dynamics between liquidity ratios and inflation rates, examining how inflation impacts financial stability. Understanding this relationship is essential for policymakers, financial managers, and economists aiming to promote economic stability and resilience.

The study found that during the period, INFR has a negative relationship with LR, but their relationship is statistically insignificance even at 10 percent significance level, the result is consistent between POLS and FEM of models. This suggests that inflation, within the observed range, does not materially affect banks liquidity management. This finding implies that inflation control, while important for overall economic stability, may not be a critical factor in determining liquidity levels for Ethiopian commercial bank.

This finding contrasts with Bayileyegn et al. (2022), found that inflation negatively impacts liquidity, indicating that higher inflation can erode the value of liquid assets. The difference in findings may be due to variations in the sample period and the specific characteristics of the Ethiopian banking sector. Vodová (2013) found that inflation negatively impacts liquidity in Czech commercial banks, suggesting that inflation can erode liquidity reserves. Yaacob et al. (2016) found that inflation positively impacts liquidity risk in Malaysian Islamic banks, indicating that inflation can increase liquidity needs. El Mehdi and Abderrassoul (2014) found that inflation negatively impacts liquidity in Moroccan banks, reinforcing the idea that inflation can strain liquidity reserves. Zaghdoudi and Hakimi (2017) found that inflation negatively impacts liquidity risk in Tunisian banks, suggesting that inflation can erode liquidity. Antony (2023) found that inflation positively impacts liquidity risk in Indian banks, indicating that inflation can increase liquidity needs.

C. Liquidity Ratio and Interest Rate Spread

The relationship between the liquidity ratio and the interest rate spread is a critical area of study in understanding how financial market conditions influence the stability and performance of banks in Ethiopia. The liquidity ratio, which measures a firm's ability to meet short-term obligations, is a key indicator of financial health. On the other hand, the interest rate spread—the difference between lending and deposit rates—reflects the profitability and risk-taking behavior of financial institutions. A wider spread often indicates higher profitability but may also signal increased risk or inefficiencies in the financial system. This discussion investigates the dynamics between liquidity ratios and interest rate spreads, examining how changes in spreads impact liquidity.

The study found that during the period, INTR has a positive relationship with LR, and their relationship is statistically significance even at 1 percent significance level, the result is consistent between POLS and FEM model. This indicates that wider interest rate spreads are associated with higher liquidity ratios, suggesting that banks tend to hold more liquid assets when interest rate spreads increase. This relationship reflects banks' response to heightened market volatility or lending risks, as wider spreads often signal greater uncertainty or risk in the financial environment. When spreads widen, banks may become more cautious, increasing their liquidity buffers to mitigate potential risks, such as higher default rates or funding difficulties. This behavior aligns with prudent risk management practices, as holding more liquid assets ensures that banks can meet short-term obligations and withstand financial shocks.

The finding is aligns with Tisa (2023), who found that macroeconomic variables such as interest rates significantly impact liquidity risk. Vodova (2013) also found that interest rates on loans positively impact liquidity in Hungarian commercial banks. Contrary, the finding is against Mekonnen (2018), who found that interest rate margin has a negative but statistically insignificant impact on liquidity, indicating that interest rate policies may not be a primary driver of liquidity risk. Karakaş and Acar (2022) found that interest rate spread negatively impacts liquidity in Turkish banks, suggesting that higher spreads can reduce liquidity. Naseem (2021) found that interest rate spread positively impacts liquidity risk in Pakistani banks, indicating that higher spreads can increase liquidity needs. Antony (2023) found that interest rate spread has an insignificant impact on liquidity risk in Indian banks, supporting the idea that interest rate policies may not be a primary driver of liquidity risk. Islam et al. (2021) found that interest rate spread negatively impacts liquidity in Bangladeshi banks, suggesting that higher spreads can reduce liquidity. Rashid et al. (2017) found that interest rate spread positively impacts liquidity risk in Islamic banks in Malaysia and GCC countries, indicating that higher spreads can increase liquidity needs.

The positive relationship between interest rate spreads and liquidity ratios in Ethiopian banks demonstrates that wider spreads lead to increased liquidity buffers as banks adopt more cautious risk management practices, though this may constrain credit availability and economic growth. This creates a policy dilemma for monetary authorities who must balance financial stability (through maintained liquidity) against economic expansion (through credit access), while persistent wide spreads may indicate structural inefficiencies in financial intermediation requiring market reforms. These findings highlight the need for context-specific policies that monitor spreads as liquidity risk indicators and carefully calibrate monetary interventions to address Ethiopia's unique banking sector dynamics.

CHAPTER FIVE: CONCLUSION AND RECOMMENDATION

5.1. Introduction

This chapter presents the summary, conclusion and recommendation sections of this study, analyze the key findings, drawing conclusions, and offering actionable recommendations based on the analysis of liquidity risk key drivers in the Ethiopian banking sector. The chapter begins by summarizing the main insights derived from the empirical analysis, which examined both bank-specific and macroeconomic factors affecting liquidity risk. It then consolidates these findings into a coherent conclusion, highlighting the critical drivers of liquidity risk and their implications for the banking industry. Finally, the chapter provides a set of practical recommendations aimed at enhancing liquidity risk management practices, ensuring financial stability, and supporting the sustainable growth of the Ethiopian banking sector. This chapter not only ties together the theoretical and empirical aspects of the study but also offers valuable insights for policymakers, bank management, and other stakeholders in the financial sector.

5.2. Summary

This study aimed to identify the key drivers of liquidity risk in the Ethiopian banking industry, focusing on both bank-specific and macroeconomic factors. The research was conducted using panel data from 17 commercial banks in Ethiopia over the period from 2000 to 2023. The study employed a quantitative research approach, utilizing a fixed effects model to analyze the determinants of liquidity risk. The dependent variable, liquidity ratio, was measured as the ratio of total liquid assets to net current liabilities. Independent variables included bank-specific factors such as bank size, capital adequacy ratio, asset quality, and loan-to-deposit ratio, as well as macroeconomic factors like GDP growth rate, inflation rate, and interest rate spread. To get more detail effects of the factor the researcher decompose the model into two models. First model is solely on bank specific factors and the second model is including both factors i.e bank specific and macro economic variables.

