

The dynamics of liquidity-profitability nexus: evidence from Morocco's commercial banks.

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Abstract

Liquidity management is a central issue for banks because maintaining sufficient liquidity strengthens financial resilience, while excessive liquidity holdings may reduce profitability by limiting the allocation of resources to higher-yielding assets. This study examines the relationship between bank liquidity and financial performance in Morocco, with particular emphasis on the trade-off between liquidity and profitability. The empirical analysis covers six Moroccan commercial banks listed on the Casablanca Stock Exchange over the period 2004–2022. Using annual bank-level and macroeconomic data, the study adopts a quantitative panel-data approach based on a fixed-effects model with Driscoll and Kraay standard errors. This methodological approach allows the analysis to account for unobserved time-invariant bank heterogeneity while providing robust inference in the presence of heteroskedasticity, serial correlation, and cross-sectional dependence. Bank profitability is measured by return on assets (ROA) and return on equity (ROE), while liquidity is captured through three indicators: liquid assets to total assets (L1), loans to deposits (L2), and liquid assets to deposits (L3). The results indicate that L1 has a negative and statistically significant effect on both ROA and ROE, whereas L2 does not exhibit a statistically significant effect. The effect of L3 varies across model specifications. Furthermore, bank size, market concentration, and the interbank rate significantly affect ROA, while their effects on ROE are generally not statistically significant. Overall, the findings highlight the existence of a liquidity–profitability trade-off and suggest that Moroccan banks need to balance adequate liquidity buffers with efficient allocation of financial resources.

Keywords: Bank performance, liquidity management, financial stability, fixed-effects model

1. Introduction

The financial crisis that hit the world at the end of 2007 highlighted the importance of liquidity to the smooth operation of financial markets and the banking sector. Previously, asset markets had been buoyant, and low-cost financing available. However, the market liquidity reversal during the crisis reflected the reality of liquidity depletion and persistent scarcity (Diamond and Rajan, 2011).

In such circumstances, banking systems underwent severe stress, and central banks had to support money markets along with specific institutions. In addition, banks' liquidity were regularly reviewed by supervisors to provide liquidity risk policies and guidelines (Baker et al., 2017). On the other hand, the financial crisis has revealed weaknesses in those practices, which supervisory authorities are working to correct on an international scale.

Within this transition, the Basel Committee on Banking Supervision published a report outlining principles of good liquidity management (Turk, 2014). In fact, this document modified the pre-existing version from 2000, integrating the lessons learned from the crisis, which include the introduction of the Net Stable Funding Ratio (NSFR), and the Liquidity Coverage Ratio (LCR), enabling banks to assess their short- and long-term ability to hold sufficient assets in order to cope with potential financial disruptions, and ensure optimal financial performance (Chen et al., 2021).

In this vein, Saif-Alyousfi and Saha (2021) identify endogenous and/or exogenous determinants of bank performance. Munteanu (2012) consider liquidity to be an internal factor, insofar as holding it grant banks stability while optimizing their profitability. Nevertheless, a trade-off arises from this relationship. On the one hand, banks are obliged to hold sufficient funds to meet immediate client demand. On the other hand, idle liquid assets generate low returns, but provide security.

Against this background, the subject of this research is the liquidity–profitability nexus within the Moroccan banking sector. More specifically, this study investigates whether and to what extent different dimensions of bank liquidity influence financial performance, while taking into account bank-specific and macroeconomic factors that may also affect profitability. The study focuses on six Moroccan commercial banks listed on the Casablanca Stock Exchange over the period 2004–2022. Bank financial performance is assessed through return on assets (ROA) and return on equity

(ROE), while liquidity is captured through three complementary indicators: liquid assets to total assets, loans to deposits, and liquid assets to deposits. The central research question addressed in this study is therefore: To what extent does liquidity management affect the financial performance of Moroccan commercial banks?

The objective of the study is twofold. First, it seeks to identify the direction and significance of the relationship between different dimensions of liquidity and bank profitability. Second, it examines whether bank-specific characteristics and macroeconomic conditions modify or complement this relationship. To achieve these objectives, the study relies on a quantitative panel-data methodology using a fixed-effects model with Driscoll and Kraay standard errors. This approach makes it possible to exploit both the time dimension and the cross-sectional dimension of the data while accounting for unobserved bank-specific heterogeneity and potential dependence across banks.

The remainder of the paper is organized as follows. Section 2 reviews the theoretical and empirical literature on bank liquidity and profitability and develops the research hypotheses. Section 3 presents the methodological approach, the variables, the sample and the data sources. Section 4 reports and discusses the empirical results. Finally, Section 5 concludes the paper, highlights the main implications of the findings, and discusses the limitations and avenues for future research.

