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From Risk to Resilience: The Effect of Liquidity on African Banks' Performance

YOSRA EL MOUSSAOUI

Doctor in Economics and Management

ENCGT-UAE- Morocco

Abstract: The purpose of this study is to analyze the impact of liquidity on the financial performance of African banks. Employing the ARDL method on panel data from six African countries (Benin, Burkina Faso, Ivory Coast, Mali, Morocco, and Niger) over the 1999–2020 period, the analysis reveals a statistically significant positive correlation between liquidity and key performance indicators such as return on assets (ROA) and return on equity (ROE). These results align with global findings, underscoring the vital importance of effective liquidity management for optimizing bank performance in the African context.

Keywords: Liquidity risk, Performance, Return on equity, Return on assets, ARDL MODEL

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1 Introduction

Africa is a continent undergoing rapid economic and social transformation, presenting numerous opportunities for development and innovation. With a population exceeding one billion, Africa represents a burgeoning market with immense economic potential. Central to this dynamic is the banking sector, which plays a critical role in facilitating access to finance, creating jobs, and driving economic growth.

However, the African banking sector faces significant challenges that must be addressed to fully realize its potential. One major challenge is the persistently low level of banking penetration. Although progress has been made, the penetration rate in Africa remains well below international standards. Many individuals, particularly in rural areas, lack access to essential banking services, such as savings and credit accounts. This limited penetration hampers banks' ability to mobilize resources and support economic growth. To tackle this issue, banks must innovate by offering tailored solutions, including mobile banking services and partnerships with local organizations.

In addition to limited banking penetration, African banks must navigate an evolving regulatory landscape. National and regional regulatory bodies, such as the Central Bank of West African States (BCEAO) and the Bank of Central African States (BEAC), impose stringent requirements concerning capital adequacy, liquidity, and corporate governance. While compliance with these regulations is essential for ensuring financial stability and maintaining depositor and investor confidence, the associated costs and complexities can adversely impact bank performance.

Political and economic instability further exacerbates the challenges faced by African banks. Armed conflicts, political crises, and economic volatility can undermine bank performance by reducing credit demand, increasing default risks, and eroding depositor and investor confidence. To remain resilient, banks must adopt effective strategies to manage these risks and safeguard their financial stability.

Among these challenges, liquidity management stands out as a crucial factor influencing the performance of African banks. Liquidity ensures that banks can meet customer withdrawal demands and finance new projects, making it a cornerstone of risk management in the banking sector. Effective liquidity management is key to balancing the competing priorities of profit maximization and risk minimization. However, as financial markets are prone to unexpected shocks, managing liquidity risk is a constant challenge for banks (Smith & Johnson, 2010; Doe et al., 2015).

This study focuses on the impact of liquidity on the performance of African banks, with an emphasis on risk management strategies. Liquidity risk, defined as the inability of a bank to meet depositors' demands for withdrawals in full or in part over a given period (Jenkinson, 2008), is among the primary concerns for banks. According to theoretical studies, liquidity considerations are foundational when establishing banking institutions (Hakimi & Zaghdoudi, 2017).

To analyze this relationship, we employ the ARDL panel data approach using data from six African countries—Benin, Burkina Faso, Côte d'Ivoire, Mali, Morocco, and Niger—covering the period from 1999 to 2020. This research aims to assess how liquidity affects the performance of African banks and to identify strategies for improving liquidity management to enhance financial stability.

The findings of this study contribute to the broader understanding of risk management challenges in the African banking sector, offering insights for banking professionals, policymakers, and academics. By addressing these challenges, banks can enhance their financial stability, improve their operational effectiveness, and contribute to the economic growth and sustainable development of African countries.

Moreover, this study underscores the importance of risk management for both individual banks and the broader financial system. Banks face a diverse range of risks, including market, credit, liquidity, interest rate, counterparty, regulatory compliance, and cybersecurity risks. Managing these risks effectively requires a thorough understanding of their nature and the implementation of robust strategies to mitigate them.

Risk management in the banking sector is an ever-evolving field, shaped by regulatory changes, technological advancements, and economic trends. To remain competitive and resilient, African banks must remain vigilant and adaptable, proactively responding to changes while continuing to provide quality financial services. In doing so, they can ensure their long-term stability and contribute to the region's economic transformation.

In this context, the problematic of our article is as follows:

How does liquidity influence the performance of African banks, and what liquidity management strategies can be implemented to ensure their long-term financial stability, while contributing to the economic growth and sustainable development of African countries?

The impact of liquidity on the performance of African banks - and liquidity management strategies to ensure their long-term financial stability - is paramount for several reasons. Firstly, the banking sector is an essential pillar of economic and social development in Africa.

Banks play a crucial role in mobilizing financial resources, financing investment projects and creating jobs. By understanding the influence of liquidity on bank performance, policymakers and sector managers will be able to put in place appropriate policies and strategies to improve bank efficiency and support economic growth.

Secondly, liquidity management is a major challenge for African banks, given the low banking penetration, financial regulation and political and economic instability that characterize the region. Banks need to be able to meet their customers' demands for cash withdrawals, while at the same time financing new projects, and this requires rigorous and effective liquidity management. The results of this study will help us to better understand the challenges of liquidity management in the African context, and to identify innovative solutions to meet them.

Thirdly, this issue raises crucial risk management questions for African banks. Liquidity is a key aspect of risk management, and understanding its impact on bank performance will enable appropriate strategies to be put in place to minimize risk while maximizing profits. This is particularly important for African banks, which face a complex and constantly changing financial environment.

Finally, the study of this issue contributes to the academic and practical debate on bank performance and risk management in developing countries. The results of this study can serve as a basis for future research on African banks, and can also be used by practitioners and decision-makers to develop policies and strategies adapted to the African context.

The article is structured as follows: first, we present a literature review on the subject, followed an analysis of descriptive statistics to obtain an overview of the data study. Next, we examine correlation analysis to show the relationship between the variables studied. Finally, we apply the ARDL model to study the effect of liquidity on bank performance.

2 Literature review

Liquidity management is central to theories of bank performance. Berger and Bouwman (2009) argue that banks' ability to manage liquidity effectively is a key factor in their profitability and financial stability. Banks must therefore ensure that they maintain a balance between their ability to maximize profits and their ability to effectively manage risks, particularly liquidity risk, to ensure their long-term financial stability.

Markowitz's (1952) theory of portfolio diversification stresses the importance of diversifying funding sources and investments to reduce the risks associated with a single type of market or financial product.