The findings revealed that CAR, and Lagged Liquidity Ratio, have a significant positive impact on liquidity ratio, the finding indicates that those with higher capital buffers are better positioned to manage liquidity risks, the historical liquidity ratio also affects current liquidity ratio. Conversely, the LDR showed a negative relationship with liquidity, suggesting that higher lending relative to deposits can strain liquidity. Asset quality, measured by loan provisions, had a negative impact on liquidity, as the loan loss provision increases it affects negatively bank liquidity. Among macroeconomic factors, GDP growth rate and inflation negatively influenced liquidity ratio with insignificant influence, while interest rate spreads show significant impacts the liquidity ratio and their relationship is significance.

5.3. Conclusion

The study examined the key drivers of liquidity risk in the Ethiopian banking industry, focusing on bank-specific and macroeconomic factors. The findings reveal that liquidity risk is significantly influenced by internal bank characteristics, while macroeconomic conditions exhibit mixed effects.

1. Bank-Specific Factors

- Bank Size: Larger banks tend to hold lower liquidity buffers, increasing their vulnerability to liquidity shocks. This suggests that while size provides access to diversified funding, it may also lead to riskier liquidity management strategies.
- Capital Adequacy Ratio: Banks with higher capital buffers maintain better liquidity positions, reinforcing the role of capital in absorbing financial shocks and ensuring regulatory compliance.
- Loan-to-Deposit Ratio: A higher LDR negatively impacts liquidity, indicating that aggressive lending without sufficient deposit backing strains liquidity reserves.
- Asset Quality: Deteriorating asset quality (higher loan provisions) reduces liquidity, as impaired loans immobilize funds.

2. Macroeconomic Factors

- GDP Growth: Insignificant impact on liquidity, suggesting Ethiopian banks prioritize internal risk management over macroeconomic fluctuations.
- Inflation: No significant effect, implying inflation control policies may not directly influence bank liquidity.
- Interest Rate Spread: Wider spreads correlate with higher liquidity, as banks hold more liquid assets amid increased lending risks.

5.4. Recommendations

The findings of this study highlight critical bank-specific and macroeconomic factors influencing liquidity risk in Ethiopia's banking sector. To enhance financial stability and mitigate liquidity vulnerabilities, targeted interventions are needed at regulatory, institutional, and macroeconomic levels. The following recommendations provide actionable strategies for the NBE, commercial banks, and policymakers to strengthen liquidity risk management, align with global best practices, and address Ethiopia's unique financial landscape. These measures aim to balance profitability with prudence, ensuring resilience against systemic shocks while supporting sustainable economic growth.

1. Regulatory Enhancements by NBE

Implement dynamic LDR thresholds: Mandate lower LDR limits for larger banks (to curb excessive lending and ensure liquidity buffers. Smaller banks could have slightly higher thresholds with stricter monitoring. Introduce tiered LDR regulations based on bank size and risk profiles, as larger banks showed higher liquidity risk in the study.

Strengthen capital adequacy requirements: Enforce higher CAR for systemically important banks to bolster liquidity resilience. Link CAR compliance to liquidity ratios to ensure capital buffers directly support liquidity management.

Macro-prudential measures: Adjust reserve requirements counter-cyclically (e.g., increase during high inflation/GDP growth) to curb excessive risk-taking. Mandate stress testing for liquidity shocks (e.g., sudden deposit withdrawals) and require banks to submit contingency funding plans.

2. Bank-Level Risk Management Practices

Asset-Liability matching: Banks should reduce maturity mismatches by aligning loan tenures with stable deposits (e.g., use long-term deposits for long-term loans). Diversify funding sources (e.g., interbank markets) to reduce reliance on volatile short-term deposits.

Improve asset quality: Strengthen loan underwriting standards and collateral requirements to minimize NPLs', which strain liquidity. Establish dynamic provisioning policies where provisions increase during economic booms to buffer future downturns.

Liquidity monitoring tools: Adopt Basel III metrics like the NSFR alongside local liquidity ratios to ensure long-term stability. Use real-time dashboards to track LDR, CAR, and deposit concentrations, with alerts for breaches.

3. Macroeconomic and Policy Coordination

Interest rate policy adjustments: NBE should narrow INTR during periods of high liquidity risk to reduce banks' incentive to over-lend. Offer preferential rates for banks maintaining liquidity buffers above regulatory minima.

Economic stability measures: Coordinate with fiscal policymakers to stabilize inflation and GDP growth , as volatility indirectly exacerbates liquidity risks. Develop a liquidity facility for banks during systemic shocks (e.g., forex shortages) to prevent fire sales of assets.

4. Capacity Building and Transparency

Training Programs: NBE should mandate liquidity risk management training for bank boards and executives, focusing on stress testing and scenario analysis.

Disclosure Requirements: Require banks to publish quarterly liquidity risk reports, including LDR trends, NPL ratios, and contingency funding coverage.

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APPENDICES

Appendix One

Variables Stationary Test

Null Hypothesis: Unit root (individual unit root process)
Series: LR
Date: 02/19/25 Time: 09:23
Sample: 2000 2023
Exogenous variables: Individual effects
User-specified lags: 1
Total number of observations: 274
Cross-sections included: 17

Method	Statistic	Prob.**
Im, Pesaran and Shin W-stat	-3.44043	0.0003

** Probabilities are computed assuming asympotic normality

Intermediate ADF test results

Cross section	t-Stat	Prob.	E(t)	E(Var)	Lag	Max Lag	Obs
Abay	-4.1430	0.0109	-1.491	1.206	1	1	11
BOA	-1.4642	0.5323	-1.515	0.893	1	1	22
Addis	-2.4181	0.1605	-1.488	1.255	1	1	10
Awash	-1.5527	0.4890	-1.515	0.893	1	1	22
Berhan	-3.3644	0.0349	-1.494	1.157	1	1	12
Bunna	-4.7339	0.0038	-1.494	1.157	1	1	12
CBE	-1.5546	0.4880	-1.515	0.893	1	1	22
CBO	-2.0053	0.2819	-1.508	0.973	1	1	17
Dashin	-0.8087	0.7968	-1.515	0.893	1	1	22
Enat	-2.5365	0.1419	-1.516	1.812	1	1	8
Global	-1.6391	0.4254	-1.502	1.534	1	1	9
Hibret	-0.7621	0.8101	-1.515	0.893	1	1	22
Lion	-2.1416	0.2328	-1.503	1.011	1	1	15
NIB	-1.1125	0.6918	-1.515	0.893	1	1	22
OB	-4.7150	0.0033	-1.497	1.109	1	1	13
Wegagen	-1.2857	0.6172	-1.515	0.893	1	1	22
Zemen	-4.1875	0.0080	-1.497	1.109	1	1	13
Average	-2.3779		-1.506	1.093			

Warning: for some series the expected mean and variance for the given lag and observation are not covered in IPS paper

Null Hypothesis: Unit root (individual unit root process)
Series: BS
Date: 02/19/25 Time: 09:52
Sample: 2000 2023
Exogenous variables: Individual effects
User-specified lags: 1
Total number of observations: 274
Cross-sections included: 17

Method	Statistic	Prob.**
Im, Pesaran and Shin W-stat	-0.49702	0.3096

** Probabilities are computed assuming asympotic normality

Intermediate ADF test results

Cross section	t-Stat	Prob.	E(t)	E(Var)	Lag	Max Lag	Obs
Abay	-1.3561	0.5635	-1.491	1.206	1	1	11
BOA	1.2652	0.9975	-1.515	0.893	1	1	22
Addis	-2.8819	0.0819	-1.488	1.255	1	1	10
Awash	0.6959	0.9891	-1.515	0.893	1	1	22
Berhan	-2.5539	0.1282	-1.494	1.157	1	1	12
Bunna	-1.7516	0.3836	-1.494	1.157	1	1	12
CBE	0.1678	0.9638	-1.515	0.893	1	1	22
CBO	-2.3937	0.1577	-1.508	0.973	1	1	17
Dashin	-1.1311	0.6843	-1.515	0.893	1	1	22
Enat	-8.0946	0.0003	-1.516	1.812	1	1	8
Global	-0.1846	0.9084	-1.502	1.534	1	1	9
Hibret	-2.8536	0.0672	-1.515	0.893	1	1	22
Lion	-1.3897	0.5588	-1.503	1.011	1	1	15
NIB	-1.1669	0.6694	-1.515	0.893	1	1	22
OB	-1.9822	0.2897	-1.497	1.109	1	1	13
Wegagen	-2.1056	0.2444	-1.515	0.893	1	1	22
Zemen	-0.0222	0.9395	-1.497	1.109	1	1	13
Average	-1.6317		-1.506	1.093			

Warning: for some series the expected mean and variance for the given lag and observation are not covered in IPS paper

Null Hypothesis: Unit root (individual unit root process)
Series: CAR
Date: 02/19/25 Time: 09:52
Sample: 2000 2023
Exogenous variables: Individual effects
User-specified lags: 1
Total number of observations: 274
Cross-sections included: 17

Method	Statistic	Prob.**
Im, Pesaran and Shin W-stat	-2.27029	0.0116

** Probabilities are computed assuming asympotic normality

Intermediate ADF test results

Cross section	t-Stat	Prob.	E(t)	E(Var)	Lag	Max Lag	Obs
Abay	-2.2447	0.2031	-1.491	1.206	1	1	11
BOA	-2.1999	0.2117	-1.515	0.893	1	1	22
Addis	-0.5968	0.8296	-1.488	1.255	1	1	10
Awash	-1.5510	0.4898	-1.515	0.893	1	1	22
Berhan	-0.5168	0.8556	-1.494	1.157	1	1	12
Bunna	-5.5086	0.0012	-1.494	1.157	1	1	12
CBE	-2.9056	0.0608	-1.515	0.893	1	1	22
CBO	-3.9083	0.0096	-1.508	0.973	1	1	17
Dashin	-2.8451	0.0683	-1.515	0.893	1	1	22
Enat	-0.4689	0.8491	-1.516	1.812	1	1	8
Global	0.2380	0.9575	-1.502	1.534	1	1	9
Hibret	-2.5813	0.1117	-1.515	0.893	1	1	22
Lion	-2.6470	0.1059	-1.503	1.011	1	1	15
NIB	-0.8780	0.7757	-1.515	0.893	1	1	22
OB	-3.3871	0.0318	-1.497	1.109	1	1	13
Wegagen	-1.3840	0.5711	-1.515	0.893	1	1	22
Zemen	-1.9965	0.2844	-1.497	1.109	1	1	13
Average	-2.0813		-1.506	1.093			

Warning: for some series the expected mean and variance for the given lag and observation are not covered in IPS paper

Null Hypothesis: Unit root (individual unit root process)
Series: AQ
Date: 02/19/25 Time: 09:53
Sample: 2000 2023
Exogenous variables: Individual effects
User-specified lags: 1
Total number of observations: 264
Cross-sections included: 16 (1 dropped)