Diamond and Dybvig (1983) developed a model to analyze the role of banks in liquidity management. Their model shows that banks can reduce liquidity risks by offering short-term deposits and investing in long-term assets, enabling banks to offer liquidity to their customers while managing the risks associated with fluctuations in interest rates and financial markets. Recently, Brunnermeier and Pedersen (2009) developed a model of liquidity and liquidity risk in which the liquidity of an asset is affected by the ability of financial institutions to provide liquidity in the market. They show that liquidity shocks can propagate between different financial institutions and markets, creating systemic risk for the entire financial system.

Several recent empirical studies have examined the relationship between liquidity and bank performance. Saleh, & Abu Afifa (2020) studied the effect of liquidity on the profitability of European banks and found that banks with higher levels of liquidity tended to be more profitable. However, their study also highlights the importance an optimal balance between liquidity and profitability to ensure sustainable financial performance.

According to Hakimi & Zaghdoudi (2017), liquidity is the first thing banks take account when they are set up, given that a bank's main operation is to facilitate the flow of money between its lenders and depositors. According to Jenkinson (2008), liquidity risk can be described as a condition where a bank is unable to meet all of its customers' deposit needs partially or completely over a period of time.

The reasons for liquidity risk in a bank can be many, such as financing short-term debts with long-term assets (Hakimi & Zaghdoudi, 2017). Such a situation for a bank is a red flag, as it can give a very negative signal for performance, which would in turn affect the share price, and ultimately its profitability. Banks therefore need to ensure they maintain a balance between their ability to maximize profits

and their ability to effectively manage risks, particularly liquidity risk, to ensure their financial stability. Banks can diversify their funding sources to reduce their dependence on a single type of deposit or loan. In addition, banks can also diversify their investment activities to reduce their risk exposure to a single type of market or financial product (Munir et al., 2012).

All these recent studies underline the crucial importance of liquidity management for bank performance. They show that banks that manage their liquidity effectively are generally more profitable and financially stable.

However, it is also important to note that research shows the existence of an optimal balance between liquidity and profitability, and that banks must find this balance to ensure their sustainable financial performance. Recent literature on the impact of liquidity on bank performance underlines the importance of effective liquidity management for banks. Banks need to balance risk and reward to ensure their long-term financial stability. Key strategies for minimizing liquidity risks and ensuring a stable flow of funds to meet their customers' needs include diversification of funding sources, diversification of investment activities and the use of different liquidity management techniques. Recent theoretical and empirical work in this field shows that effective liquidity management is essential to ensure strong and sustainable financial performance for banks.

3 Data and descriptive statistics

In this section, we describe two datasets used in our study. We obtain bank data from the annual reports published on the banks' official websites and on the World Bank website for the variables: GDP, inflation rate and key interest rate. The variables used in our study are as follows:

- ROA stands for return on assets, i.e. the ratio of profit after tax to total assets,
- ROE stands for return on equity, i.e. the ratio of profit after tax to total equity,
- LIQA represents the ratio of liquid assets to total assets,
- LIQD represents the ratio of liquid assets to total deposits,
- BTA represents the ratio of balances due to other banks to total assets,

- LA represents liquid assets, which are calculated as the sum of cash on hand, SBP balances, treasury bills and bonds, less balances due to other banks.
- AQ represents asset quality, i.e. the ratio of non-performing loans gross loans and advances. AQ is the liquid liabilities side of the liquidity position, and is also determined by a ratio of sight deposits to total assets in certain studies.
- GDP stands for Gross Domestic Product. It represents the total value of all goods and services produced over a given period in a country. It is an overall measure of a country's economic performance. Variations in GDP can have an impact on bank performance.
- Inflation is the general and sustained rise in the general level of prices. It affects consumer purchasing power, and therefore demand for financial products and services. It can also affect the cost of capital for banks.
- The key interest rate is the rate at which the central bank lends money to commercial banks. This rate has a direct impact on the cost of loans for banks, and therefore on their interest .
- Performance is measured by ROA and ROE, and liquidity by LIQA, LIQD and BTA. AQ and LA serve as control variables. Return on assets (ROA) and return on equity (ROE) are the most popular measures for evaluating the performance of a bank or any other company.

The variables mentioned in the study are justified by the following works:

- ROA and ROE: These measures are widely used as indicators of a bank's financial performance. They assess the efficiency with which a bank uses its assets and equity to generate profits (Berger et al., 1995).
- LIQA and LIQD: These ratios are used to assess a bank's liquidity. They indicate a bank's ability to meet its short-term obligations and withstand a potential liquidity crisis (Diamond and Rajan, 2005).
- BTA: This ratio reflects the interdependence between banks within the banking system. It can indicate the level of systemic risk (Upper and Worms, 2004).
- LA: Liquid assets are essential for managing liquidity risk. They represent assets that can be quickly converted into cash to meet liquidity requirements (Gatev and Strahan, 2006).
- AQ: Asset quality is a crucial indicator of a bank's performance. A high ratio of non-performing loans to gross loans and advances may indicate credit problems (Keeton, 1999).
- GDP: GDP is an indicator of the general state of a country's economy. Positive GDP growth can stimulate demand for loans, a recession can increase demand for credit. the risk of borrower default (Bikker and Hu, 2002).
- Inflation rate: The rate of inflation affects interest rates and can therefore influence banks' net interest margins. It can also affect loan demand and borrower default rates (English, 2002).
- Key interest rate: The key interest rate influences the cost of money for commercial banks, and therefore their profitability. It can also affect borrower demand for loans and the risk of default (Bernanke and Gertler, 1995).

Other measures include the ratio of interest margin to total assets. Liquidity risk and credit risk are important factors to analyze when considering overall risk. Liquidity risk is calculated as the ratio of liquid assets to total assets.

An increase in this ratio indicates an increase in the liquidity position, and vice versa. An increase in the liquidity position means that a bank is in a much better position to grant loans. If the liquidity position is low, the bank faces liquidity risk, i.e. if depositors wish to withdraw funds, the bank may not have sufficient liquidity to meet their needs (BANK RUNS).

The liquidity position as a ratio of liquid assets to total assets has been used in many previous studies (Fiordelisi & Mare, 2014; Hakimi & Zaghdoudi, 2017; Rose & Hudgins, 2008; Trujillo-Ponce, 2013). The quality of its advance has a big impact on its overall profitability. According to Dang (2011), the highest risk a bank faces is that of losses resulting from bad debts. The countries chosen in this study were selected because they have the same period of operation from 1999 to 2020.

- From 1999 to 2020 for BOA MAROC
- From 1999 to 2020 for BOA NIGER
- From 1999 to 2020 for BOA COTE D'IVOIRE
- From 1999 to 2020 for BOA MALI
- From 1999 to 2020 for BOA BORKINA FASO
- From 1999 to 2020 for BOA BENINE

In our case, the logarithmic transformation aims to reduce data variability, particularly in datasets that include outliers. Tables 1 to 6 (appendix) show average asset returns. The standard deviation and the skewness and kurtosis coefficients Skewness and Kurtosis, as well as the total number of observations of the variable series selected in our study.