Method	Statistic	Prob.**
Im, Pesaran and Shin W-stat	-0.36923	0.3560

** Probabilities are computed assuming asympotic normality

Intermediate ADF test results

Cross section	t-Stat	Prob.	E(t)	E(Var)	Lag	Max Lag	Obs
Abay	-2.4193	0.1584	-1.491	1.206	1	1	11
BOA	-2.7117	0.0880	-1.515	0.893	1	1	22
Addis		Dropped from Test					
Awash	-1.2502	0.6333	-1.515	0.893	1	1	22
Berhan	-0.6742	0.8171	-1.494	1.157	1	1	12
Bunna	-1.3027	0.5915	-1.494	1.157	1	1	12
CBE	-1.9564	0.3023	-1.515	0.893	1	1	22
CBO	-2.5851	0.1150	-1.508	0.973	1	1	17
Dashin	-0.8975	0.7695	-1.515	0.893	1	1	22
Enat	-0.7032	0.7899	-1.516	1.812	1	1	8
Global	-1.7321	0.3853	-1.502	1.534	1	1	9
Hibret	-1.9603	0.3007	-1.515	0.893	1	1	22
Lion	-0.4113	0.8837	-1.503	1.011	1	1	15
NIB	-2.0186	0.2772	-1.515	0.893	1	1	22
OB	-1.8496	0.3429	-1.497	1.109	1	1	13
Wegagen	-1.3973	0.5648	-1.515	0.893	1	1	22
Zemen	-1.7757	0.3744	-1.497	1.109	1	1	13
Average	-1.6028		-1.507	1.083			

Warning: for some series the expected mean and variance for the given lag and observation are not covered in IPS paper

Null Hypothesis: Unit root (individual unit root process)
Series: LDR
Date: 02/19/25 Time: 09:27
Sample: 2000 2023
Exogenous variables: Individual effects
User-specified lags: 1
Total number of observations: 274
Cross-sections included: 17

Method	Statistic	Prob.**
Im, Pesaran and Shin W-stat	2.15264	0.9843

** Probabilities are computed assuming asympotic normality

Intermediate ADF test results

Cross section	t-Stat	Prob.	E(t)	E(Var)	Lag	Max Lag	Obs
Abay	0.3099	0.9666	-1.491	1.206	1	1	11
BOA	-2.7542	0.0813	-1.515	0.893	1	1	22
Addis	0.1912	0.9558	-1.488	1.255	1	1	10
Awash	-1.3839	0.5712	-1.515	0.893	1	1	22
Berhan	-1.2283	0.6247	-1.494	1.157	1	1	12
Bunna	-0.4633	0.8673	-1.494	1.157	1	1	12
CBE	-2.3920	0.1552	-1.515	0.893	1	1	22
CBO	-2.9108	0.0648	-1.508	0.973	1	1	17
Dashin	-1.5064	0.5117	-1.515	0.893	1	1	22
Enat	0.2578	0.9564	-1.516	1.812	1	1	8
Global	-0.2263	0.9017	-1.502	1.534	1	1	9
Hibret	-2.2252	0.2035	-1.515	0.893	1	1	22
Lion	1.1088	0.9953	-1.503	1.011	1	1	15
NIB	-1.8528	0.3469	-1.515	0.893	1	1	22
OB	-0.8983	0.7545	-1.497	1.109	1	1	13
Wegagen	-0.5807	0.8560	-1.515	0.893	1	1	22
Zemen	0.2360	0.9636	-1.497	1.109	1	1	13
Average	-0.9599		-1.506	1.093			

Warning: for some series the expected mean and variance for the given lag and observation are not covered in IPS paper

Null Hypothesis: Unit root (individual unit root process)
Series: GDPR
Date: 02/19/25 Time: 09:29
Sample: 2000 2023
Exogenous variables: Individual effects
User-specified lags: 1
Total (balanced) observations: 374
Cross-sections included: 17

Method	Statistic	Prob.**
Im, Pesaran and Shin W-stat	-3.87928	0.0001

** Probabilities are computed assuming asympotic normality

Intermediate ADF test results

Cross section	t-Stat	Prob.	E(t)	E(Var)	Lag	Max Lag	Obs
Abay	-2.4045	0.1519	-1.515	0.893	1	1	22
BOA	-2.4045	0.1519	-1.515	0.893	1	1	22
Addis	-2.4045	0.1519	-1.515	0.893	1	1	22
Awash	-2.4045	0.1519	-1.515	0.893	1	1	22
Berhan	-2.4045	0.1519	-1.515	0.893	1	1	22
Bunna	-2.4045	0.1519	-1.515	0.893	1	1	22
CBE	-2.4045	0.1519	-1.515	0.893	1	1	22
CBO	-2.4045	0.1519	-1.515	0.893	1	1	22
Dashin	-2.4045	0.1519	-1.515	0.893	1	1	22
Enat	-2.4045	0.1519	-1.515	0.893	1	1	22
Global	-2.4045	0.1519	-1.515	0.893	1	1	22
Hibret	-2.4045	0.1519	-1.515	0.893	1	1	22
Lion	-2.4045	0.1519	-1.515	0.893	1	1	22
NIB	-2.4045	0.1519	-1.515	0.893	1	1	22
OB	-2.4045	0.1519	-1.515	0.893	1	1	22
Wegagen	-2.4045	0.1519	-1.515	0.893	1	1	22
Zemen	-2.4045	0.1519	-1.515	0.893	1	1	22
Average	-2.4045		-1.515	0.893			

Null Hypothesis: Unit root (individual unit root process)
Series: INFR
Date: 02/19/25 Time: 09:31
Sample: 2000 2023
Exogenous variables: Individual effects
User-specified lags: 1
Total (balanced) observations: 374
Cross-sections included: 17