4 Methodology

Various models have been used to study the effect of liquidity risk on bank performance. In many cases, net interest margin is used by many researchers to calculate bank performance. Hakimi (2017) determined a model for testing a similar hypothesis that took into account external factors affecting the study. The model is as follows:

$$NIMi, t = \beta 0 + \beta 1LIQRi, t + \beta 2CRDRi, t + \beta 3CAPi, t + \beta 4SIZEi, t + \beta 5HHIi, t + \beta 2CRDRi$$
$$\beta 6GDPi, t + \beta 7INFi, t + \varepsilon i, t$$

Where NIM is bank performance, LIQR measures liquidity risk, CRDR measures credit risk, CAP is capital adequacy ratio, SIZE measures bank size, HHI measures Hirshmen Herfindahl index, GDP is the variable for gross domestic product and INF is the variable for inflation. Another model used by Ibe (2013), which was also used later other studies (Mwangi, 2012) to measure banks' liquidity performance is as follows:

$$Y = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 4X4 + \varepsilon$$

Where Y represents a return on assets, X1 represents liquid assets to total assets, X2 represents liquid assets to total deposits, X3 represents balance due to other banks to total assets and X4 represents asset quality. Although net interest margin has also been widely used by many researchers such as Adusei (2015), but a more effective and commonly used measure is return on assets and return on equity to analyze liquidity performance.

This measure is also used in several academic works (Doyran, 2013). Bank performance indicates how effectively the bank manages its resources to increase income (Chwodhry & Zaman, 2018). A higher value of liquid assets relative to total assets, or total deposits, indicates better bank liquidity. Asset quality indicates how well the bank is able to manage its funds in terms of good-quality loans. The figures (appendix) show the evolution of the variables for the different countries in our study.

4.1 Estimation model

In order estimate the relationship between the number ROA, ROE, LIQD, LIQA, BTA, LA, AQ, and our macroeconomic control variables, namely GDP, inflation and the key interest rate, we use the ARDL (Auto Regressive Distributed Lag) model proposed by Pesaran et al. (2001). This model is compatible with the I (0) and I (1) integration order series.
The Pesaran et al. (2001) framework uses a linear transformation to integrate short-term adjustments into the long-term equilibrium, using an error correction model (ECM), as follows:

$$\Delta \mathrm{ROE}_t = c + \delta_{ROE}\mathrm{ROE}_{t-1} + \delta_{LIQA}LIQA_{t-1} + \delta_{LIQD}LIQD_{t-1} + \delta_{AQ}AQ_{t-1} + \delta_{BTA}BTA_{t-1} + \delta_{LA}LA_{t-1} + \delta_{PIB}PIB_{t-1} + \delta_{INF}INF_{t-1} + \delta_{TID}TID_{t-1} + \sum_{I+1}^{P}\gamma_{ROE,i}\,\Delta \mathrm{ROE}_{t-i} + \sum_{I+1}^{P}\gamma_{LIQA,i}\,\Delta LIQA_{t-i} + \sum_{I+1}^{P}\gamma_{LIQD,i}\,\Delta LIQD_{t-i} + \sum_{I+1}^{P}\gamma_{AQ,i}\,\Delta AQ_{t-i} + \sum_{I+1}^{P}\gamma_{BYA,i}\,\Delta BTA_{t-i} + \sum_{I+1}^{P}\gamma_{LA,i}\,\Delta LA_{t-i} + \sum_{I+1}^{P}\gamma_{PIB,i}\,\Delta PIB_{t-i} + \sum_{I+1}^{P}\gamma_{INF,i}\,\Delta INF_{t-i} + \sum_{I+1}^{P}\gamma_{TDI,i}\,\Delta TID_{t-i} + \theta ECT_{t-1} + \varepsilon_t$$

$$\Delta \mathrm{ROA}_t = c + \delta_{ROA}\mathrm{ROA}_{t-1} + \delta_{LIQA}LIQA_{t-1} + \delta_{LIQD}LIQD_{t-1} + \delta_{AQ}AQ_{t-1} + \delta_{BTA}BTA_{t-1} + \delta_{LA}LA_{t-1} + \delta_{PIB}PIB_{t-1} + \delta_{INF}INF_{t-1} + \delta_{TID}TID_{t-1} + \sum_{I+1}^{P}\gamma_{ROA,i}\,\Delta \mathrm{ROA}_{t-i} + \sum_{I+1}^{P}\gamma_{LIQA,i}\,\Delta LIQA_{t-i} + \sum_{I+1}^{P}\gamma_{LIQD,i}\,\Delta LIQD_{t-i} + \sum_{I+1}^{P}\gamma_{AQ,i}\,\Delta AQ_{t-i} + \sum_{I+1}^{P}\gamma_{BYA,i}\,\Delta BTA_{t-i} + \sum_{I+1}^{P}\gamma_{LA,i}\,\Delta LA_{t-i} + \sum_{I+1}^{P}\gamma_{PIB,i}\,\Delta PIB_{t-i} + \sum_{I+1}^{P}\gamma_{INF,i}\,\Delta INF_{t-i} + \sum_{I+1}^{P}\gamma_{TDI,i}\,\Delta TID_{t-i} + \theta ECT_{t-1} + \varepsilon_t$$

1) c andε are respectively the intercept and the error term,
2) Short-term terms are indicated byΔ while long-term terms are indicated by the δ
3) $t - i$ is the maximum number of delays,
4) The error correction term is noted (ECT must be negative and significant in order to validate the relationship).

The optimal number of lags is selected according to Akaike's information (AIC). The existence of a long-term relationship for Model 1 is validated using the F statistic, where the null hypothesis of non-cointegration is δ ROA = δ $LIQD$ = δ $LIQA$ = δ $BETA$ = A =δ LA = δ PIB = δ INF = δ TID = 0. And for model 2 by; δ ROE = δ = δ $LIQA$ = δ $BETA$ = δ AQ = δ LA = δ PIB = δ INF = δ TID = 0.
In this formula, we include not only our original variables (ROA, ROE, LIQD, LIQA, BTA, LA, AQ), but also our new control variables (GDP, inflation, interest rate). This will enable us to observe more precisely the influence of these macroeconomic variables on bank performance.