Method	Statistic	Prob.**
Im, Pesaran and Shin W-stat	-2.60575	0.0046

** Probabilities are computed assuming asympotic normality

Intermediate ADF test results

Cross section	t-Stat	Prob.	E(t)	E(Var)	Lag	Max Lag	Obs
Abay	-2.1126	0.2419	-1.515	0.893	1	1	22
BOA	-2.1126	0.2419	-1.515	0.893	1	1	22
Addis	-2.1126	0.2419	-1.515	0.893	1	1	22
Awash	-2.1126	0.2419	-1.515	0.893	1	1	22
Berhan	-2.1126	0.2419	-1.515	0.893	1	1	22
Bunna	-2.1126	0.2419	-1.515	0.893	1	1	22
CBE	-2.1126	0.2419	-1.515	0.893	1	1	22
CBO	-2.1126	0.2419	-1.515	0.893	1	1	22
Dashin	-2.1126	0.2419	-1.515	0.893	1	1	22
Enat	-2.1126	0.2419	-1.515	0.893	1	1	22
Global	-2.1126	0.2419	-1.515	0.893	1	1	22
Hibret	-2.1126	0.2419	-1.515	0.893	1	1	22
Lion	-2.1126	0.2419	-1.515	0.893	1	1	22
NIB	-2.1126	0.2419	-1.515	0.893	1	1	22
OB	-2.1126	0.2419	-1.515	0.893	1	1	22
Wegagen	-2.1126	0.2419	-1.515	0.893	1	1	22
Zemen	-2.1126	0.2419	-1.515	0.893	1	1	22
Average	-2.1126		-1.515	0.893			

Null Hypothesis: Unit root (individual unit root process)
Series: INTR
Date: 02/19/25 Time: 09:54
Sample: 2000 2023
Exogenous variables: Individual effects
User-specified lags: 1
Total (balanced) observations: 374
Cross-sections included: 17

Method	Statistic	Prob.**
Im, Pesaran and Shin W-stat	-7.88365	0.0000

** Probabilities are computed assuming asympotic normality

Intermediate ADF test results

Cross section	t-Stat	Prob.	E(t)	E(Var)	Lag	Max Lag	Obs
Abay	-3.3225	0.0261	-1.515	0.893	1	1	22
BOA	-3.3225	0.0261	-1.515	0.893	1	1	22
Addis	-3.3225	0.0261	-1.515	0.893	1	1	22
Awash	-3.3225	0.0261	-1.515	0.893	1	1	22
Berhan	-3.3225	0.0261	-1.515	0.893	1	1	22
Bunna	-3.3225	0.0261	-1.515	0.893	1	1	22
CBE	-3.3225	0.0261	-1.515	0.893	1	1	22
CBO	-3.3225	0.0261	-1.515	0.893	1	1	22
Dashin	-3.3225	0.0261	-1.515	0.893	1	1	22
Enat	-3.3225	0.0261	-1.515	0.893	1	1	22
Global	-3.3225	0.0261	-1.515	0.893	1	1	22
Hibret	-3.3225	0.0261	-1.515	0.893	1	1	22
Lion	-3.3225	0.0261	-1.515	0.893	1	1	22
NIB	-3.3225	0.0261	-1.515	0.893	1	1	22
OB	-3.3225	0.0261	-1.515	0.893	1	1	22
Wegagen	-3.3225	0.0261	-1.515	0.893	1	1	22
Zemen	-3.3225	0.0261	-1.515	0.893	1	1	22
Average	-3.3225		-1.515	0.893			

Null Hypothesis: Unit root (individual unit root process)
Series: DBS
Date: 02/19/25 Time: 09:39
Sample: 2000 2023
Exogenous variables: Individual effects
User-specified lags: 1
Total number of observations: 257
Cross-sections included: 17

Method	Statistic	Prob.**
Im, Pesaran and Shin W-stat	-3.26360	0.0006

** Probabilities are computed assuming asympotic normality

Intermediate ADF test results

Cross section	t-Stat	Prob.	E(t)	E(Var)	Lag	Max Lag	Obs
Abay	-2.6449	0.1163	-1.488	1.255	1	1	10
BOA	-2.5382	0.1212	-1.516	0.904	1	1	21
Addis	-1.8655	0.3310	-1.502	1.534	1	1	9
Awash	-4.0095	0.0062	-1.516	0.904	1	1	21
Berhan	-1.5702	0.4634	-1.491	1.206	1	1	11
Bunna	-2.5528	0.1304	-1.491	1.206	1	1	11
CBE	-2.7999	0.0753	-1.516	0.904	1	1	21
CBO	-2.8628	0.0719	-1.506	0.992	1	1	16
Dashin	-1.7909	0.3743	-1.516	0.904	1	1	21
Enat	-1.0199	0.6795	-1.530	2.091	1	1	7
Global	-2.7723	0.1040	-1.516	1.812	1	1	8
Hibret	-1.3855	0.5694	-1.516	0.904	1	1	21
Lion	-2.2215	0.2077	-1.500	1.060	1	1	14
NIB	-2.7543	0.0820	-1.516	0.904	1	1	21
OB	-2.5962	0.1202	-1.494	1.157	1	1	12
Wegagen	-2.2092	0.2089	-1.516	0.904	1	1	21
Zemen	-2.5494	0.1291	-1.494	1.157	1	1	12
Average	-2.3613		-1.507	1.165			

Warning: for some series the expected mean and variance for the given lag and observation are not covered in IPS paper

Null Hypothesis: Unit root (individual unit root process)
Series: DLDR
Date: 02/19/25 Time: 09:41
Sample: 2000 2023
Exogenous variables: Individual effects
User-specified lags: 1
Total number of observations: 257
Cross-sections included: 17

Method	Statistic	Prob.**
Im, Pesaran and Shin W-stat	-6.53496	0.0000

** Probabilities are computed assuming asympotic normality

Intermediate ADF test results

Cross section	t-Stat	Prob.	E(t)	E(Var)	Lag	Max Lag	Obs
Abay	-2.0735	0.2565	-1.488	1.255	1	1	10
BOA	-3.8970	0.0079	-1.516	0.904	1	1	21
Addis	-3.4525	0.0381	-1.502	1.534	1	1	9
Awash	-3.1334	0.0393	-1.516	0.904	1	1	21
Berhan	-5.6889	0.0011	-1.491	1.206	1	1	11
Bunna	-1.7079	0.4010	-1.491	1.206	1	1	11
CBE	-3.6268	0.0141	-1.516	0.904	1	1	21
CBO	-3.8228	0.0121	-1.506	0.992	1	1	16
Dashin	-2.7332	0.0853	-1.516	0.904	1	1	21
Enat	-1.5817	0.4401	-1.530	2.091	1	1	7
Global	-5.1976	0.0049	-1.516	1.812	1	1	8
Hibret	-4.1116	0.0049	-1.516	0.904	1	1	21
Lion	-2.7807	0.0860	-1.500	1.060	1	1	14
NIB	-2.3408	0.1694	-1.516	0.904	1	1	21
OB	-3.6454	0.0220	-1.494	1.157	1	1	12
Wegagen	-2.5516	0.1184	-1.516	0.904	1	1	21
Zemen	-2.3541	0.1725	-1.494	1.157	1	1	12
Average	-3.2176		-1.507	1.165			