5 Results

Before estimating the parameters, stationarity and cointegration tests were performed to show that the ARDL panel approach is appropriate for the data. The Root Test is a popular method for testing stationarity for annual time series and panel data. The stationarity test is performed for the "individual intercept" in the test equations. There are many types of unit root tests for panel data, such as Levin, Lin and Chu (LLC) t-stat and Breitung t-stat with a common unit root process; I'm, Pesaran and Shin (IPS) W-stat, ADF-Fisher (ADF) chi-square and PP-Fisher (PP) chi-square with an individual unit root process.

The panel data in this study are balanced so that both hypotheses can be applied. The ADF test is chosen. The results of the panel unit root tests for the variables and logarithms of the variables are summarized in Table 7 (see Appendix).

According to Table 7, most series are non-stationary at level, but stationary at first and second difference. Therefore, a cointegration test must be performed to consider the long-term relationship between the variables. To analyze the cointegrating relationship between variables in the panel data model, this study chooses the Johansen Fisher Panel Cointegration , as it is more complete and universal. The Schwarz Information Criterion (SIC) automatically selects the lag length with automatic bandwidth selection. Table 8 (appendix) shows the results of the panel cointegration test. According to the test results in Table 8, a maximum of 5 tests are significant at the 0.001 level for the "individual intercept". This indicates that there are at most 5 long-term relationships between the panel data variables, for which the ARDL technique is the most appropriate. Table 9 (appendix) confirms the results of the individual cross-sectional cointegration tests for each country.

5.1 Estimation results

This study uses dynamic regression to estimate the impact of bank financial variation on the performance of African banks. The PMG estimator is a well-known technique used in estimating a dynamic model of heterogeneous panel data. In addition to panel regression results, PMG also generates results for individual units (Blackburne and Frank 2007).

Calculating the impact of financial ratios and values on banking performance enables us to assess the long-term and short-term reactions for the general sample and for each sample (each country). First, the parameters are estimated by the PMG estimator for the general sample (panel data), with automatic selection of three maximum lags, the Akaike information criterion (AIC) in the model selection method, and the linear trend in the trend specification. Appendix Table 10 summarizes the estimator regression results for the long-term and short-term sample. The results are not significant for the model, except for the variable D(LOGAQ), which has a significant negative impact on ROA.

According to the long-term model, LIQA, LOGBTA, TID and LOGPIB have a positive impact on bank performance. This means that when there is an increase in the ratio of liquid assets to total assets (LIQA), the ratio of balances due to other banks to total assets (LOGBTA), or the logarithm of Gross Domestic Product (LOGPIB), banks' return on assets (ROA) increases by 0.048318, 0.014705, 0.002525 and 0.056392 respectively. Conversely, LIQD, inflation (INF) and LOGLA have a negative impact on bank performance. An increase in the ratio of liquid assets to total deposits (LIQD), inflation (INF), or the logarithm of liquid assets (LOGLA) leads to a decrease in banks' return on assets (ROA) of -0.046086, - 0.000627 and -0.008914 respectively.

It's worth noting that liquidity, while generally seen as a positive factor for banks in terms of risk management, appears in this case to have a negative effect on bank performance. This may be due to the fact that holding liquid assets at a high level can reduce banks' ability to generate higher returns from more profitable investments. In other words, an increase in liquidity can have a negative impact on banks' return on assets (ROA), although it can also make them more resilient to certain forms of financial risk.

Akaike's information criterion shows that the optimal number of delays for our model is ARDL (2, 1, 1, 1, 1,1,1,1,1). The optimal number of delays is selected by choosing the model with the smallest value of Akaike's information criterion (Figure 2 appendix).

The Wald Table 11 test (Appendix) gives significance at the 0.01 level for the F and Chi-square statistics. Consequently, the null hypothesis is rejected and the alternative hypothesis is accepted, meaning that the estimated coefficients in the model are all non-zero and that they are all necessary for the model.

This evidence supports the reliability and validity of the estimated model. The results in Table 12 (Appendix) show similar trends for ROE too. However, the results are not significant for the short-term model except for D(LOGAQ), which has a significant negative impact on ROE.

The regression results show how various variables affect a bank's return on equity (ROE) over the long term.

The LIQA coefficient is 0.646049 and is significant at 0.0000, meaning that for every unit increase in the ratio of liquid assets to total assets, return on equity (ROE) will increase by 0.646049 units, all else being equal.

The LIQD coefficient is -0.336651 and is significant at 0.0000, indicating that a unit increase in the ratio of liquid assets to total deposits will result in a 0.336651 unit decrease in return on equity (ROE), all else being equal.

The LOGAQ coefficient is 0.033584 and is significant at 0.0000, implying that for each unit increase in the logarithm of asset quality, return on equity (ROE) will increase by 0.033584 units, all else being equal.
The LOGBTA coefficient is 0.042475 and is significant at 0.0000, suggesting that each unit increase in the logarithm of the ratio of balances due to other banks to total assets, return on equity (ROE) will increase by 0.042475 units, all else being equal.
The LOGLA coefficient is 0.017816 but not significant at 0.4635, indicating that the logarithm of liquid assets has no significant impact on return on equity (ROE) in this model.
The LOGPIB coefficient is 0.123019 and is significant at 0.0247, implying that for each unit increase in the logarithm of Gross Domestic Product (GDP), return on equity (ROE) will increase by 0.123019 units, all else being equal.
The coefficient of inflation (INF) is 0.002981 and is significant at 0.0000, meaning that for each unit increase in inflation, return on equity (ROE) will increase by 0.002981 units, all else being equal.
Finally, the coefficient on the key interest rate (TID) is 0.007373 and is significant at 0.0189, suggesting that for each unit increase in the key interest rate, return equity (ROE) will increase by 0.007373 units, all else being equal.
Akaike's information criterion shows that the optimal number of delays for our model is ARDL (2, 1, 1, 1, 1,1,1,1,1) (see Appendix Figure 3). The Wald table 13 test (appendix) gives significance at the 0.01 level for the F and Chi-square statistics. Consequently, the null hypothesis is rejected and the alternative hypothesis is accepted, meaning that the estimated coefficients in the model are all non-zero and all necessary to the model. This evidence supports the reliability and validity of the estimated model.
The study reveals that short-term fluctuations in liquidity do not appear to significantly affect the performance of African banks. It is suggested that this may be due to the banks' ability to maintain liquidity reserves to manage these temporary variations. impacting their performance. What's more, these fluctuations may not be large enough to have a significant effect on bank performance.
We also highlight the importance of other economic variables, such as GDP, inflation and interest rates, which appear to influence bank performance. These factors could contribute to the lack of significant impact of short-term liquidity variations on bank performance.
The lack of significance of short-term variables in the study can be explained by several factors.

1. **Temporary effect:** Short-term variations may not have a significant effect on bank performance, as they may be temporary and normalize over time. In this way, banks can manage these fluctuations without them affecting their overall performance.
2. **Liquidity management:** Banks may have effective liquidity management mechanisms in place to manage variations. These mechanisms may include liquidity reserves, credit lines and other financial instruments that enable banks to maintain their performance despite liquidity fluctuations.
3. **Influence of other economic variables:** Bank performance is influenced by a wide range of factors, including GDP, inflation and interest rates. These factors can have a greater impact on bank performance than variations in short-term liquidity, making the effect of the latter insignificant.
4. **Amplitude of variations:** Variations in short-term liquidity may not be large enough to have a significant impact on bank performance. If these variations are relatively small, they may not affect the bank's ability to operate effectively.

However, it would be interesting to conduct further research to better understand the interaction between short-term liquidity and bank performance, as well as the influence of other economic variables on this relationship.
Further research is therefore recommended to explore in more detail how these economic variables affect the performance of African banks and how they interact with liquidity. In addition, the study of other aspects of bank performance, such as profitability and solvency, could also be useful in determining whether variations in short-term liquidity have a significant impact on these other indicators.

6 Results and discussion

By analyzing ARDL panel data for the African countries of Benin, Burkina Faso, Côte d'Ivoire, Mali, Niger and Morocco, this study has demonstrated that liquidity has a positive impact on the performance of African banks. In summary, although liquidity has a positive impact on bank performance, by analyzing the economic circumstances of the countries studied in Africa, it is possible to understand how liquidity can affect bank performance in this region. In countries with more stable and developed economies, such as Côte d'Ivoire, Morocco and Benin, it is easier for banks to maintain their liquidity and manage their assets efficiently.

Also by analyzing the data for Niger, we can see that liquidity has a positive impact on bank performance in this country. This may be linked to the nature of Niger's economy, which is mainly based on agriculture and extractive industries. These industries tend to generate irregular cash flows, which can make it difficult for banks to maintain high levels of liquidity.
By maintaining high levels of liquidity, banks can be better prepared to cope with these cash flow variations and meet their customers' needs. In addition, Niger also faces macroeconomic stability challenges, which can make difficult for banks to maintain high levels of profitability. By maintaining high levels of liquidity, banks can better manage the risks associated with these economic instabilities and thus improve their performance. This is reflected in the results of this study, where liquidity has a significant positive impact on bank performance in these countries.
In countries with less stable and less developed economies, such as Burkina Faso and Mali, it can be more difficult for banks to maintain liquidity due to factors such as political instability, weak credit demand and poor financial infrastructure. In these circumstances, liquidity may have a less significant impact on bank performance, as the results of this study show. In addition, it is important to note that the Basel rules on liquidity risk management may also have had an impact on the performance of African banks.
These rules, which were introduced to reinforce overall financial stability by requiring banks to maintain appropriate levels of liquidity, have been adopted by many African countries. However, their implementation can vary considerably from country to country, depending on the capacity of national authorities to implement them and their degree of compliance. Depending on the circumstances, these rules may have a positive or negative impact on the performance of African banks.
For example, in countries where the authorities have a strong enforcement capacity and where banks are compliant with the rules, they can help strengthen financial stability and improve bank performance.
However, in countries where the authorities have weak implementation capacity and banks are not very compliant, the Basel rules may have a negative impact on performance due to the difficulty for banks to comply with these requirements. Ultimately, it is important to take into account the contextual differences between African countries when interpreting the results of this study and how liquidity may affect bank performance in these countries. Ultimately, this study shows that liquidity is an important factor to consider for bank performance in Africa, but that its impact can vary depending on the country's economic circumstances. It is therefore important for policy-makers and bank managers to understand local economic conditions and make strategic decisions accordingly to improve the performance of their financial institutions.

7 Conclusion

In summary, this study has shown that liquidity plays an important role in the performance of African banks. According to the results of the ARDL panel analysis, an increase in liquidity has a positive impact on bank performance, particularly for return on assets. Although the results are not significant for return on equity, they are similar to those obtained in other studies conducted in other regions of the world. These results are relevant to policymakers and African bank managers seeking to improve the performance of their financial institutions. Consequently, they should be taken into account when making strategic decisions. In addition, it is important to note that the other variables studied also have an impact on the performance of African banks. These results are relevant for African banks seeking to optimize their financial performance by properly managing their liquidity and taking into account other key factors such as capital levels and loan quality.
Ultimately, this study makes an important contribution to the literature on bank performance in Africa, and provides valuable information for policymakers and African bank managers. For future research, this study has shown that liquidity has a significant impact on the performance of African banks. However, it is important to emphasize that each African country has its own unique economic circumstances that can influence these results. For example, Benin experienced stable economic growth over the study period, which may have contributed to positive bank performance in the country. To strengthen our research, it is important to integrate other variables such as GDP, inflation, rate, etc. to better understand the impact of liquidity on bank performance in different economic contexts. It would also be interesting to carry out a similar study in other regions of the world to compare the results obtained in Africa with those observed elsewhere. Finally, it would also be interesting to study the strategies used by banks to effectively manage their liquidity and liquidity risk to ensure their financial stability.

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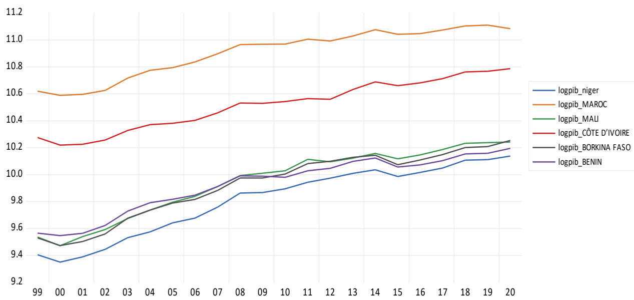
Appendices:

Figure 1: Evolution of the values of the variables ROE, ROA, log(BTA), log(AQ), LIQA, log(LA), log(GDP), INF,TDI, and LIQD