Warning: for some series the expected mean and variance for the given lag and observation are not covered in IPS paper

Null Hypothesis: Unit root (individual unit root process)
Series: DAQ
Date: 02/19/25 Time: 09:55
Sample: 2000 2023
Exogenous variables: Individual effects
User-specified lags: 1
Total number of observations: 248
Cross-sections included: 16 (1 dropped)

Method	Statistic	Prob.**
Im, Pesaran and Shin W-stat	-6.75038	0.0000

** Probabilities are computed assuming asympotic normality

Intermediate ADF test results

Cross section	t-Stat	Prob.	E(t)	E(Var)	Lag	Max Lag	Obs
Abay	-2.5617	0.1311	-1.488	1.255	1	1	10
BOA	-5.2819	0.0004	-1.516	0.904	1	1	21
Addis		Dropped from Test					
Awash	-3.4979	0.0186	-1.516	0.904	1	1	21
Berhan	-2.2635	0.1978	-1.491	1.206	1	1	11
Bunna	-4.6904	0.0048	-1.491	1.206	1	1	11
CBE	-3.4972	0.0186	-1.516	0.904	1	1	21
CBO	-4.8294	0.0018	-1.506	0.992	1	1	16
Dashin	-3.5610	0.0163	-1.516	0.904	1	1	21
Enat	-1.9640	0.2919	-1.530	2.091	1	1	7
Global	-1.5811	0.4463	-1.516	1.812	1	1	8
Hibret	-2.9063	0.0614	-1.516	0.904	1	1	21
Lion	-3.6406	0.0192	-1.500	1.060	1	1	14
NIB	-2.5602	0.1166	-1.516	0.904	1	1	21
OB	-3.6742	0.0209	-1.494	1.157	1	1	12
Wegagen	-3.5094	0.0181	-1.516	0.904	1	1	21
Zemen	-2.9504	0.0686	-1.494	1.157	1	1	12
Average	-3.3106		-1.507	1.142			

Warning: for some series the expected mean and variance for the given lag and observation are not covered in IPS paper

Appendix Two

LM Test for Model Estimation Method

Lagrange Multiplier Tests for Random Effects
Null hypotheses: No effects
Alternative hypotheses: Two-sided (Breusch-Pagan) and one-sided (all others) alternatives

	Test Hypothesis		
	Cross-section	Time	Both
Breusch-Pagan	14.82925 (0.0001)	576.7404 (0.0000)	591.5697 (0.0000)
Honda	3.850877 (0.0001)	24.01542 (0.0000)	19.70445 (0.0000)
King-Wu	3.850877 (0.0001)	24.01542 (0.0000)	18.57959 (0.0000)
Standardized Honda	4.253726 (0.0000)	26.87847 (0.0000)	17.38392 (0.0000)
Standardized King-Wu	4.253726 (0.0000)	26.87847 (0.0000)	16.10995 (0.0000)
Gourieroux, et al.	--	--	591.5697 (0.0000)

Appendix Three

Hausman for Fixed or Random Model

Correlated Random Effects - Hausman Test
Equation: Untitled
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	34.486984	7	0.0000

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
DBS	0.590147	0.456976	0.002023	0.0031
CAR	0.940825	0.769509	0.003184	0.0024
DLDR	-0.430935	-0.546896	0.000920	0.0001
DAQ	-0.047287	-0.263821	0.005108	0.0024
GDPR	0.483872	0.644083	0.001680	0.0001
INFR	-0.026161	-0.066739	0.000103	0.0001
INTR	2.527657	2.371941	0.015385	0.2093

Cross-section random effects test equation:
Dependent Variable: LR
Method: Panel Least Squares
Date: 02/20/25 Time: 14:24
Sample (adjusted): 2001 2023
Periods included: 23
Cross-sections included: 17
Total panel (unbalanced) observations: 290

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.160911	0.098306	-1.636842	0.1028
DBS	0.590147	0.120647	4.891505	0.0000
CAR	0.940825	0.097830	9.616892	0.0000
DLDR	-0.430935	0.092971	-4.635133	0.0000
DAQ	-0.047287	0.467728	-0.101099	0.9195
GDPR	0.483872	0.291506	1.659906	0.0981
INFR	-0.026161	0.066805	-0.391609	0.6957
INTR	2.527657	1.393879	1.813397	0.0709

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.562298	Mean dependent var	0.349187
Adjusted R-squared	0.524451	S.D. dependent var	0.170623
S.E. of regression	0.117662	Akaike info criterion	-1.362873
Sum squared resid	3.682579	Schwarz criterion	-1.059159
Log likelihood	221.6166	Hannan-Quinn criter.	-1.241190
F-statistic	14.85734	Durbin-Watson stat	0.608378
Prob(F-statistic)	0.000000		

Appendix Four

Homoskedastic Test for Error Term

Panel Cross-section Heteroskedasticity LR Test
Equation: UNTITLED
Specification: LR DBS CAR DLDR DAQ GDPR INFR INTR C
Null hypothesis: Residuals are homoskedastic

	Value	df	Probability
Likelihood ratio	39.69957	17	0.0014

LR test summary:

	Value	df
Restricted LogL	196.0693	282
Unrestricted LogL	215.9190	282

Unrestricted Test Equation:
Dependent Variable: LR
Method: Panel EGLS (Cross-section weights)
Date: 02/20/25 Time: 12:20
Sample: 2001 2023
Periods included: 23
Cross-sections included: 17
Total panel (unbalanced) observations: 290
Iterate weights to convergence
Convergence achieved after 17 weight iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DBS	0.479044	0.086623	5.530217	0.0000
CAR	0.727990	0.059570	12.22080	0.0000
DLDR	-0.531245	0.086542	-6.138578	0.0000
DAQ	-0.112388	0.469875	-0.239188	0.8111
GDPR	1.173421	0.313586	3.741940	0.0002
INFR	0.016601	0.061538	0.269770	0.7875
INTR	0.535106	1.262310	0.423910	0.6720
C	-0.053078	0.092260	-0.575305	0.5655

Weighted Statistics

R-squared	0.630855	Mean dependent var	0.415636
Adjusted R-squared	0.621691	S.D. dependent var	0.272607
S.E. of regression	0.130040	Akaike info criterion	-1.433924
Sum squared resid	4.768718	Schwarz criterion	-1.332686
Log likelihood	215.9190	Hannan-Quinn criter.	-1.393363
F-statistic	68.84666	Durbin-Watson stat	0.675178
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.433199	Mean dependent var	0.349187
Sum squared resid	4.768739	Durbin-Watson stat	0.561404

Appendix Five

Interdependency among Variables

Residual Cross-Section Dependence Test
Null hypothesis: No cross-section dependence (correlation) in residuals
Equation: Untitled
Periods included: 23
Cross-sections included: 17
Total panel (unbalanced) observations: 290
Note: non-zero cross-section means detected in data
Test employs centered correlations computed from pairwise samples

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	750.3603	136	0.0000
Pesaran scaled LM	37.25106		0.0000
Pesaran CD	23.88456		0.0000

Appendix 6

Endogenoutiy Test for Variables

Dependent Variable: LR
Method: Panel Least Squares
Date: 05/03/25 Time: 19:06
Sample (adjusted): 2001 2023
Periods included: 23
Cross-sections included: 17
Total panel (unbalanced) observations: 290

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESID_DBS	0.628268	0.126564	4.964050	0.0000
CAR	0.835886	0.076276	10.95871	0.0000
DLDR	-0.554790	0.093703	-5.920710	0.0000
DAQ	-0.209200	0.484197	-0.432056	0.6660
GDPR	0.670887	0.303894	2.207636	0.0281
INFR	-0.068720	0.069098	-0.994538	0.3208
INTR	2.559057	1.446290	1.769393	0.0779
LDR	-0.009482	0.043610	-0.217426	0.8280
C	-0.067514	0.103928	-0.649625	0.5165

R-squared	0.496580	Mean dependent var	0.349187
Adjusted R-squared	0.482248	S.D. dependent var	0.170623
S.E. of regression	0.122772	Akaike info criterion	-1.326437
Sum squared resid	4.235485	Schwarz criterion	-1.212544
Log likelihood	201.3334	Hannan-Quinn criter.	-1.280806
F-statistic	34.64782	Durbin-Watson stat	0.568545
Prob(F-statistic)	0.000000		

Dependent Variable: LR
Method: Panel Least Squares
Date: 05/03/25 Time: 19:12
Sample (adjusted): 2001 2023
Periods included: 23
Cross-sections included: 17
Total panel (unbalanced) observations: 290

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESID_CAR	0.753852	0.082244	9.166080	0.0000
DBS	0.810105	0.110954	7.301284	0.0000
DLDR	-0.648646	0.094926	-6.833199	0.0000
DAQ	-0.355604	0.492360	-0.722243	0.4707
GDPR	1.058739	0.305976	3.460208	0.0006
INFR	-0.067684	0.070338	-0.962270	0.3367
INTR	1.670676	1.470827	1.135875	0.2570
LDR	-0.040762	0.044616	-0.913634	0.3617
C	0.078183	0.104437	0.748617	0.4547

R-squared	0.479082	Mean dependent var	0.349187
Adjusted R-squared	0.464252	S.D. dependent var	0.170623
S.E. of regression	0.124887	Akaike info criterion	-1.292269
Sum squared resid	4.382703	Schwarz criterion	-1.178376
Log likelihood	196.3790	Hannan-Quinn criter.	-1.246638
F-statistic	32.30410	Durbin-Watson stat	0.555668
Prob(F-statistic)	0.000000		

Dependent Variable: LR
Method: Panel Least Squares
Date: 05/03/25 Time: 19:18
Sample (adjusted): 2001 2023
Periods included: 23
Cross-sections included: 17
Total panel (unbalanced) observations: 290

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESID_DLDR	-0.540046	0.095662	-5.645349	0.0000
CAR	0.811356	0.081610	9.941814	0.0000
DBS	0.509604	0.117296	4.344602	0.0000
DAQ	0.597752	0.469460	1.273275	0.2040
GDPR	0.770158	0.308544	2.496101	0.0131
INFR	-0.103490	0.070043	-1.477515	0.1407
INTR	2.698079	1.471804	1.833178	0.0678
LDR	-0.098213	0.043174	-2.274807	0.0237
C	-0.084636	0.105685	-0.800826	0.4239

R-squared	0.479082	Mean dependent var	0.349187
Adjusted R-squared	0.464252	S.D. dependent var	0.170623
S.E. of regression	0.124887	Akaike info criterion	-1.292269
Sum squared resid	4.382703	Schwarz criterion	-1.178376
Log likelihood	196.3790	Hannan-Quinn criter.	-1.246638
F-statistic	32.30410	Durbin-Watson stat	0.555668
Prob(F-statistic)	0.000000		

Dependent Variable: LR
Method: Panel Least Squares
Date: 05/03/25 Time: 19:21
Sample (adjusted): 2001 2023
Periods included: 23
Cross-sections included: 17
Total panel (unbalanced) observations: 290