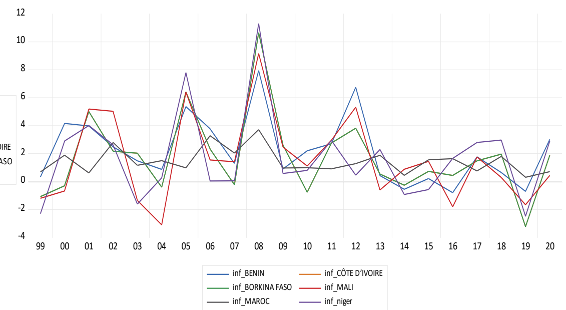
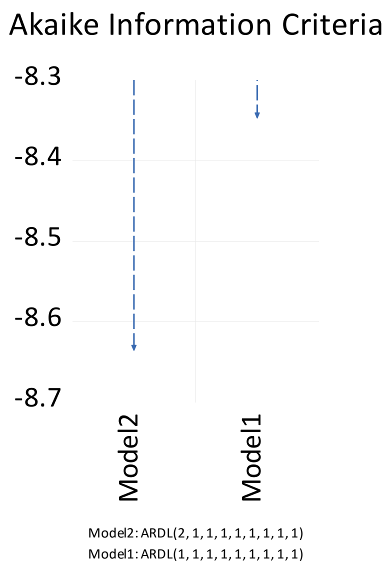
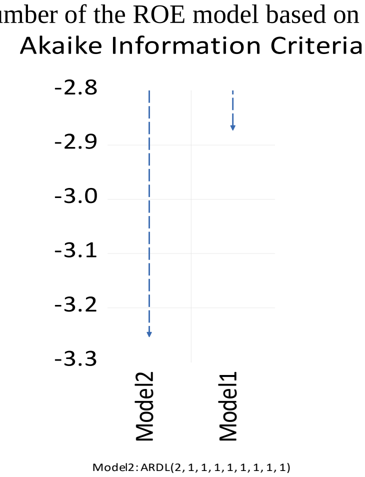


Figure 2 : Optimal lag number of the ROA model based on the AIC selection criterion



Source: Author's calculations using Eviews.

Figure 3: Optimal lag number of the ROE model based on the AIC selection criterion



Source : Author's calculations using Eviews

Table 1: Descriptive statistics for BENIN data

	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis
AQ	32.12623	29.37222	76.03514	2.411939	22.15311	0.542991	2.116544
BTA	0.156368	0.160954	0.333407	0.000212	0.090483	0.27481	2.108699
INF	2.195836	1.628327	7.947299	-0.79405	2.36219	0.862642	3.064581
LA	1.5E+10	1.08E+10	7.14E+10	4.36E+09	1.53E+10	2.833198	10.302
LIQA	0.413491	0.417522	0.498267	0.308188	0.057249	-0.17507	1.722507
LIQD	0.590561	0.580205	0.743177	0.450576	0.089997	0.143396	1.879914
LOG(AQ)	1.376251	1.466229	1.881014	0.382366	0.386324	-0.77377	3.127944
TID	7.279152	7.613	8.579167	5.095	1.05908	-1.066	2.952413
ROA	0.012133	0.013458	0.017298	0.002143	0.003696	-0.99104	3.435715
ROE	0.142526	0.14812	0.22726	0.020756	0.047611	-0.49361	3.479258
LOG(PIB)	9.926865	9.98959	10.19456	9.546542	0.209865	-0.63296	2.082421
LOG(BTA)	-0.97691	-0.79358	-0.47703	-3.67373	0.648801	-3.41726	14.95248
LOG(LA)	10.06129	10.03286	10.85358	9.639118	0.283286	1.191033	4.660176

Table 2: Descriptive statistics BORKINA FASO

	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis
AQ_BORKINA_FASO	107.8623	27.37402	1116	0.839744	237.3374	3.720028	16.27301
BTA_BORKINA_FASO	0.131985	0.124482	0.300866	0.009534	0.098246	0.251906	1.704148
INF_BORKINA_FASO	1.753243	1.683719	10.6598	-3.23339	2.917027	1.27776	5.303217
LA_BORKINA_FASO	1.40E+10	6.02E+09	1.06E+11	6.13E+08	2.39E+10	2.973126	11.56546
LIQA_BORKINA_FASO	0.585492	0.565871	0.685085	0.486821	0.064535	0.157767	1.594724
LIQD_BORKINA_FASO	0.780905	0.767148	1.052582	0.557163	0.132036	0.366933	2.556543
LOGAQ_BORKINA_FASO	1.475547	1.435568	3.047664	-0.07585	0.741641	-0.10206	2.876236
LOGBTA_BORKINA_FASO	-1.06668	-0.90547	-0.52163	-2.02071	0.47766	-0.63626	2.077236
LOGLA_BORKINA_FASO	9.75984	9.7777	11.02685	8.787487	0.590579	0.220744	2.51896
LOGPIB_BORKINA_FASO	9.925868	9.990116	10.25367	9.472518	0.251529	-0.54643	1.939184
PIB__BORKINA_FASO	9.70E+09	9.78E+09	1.79E+10	2.97E+09	4.69E+09	0.00591	1.746697
ROA_BORKINA_FASO	0.013637	0.013145	0.024523	-0.01024	0.007672	-1.19368	5.269414
ROE_BORKINA_FASO	0.201439	0.206014	0.375342	-0.13698	0.096814	-1.66359	8.248779
TID_BORKINA_FASO	7.29347	7.613	8.579167	5.095	1.032369	-1.0491	2.972635

Table 3: Descriptive statistics IVORY COAST

	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis
AQ	207.3871	125.3534	681.7143	12.89133	206.1911	0.828128	2.453352
BTA	0.247276	0.238668	0.420158	0.128795	0.082133	0.199859	2.227933
INF	1.753243	1.683719	10.6598	-3.23339	2.917027	1.27776	5.303217
LA	9764775	5433590	41569711	398617.8	12996801	1.778466	4.715395
LIQA	0.572082	0.578533	0.731136	0.409711	0.09264	-0.21479	2.20277
LIQD	0.901028	0.852951	1.321165	0.654959	0.185148	0.857155	2.918647
LOGAQ	2.024646	2.097123	2.833602	1.110298	0.574625	-0.16285	1.55816
LOGBTA	-0.63141	-0.62223	-0.37659	-0.8901	0.153149	-0.33197	2.056555
LOGLA	6.655151	6.734248	7.618777	5.600557	0.569667	0.122804	2.123891
LOGPIB	10.51555	10.53788	10.7878	10.21952	0.185411	-0.16483	1.765768
PIB	3.56E+10	3.45E+10	6.13E+10	1.66E+10	1.44E+10	0.297861	1.861405
ROA	0.010591	0.011221	0.023635	-0.00228	0.006802	-0.00597	2.381091

ROE	0.163981	0.187826	0.270781	-0.03038	0.092058	-0.67471	2.192045
TID	7.334758	7.613	8.579167	5.095	0.977345	-1.13145	3.438531

Table 4: Descriptive statistics for MALI data

	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis
AQ	52.22305	32.65088	178.9187	18.17157	50.9243	1.971461	5.133788
BTA	0.131024	0.106306	0.401887	0.013762	0.097293	1.190093	3.964569
INF	1.592589	1.260464	9.170988	-3.09978	3.056372	0.747768	3.004632
LA	8.57E+09	5.49E+09	3.32E+10	1.59E+09	9.13E+09	1.97978	5.276
LIQA	0.542729	0.538905	0.647934	0.443483	0.053426	0.223363	2.312364
LIQD	0.745382	0.75003	0.933581	0.590265	0.096556	0.008492	1.975582
LOGAQ	1.59951	1.513884	2.252656	1.259392	0.286614	1.476458	4.018911
LOGBTA	-1.01606	-0.97346	-0.3959	-1.86131	0.389702	-0.8195	3.306947
LOGLA	9.784845	9.739754	10.52122	9.200176	0.331738	0.965963	3.580479
LOGPIB	9.944522	10.01945	10.24218	9.47151	0.254242	-0.56226	1.914425
PIB	1.02E+10	1.05E+10	1.75E+10	2.96E+09	4.91E+09	-0.05552	1.651451
ROA	0.006324	0.007121	0.018294	-0.0121	0.007648	-0.97492	3.994437
ROE	0.087614	0.114398	0.259049	-0.26555	0.131131	-1.67473	5.534386
TID	7.334758	7.613	8.579167	5.095	0.977345	-1.13145	3.438531

Table 5: Descriptive statistics MOROCCO

	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis
AQ	6.005411	4.843867	11.45304	0.67207	3.210449	0.195764	1.734421
BTA	0.285345	0.169205	0.796625	0.06972	0.228614	0.953809	2.530012
INF	1.451088	1.227428	3.714843	0.303386	0.897402	1.066246	3.493875
LA	4212842	4043592	7593791	257639	2167730	0.016808	2.023511
LIQA	0.521759	0.543608	0.61101	0.393331	0.071768	-0.39569	1.67837
LIQD	0.869961	0.753466	3.644814	0.496149	0.639534	3.933897	17.70418
LOGAQ	0.70008	0.685143	1.058921	-0.17259	0.297764	-1.06682	4.298766
LOGBTA	-0.67178	-0.77162	-0.09875	-1.15664	0.33563	0.398106	1.693499
LOGLA	6.536442	6.60645	6.880459	5.411012	0.340132	-1.72801	6.416379
LOGPIB	10.90556	10.96875	11.11032	10.58947	0.179949	-0.63203	1.946832
PIB	8.66E+10	9.31E+10	1.29E+11	3.89E+10	3.10E+10	-0.29552	1.676738
ROA	0.00796	0.007195	0.0225	0.003365	0.004248	1.946977	7.391263
ROE	0.093793	0.086697	0.2345	0.035588	0.046477	1.578532	5.530198
TID	3.888182	3.767917	6.3875	2.865833	0.793653	1.61671	5.79083

Table 6: Descriptive statistics NIGER

	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis
TID	7.334758	7.613	8.579167	5.095	0.977345	-1.13145	3.438531
ROE	0.167475	0.187759	0.252265	0.022411	0.062189	-0.62687	2.516732
ROA	0.017375	0.0163	0.025512	0.009515	0.004974	0.153339	1.858452
PIB	7.48E+09	7.60E+09	1.37E+10	2.24E+09	3.77E+09	0.038799	1.679166
LOGPIB	9.807626	9.880674	10.13812	9.350588	0.261369	-0.47717	1.800422
AQ	16.57804	12.094	56.8	2.096186	14.20185	1.284419	4.219436
BTA	0.173674	0.219149	0.364694	0.005072	0.130114	-0.16517	1.362043
INF	1.749053	1.228981	11.30511	-2.48979	3.169316	1.352985	5.211985
LA	6.16E+09	2.75E+09	2.79E+10	5.66E+08	8.21E+09	1.939664	5.370605
LIQA	0.513606	0.577265	0.68966	0.208103	0.135401	-0.83076	2.338076
LIQD	0.821246	0.996132	1.13385	0.262476	0.304676	-0.63321	1.659325
LOGAQ	1.057027	1.081348	1.754348	0.32143	0.407306	-0.21598	2.123668

LOGBTA	-1.033	-0.66028	-0.43807	-2.29484	0.62945	-0.82482	2.221839
LOGLA	9.509721	9.438508	10.44633	8.752819	0.489273	0.439378	2.407335

Table 7: Stationarity test for panel data

	ADF - Fisher Chi-square	ADF - Choi Z-stat	Probabilité	Ordre d'intégration
Test au niveau				
INF	56.3919	-5.40984	0.0000	I(0)
LIQA	23.6098	-2.06656	0.0630	I(1)
LOGPIB	21.1186	-1.95906	0.0587	I(1)
TDI	1.68390	4.10183	0.9998	I(1)
LIQD	19.1584	-1.00226	0.0848	I(1)
LOGAQ	12.9277	-0.53787	0.3743	I(1)
LOGBTA	18.0529	-1.51977	0.1141	I(1)
LOGLA	4.66554	3.42577	0.9682	I(1)
ROA	11.5879	-0.15280	0.4793	I(1)
ROE	18.4816	-1.78928	0.1018	I(1)
Test a la première différence				
	ADF - Fisher Chi-square	**ADF - Choi Z-stat**	**Probabilité**	**Ordre d'intégration**
LIQA	57.8915	-5.60001	0.0000	I (1)
LOGPIB	44.5040	-4.63027	0.0000	I (1)
TDI	33.5216	-3.77102	0.0008	I (1)
LIQD	44.1317	-3.63550	0.0000	I (1)
LOGAQ	85.4461	-7.36903	0.0000	I (1)
LOGBTA	105.498	-8.38523	0.0000	I (1)
LOGLA	97.4167	-8.20260	0.0000	I (1)
ROA	91.3959	-7.93376	0.0000	I (1)
ROE	88.8824	-7.85283	0.0000	I (1)

Source : Author's calculations using Eviews

Table 8: Results of the panel cointegration test.

Hypothesized No. of CE(s)	Fisher Stat.* (from trace test)	Prob.	Fisher Stat.* (from max-eigen test)	Prob.
None	0.000	1.0000	0.000	1.0000
At most 1	0.000	1.0000	0.000	1.0000
At most 2	376.7	0.0000	214.6	0.0000
At most 3	345.3	0.0000	234.8	0.0000
At most 4	184.3	0.0000	154.2	0.0000
At most 5	73.88	0.0000	57.71	0.0000
At most 6	31.62	0.0016	33.52	0.0008
At most 7	7.883	0.7942	7.883	0.7942

Source : Author's calculations using Eviews

Table 9: Results of individual cointegration test cross-sections

Hypothesis of at most 2 cointegration relationship				
MALI	1401.7314	0.0000	668.8193	0.0000
BENIN	1336.3717	0.0000	676.9286	0.0000
niger	1273.3699	0.0000	645.6491	0.0000
CÔTE D'IVOIRE	1340.4053	0.0000	657.7331	0.0000
MAROC	NA	1.0000	NA	1.0000
BORKINA FASO	1285.4739	0.0000	617.6920	0.0000