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESID_DAQ	7.92E+15	1.03E+16	0.771743	0.4409
DLDR	-0.607316	0.129469	-4.690808	0.0000
CAR	0.825320	0.123894	6.661521	0.0000
DBS	0.444923	0.117932	3.772724	0.0002
DAQ	-0.292384	0.497014	-0.588282	0.5568
GDPR	0.173944	0.661123	0.263104	0.7927
INFR	-0.098825	0.081485	-1.212807	0.2262
INTR	9.521852	9.368731	1.016344	0.3103
LDR	-0.029134	0.045209	-0.644436	0.5198
C	-0.556559	0.637052	-0.873647	0.3831

R-squared	0.480188	Mean dependent var	0.349187
Adjusted R-squared	0.463480	S.D. dependent var	0.170623
S.E. of regression	0.124977	Akaike info criterion	-1.287498
Sum squared resid	4.373400	Schwarz criterion	-1.160950
Log likelihood	196.6871	Hannan-Quinn criter.	-1.236796
F-statistic	28.73961	Durbin-Watson stat	0.563679
Prob(F-statistic)	0.000000		

Dependent Variable: LR
Method: Panel Least Squares
Date: 05/03/25 Time: 19:25
Sample (adjusted): 2001 2023
Periods included: 23
Cross-sections included: 17
Total panel (unbalanced) observations: 290

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESID_GDPR	0.624658	0.309619	2.017507	0.0446
DAQ	-0.594302	0.460696	-1.290009	0.1981
DLDR	-0.556112	0.095330	-5.833536	0.0000
CAR	0.779231	0.081276	9.587478	0.0000
DBS	0.460508	0.117625	3.915040	0.0001
INFR	-0.080356	0.070033	-1.147410	0.2522
INTR	3.083727	1.431170	2.154689	0.0320
LDR	-0.048351	0.044096	-1.096474	0.2738
C	-0.064806	0.105654	-0.613374	0.5401

R-squared	0.479082	Mean dependent var	0.349187
Adjusted R-squared	0.464252	S.D. dependent var	0.170623
S.E. of regression	0.124887	Akaike info criterion	-1.292269
Sum squared resid	4.382703	Schwarz criterion	-1.178376
Log likelihood	196.3790	Hannan-Quinn criter.	-1.246638
F-statistic	32.30410	Durbin-Watson stat	0.555668
Prob(F-statistic)	0.000000		

Dependent Variable: LR
Method: Panel Least Squares
Date: 05/03/25 Time: 19:28
Sample (adjusted): 2001 2023
Periods included: 23
Cross-sections included: 17
Total panel (unbalanced) observations: 290

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESID_INFR	-0.067145	0.070338	-0.954596	0.3406
GDPR	0.652175	0.308274	2.115569	0.0353
DAQ	-0.218646	0.491855	-0.444534	0.6570
DLDR	-0.548405	0.095261	-5.756888	0.0000
CAR	0.753918	0.082244	9.166882	0.0000
DBS	0.452574	0.117664	3.846324	0.0001
INTR	2.084629	1.439632	1.448029	0.1487
LDR	-0.039108	0.044369	-0.881420	0.3788
C	-0.061537	0.105168	-0.585130	0.5589

R-squared	0.479082	Mean dependent var	0.349187
Adjusted R-squared	0.464252	S.D. dependent var	0.170623
S.E. of regression	0.124887	Akaike info criterion	-1.292269
Sum squared resid	4.382703	Schwarz criterion	-1.178376
Log likelihood	196.3790	Hannan-Quinn criter.	-1.246638
F-statistic	32.30410	Durbin-Watson stat	0.555668
Prob(F-statistic)	0.000000		

Dependent Variable: LR
Method: Panel Least Squares
Date: 05/03/25 Time: 19:42
Sample (adjusted): 2001 2023
Periods included: 23
Cross-sections included: 17
Total panel (unbalanced) observations: 290

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESID_INTR	2.381642	1.471286	1.618749	0.1066
GDPR	0.751529	0.300218	2.503276	0.0129
DAQ	-0.245271	0.490982	-0.499551	0.6178
DLDR	-0.551058	0.095140	-5.792044	0.0000
CAR	0.747480	0.082035	9.111719	0.0000
DBS	0.459279	0.117446	3.910542	0.0001
LDR	-0.036691	0.044290	-0.828428	0.4081
C	0.077312	0.043147	1.791837	0.0742

R-squared	0.478353	Mean dependent var	0.349187
Adjusted R-squared	0.465405	S.D. dependent var	0.170623
S.E. of regression	0.124753	Akaike info criterion	-1.297767
Sum squared resid	4.388838	Schwarz criterion	-1.196529
Log likelihood	196.1762	Hannan-Quinn criter.	-1.257206
F-statistic	36.94226	Durbin-Watson stat	0.546539
Prob(F-statistic)	0.000000		

Dependent Variable: LR
Method: Panel Least Squares
Date: 05/03/25 Time: 19:45
Sample (adjusted): 2001 2023
Periods included: 23
Cross-sections included: 17
Total panel (unbalanced) observations: 290

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESID_LDR	-1.28E+14	1.12E+14	-1.139957	0.2553
GDPR	-0.567012	1.195161	-0.474423	0.6356
DAQ	-0.796696	0.690056	-1.154539	0.2493
DLDR	-0.543232	0.095609	-5.681820	0.0000
CAR	0.192686	0.493577	0.390388	0.6965
DBS	0.705302	0.245836	2.868995	0.0044
LDR	-0.380352	0.304719	-1.248204	0.2130
C	0.510908	0.382812	1.334618	0.1831

R-squared	0.475921	Mean dependent var	0.349187
Adjusted R-squared	0.462912	S.D. dependent var	0.170623
S.E. of regression	0.125043	Akaike info criterion	-1.293116
Sum squared resid	4.409300	Schwarz criterion	-1.191877
Log likelihood	195.5018	Hannan-Quinn criter.	-1.252555
F-statistic	36.58386	Durbin-Watson stat	0.572240
Prob(F-statistic)	0.000000		