		Hypothesis of at most 3 cointegration relationship		
MALI	732.9121	0.0000	625.8877	0.0000
BENIN	659.4431	0.0000	589.7659	0.0000
niger	627.7209	0.0000	555.0371	0.0000
CÔTE D'IVOIRE	682.6722	0.0000	619.8759	0.0000
MAROC	826.1161	0.0000	734.7360	0.0000
BORKINA FASO	667.7819	0.0000	543.9748	0.0000
		Hypothesis of at most 4 cointegration relationship		
MALI	107.0245	0.0000	70.5392	0.0000
BENIN	69.6771	0.0000	39.5862	0.0002
niger	72.6837	0.0000	37.1304	0.0005
CÔTE D'IVOIRE	62.7963	0.0001	32.8176	0.0026
MAROC	91.3801	0.0000	65.0197	0.0000
BORKINA FASO	123.8071	0.0000	78.8711	0.0000
	Hypothesis of at most 5 cointegration relationship			
MALI	36.4852	0.0009	26.8209	0.0017
BENIN	30.0909	0.0083	19.6862	0.0257
niger	35.5534	0.0013	25.7553	0.0026
CÔTE D'IVOIRE	29.9787	0.0086	17.4661	0.0560
MAROC	26.3604	0.0269	19.0937	0.0318
BORKINA FASO	44.9360	0.0000	27.1694	0.0015

Source : Author's calculations using Eviews

Table 10: Results of the ARDL panel model estimation for the dependent variable ROA

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
	Long Run Equation			
LIQA	0.048318	0.015017	3.217567	0.0021
LIQD	-0.046086	0.008703	-5.295533	0.0000
LOGAQ	0.002762	0.001795	1.538570	0.1293
LOGBTA	0.014705	0.002056	7.152242	0.0000
LOGLA	-0.008914	0.003303	-2.698762	0.0091
LOGPIB	0.056392	0.008994	6.269584	0.0000
INF	-0.000627	0.000313	-2.004205	0.0497
TID	0.002525	0.000923	2.736557	0.0082
	Short Run Equation			
COINTEQ01	-0.325737	0.121996	-2.670059	0.0098
D(ROA(-1))	-0.164888	0.171129	-0.963533	0.3393
D(LIQA)	0.018009	0.024834	0.725153	0.4713
D(LIQD)	-0.009068	0.019013	-0.476947	0.6352
D(LOGAQ)	-0.003246	0.001023	-3.171995	0.0024
D(LOGBTA)	0.003160	0.010396	0.303996	0.7622
D(LOGLA)	0.003351	0.003304	1.014266	0.3147
D(LOGPIB)	0.004419	0.020727	0.213208	0.8319
D(INF)	1.25E-05	0.000129	0.096689	0.9233
D(TID)	-0.000332	0.001911	-0.173825	0.8626
C	-0.161611	0.063936	-2.527687	0.0142
Root MSE	0.002830	Mean dependent var		5.93E-05
S.D. dependent var	0.004348	S.E. of regression		0.004269
Akaike info criterion	-7.847399	Sum squared resid		0.001057
Schwarz criterion	-6.231283	Log likelihood		591.9284
Hannan-Quinn criter.	-7.190684			

*Note: p-values and any subsequent tests do not account for model selection.

Source : Author's calculations using Eviews

Table 11: Wald test results for the dependent variable ROA.

Wald Test:			
Test Statistic	Value	df	Probability
F-statistic	31.72503	(7, 58)	0.0000
Chi-square	222.0752	7	0.0000

Null Hypothesis: C(1)=C(2)=C(3)= C(4) =C(5)=C(6)=C(7)=C (8)
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(1) - C(8)	0.045794	0.014449
C(2) - C(8)	-0.048611	0.009098
C(3) - C(8)	0.000237	0.001762
C(4) - C(8)	0.012180	0.001766
C(5) - C(8)	-0.011438	0.003158
C(6) - C(8)	0.053867	0.008838
C(7) - C(8)	-0.003152	0.001126

Restrictions are linear in coefficients.

Source : Author's calculations using Eviews

Table 12: Results of the ARDL panel model estimation for the ROE variable.

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
	Long Run Equation			
LIQA	0.646049	0.092989	6.947601	0.0000
LIQD	-0.336651	0.065856	-5.111924	0.0000
LOGAQ	0.033584	0.003585	9.367752	0.0000
LOGBTA	0.042475	0.005497	7.726995	0.0000
LOGLA	0.017816	0.024141	0.737999	0.4635
LOGPIB	0.123019	0.053355	2.305672	0.0247
INF	0.002981	0.000637	4.682308	0.0000
TID	0.007373	0.003052	2.415971	0.0189
	Short Run Equation			
COINTEQ01	-0.926834	0.498183	-1.860429	0.0679
D(ROE(-1))	0.169975	0.264626	0.642321	0.5232
D(LIQA)	-0.247136	0.515809	-0.479123	0.6337
D(LIQD)	0.103766	0.325198	0.319085	0.7508
D(LOGAQ)	-0.072398	0.014101	-5.134193	0.0000
D(LOGBTA)	0.086400	0.153639	0.562358	0.5760
D(LOGLA)	0.023016	0.039300	0.585649	0.5604
D(LOGPIB)	-0.680324	0.537404	-1.265946	0.2106
D(INF)	-0.000162	0.001399	-0.115792	0.9082
D(TID)	-0.027024	0.019006	-1.421902	0.1604
C	-1.251186	0.637486	-1.962689	0.0545
Root MSE	0.046347	Mean dependent var		-0.000774
S.D. dependent var	0.072791	S.E. of regression		0.069918
Akaike info criterion	-2.953259	Sum squared resid		0.283537
Schwarz criterion	-1.337143	Log likelihood		268.9151
Hannan-Quinn criter.	-2.296544			

*Note: p-values and any subsequent tests do not account for model selection.

Source : Author's calculations using Eviews

Table 13: Wald test results for the dependent variable ROE.

Wald Test:

Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	447.8717	(7, 58)	0.0000
Chi-square	3135.102	7	0.0000

Null Hypothesis: C(1)=C(2)=C(3)= C(4) =C(5)=C(6)=C(7)=C(8)

Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(1) - C(8)	0.638676	0.095031
C(2) - C(8)	-0.344024	0.063872
C(3) - C(8)	0.026211	0.005681
C(4) - C(8)	0.035102	0.006836
C(5) - C(8)	0.010443	0.021350
C(6) - C(8)	0.115646	0.055945
C(7) - C(8)	-0.004392	0.002636

Restrictions are linear in coefficients.

Source : Author's calculations using Eviews