2. Literature review

In context where banks play a central role in financing the economy and transforming deposits into long-term credit, the question of liquidity becomes important. As Baia et al., (2018) show, bank liquidity is vital to the function of financial institutions and to the stability of the entire economic system. In this regard, Yeager and Seitz (1989) consider liquidity as the bank ability to satisfy individuals' fund demands. From an economic perspective, Berger and Bouwman (2009) define it as the transformation of liquid liabilities into illiquid assets. However, in the risk management field, the bank liquidity is the financial institutions' capacity to raise funds in order to meet the demands while maintaining current operations (Drehmann and Nikolaou, 2013; Tran and Nguyen, 2024).

For the aim of this study, we consider the definition of Adelopo et al., (2022), which states that bank liquidity is the ability to honor cash obligations as they fall due. This explanation covers two

dimensions: funding liquidity linked to the management of instant cash needs, and market liquidity, which concerns banks' ability to sell assets quickly to raise funds. As reported by Gupta and Kashiramka (2020), the balance between these two aspects is essential to a bank's soundness. Therefore, managing liquidity means monitoring the markets constantly, adapting to regulatory changes and controlling risks (Abbas et al., 2019; Chen et al., 2021).

On the other hand, the second facet of this research focuses on the banking performance. In fact, economic literature prioritizes this concept, which is expressed through competition, concentration, efficiency, profitability and productivity (Bikker and Bos, 2008). In addition, according to Barth et al., (2003), bank performance is the financial institution capability to achieve its economic and operational objectives. For the purposes of this article, we focus on the efficiency and profitability dimensions of bank performance. As announced by Heem (2021), the latter is often measured by financial indicators such as return on equity ROE or net banking income (NBI), which is the sum of the intermediation margin and commissions.

Through the concepts of liquidity and bank performance, the literature has developed a series of theoretical frameworks that constitute the foundational elements of our analysis. In this sense, the theory of financial intermediation represents the first stage of our reflection. Developed by Gurley and Shaw (1960), this theory states that banks play a central role in the economy, transforming short-term deposits into long-term credit. However, this activity creates a trade-off between the necessity of maintaining sufficient liquidity and the profitability sought by longer, riskier investments. Diamond and Dybvig (1983) extended this understanding by introducing their model of bank runs and liquidity transformation, which demonstrates how financial entities create economic value by offering demand deposits (liquid liabilities) while investing in illiquid assets. This “maturity transformation” explains why banks should carefully balance liquidity needs and profit opportunities (Paul, 2023).

Based on Diamond and Dybvig work, Allen and Gale (1998) developed a sophisticated model to explain how banks provide liquidity insurance to depositors. Their scheme shows that banks actively manage their liquidity reserves to mitigate the risk of unexpected demands. This mechanism is influenced by several factors, mainly the expected distribution of deposit

withdrawals, the potential returns on different investment - ranging from highly liquid assets to less but potentially more profitable investments - and the emergency funding costs in critical periods.

Furthermore, modern banking theory has evolved the incorporation of the “trade-off theory”, related to liquidity management. This approach, developed by Freixas and Rochet (2008), emphasizes that financial institutions face a constant dilemma. On the first hand, banks must weigh up the opportunity costs of holding liquid assets, which typically generate lower returns. On the other hand, banks have to consider the strategic advantages associated with high liquidity, such as lower financing costs and reduced risk of bankruptcy. Besides, strict regulations impose minimum liquidity requirements, adding a further constraint to banks' decisions. Similarly, the agency theory of Jensen and Meckling (1976) provides another theoretical perspective for understanding bank liquidity decisions. In fact, well-informed managers may be tempted to maintain higher levels of liquidity than would maximize shareholder value. This information asymmetry is motivated by several factors such as personal risk aversion, career concerns or regulations. Acharya and Naqvi (2012) have similarly enriched liquidity management theory by introducing a dynamic dimension, which suggests that banks should not react to exogenous shocks only, but also has to anticipate future developments. Indeed, optimal liquidity levels depend on banks' expectations related to macroeconomic conditions, funding costs, investment opportunities and the regulatory framework.

Additionally, the economic literature highlights the contribution of holding liquid assets in improving bank profitability. However, Bernanke (2008) claims that there is threshold beyond which holding extra liquidity reduces bank performance, all other things being equal. According to Kasselaki and Tagkalakis, (2014), high liquidity is considered a signal of financial soundness. Nevertheless, Agénor and El Aynaoui (2010) notes that excessive liquidity can be merely as undesirable as insufficient, because financial institutions can hold surplus liquidity that could be used for investments to increase returns. Also, the invested amounts in current assets generate further maintenance costs, reducing the banks' financial performance. In contrast, Arnold (2014) points out that holding cash has certain advantages as it ensures ongoing expenses, including wages, materials and taxes. Given the uncertainty of future incomes, liquidity provides a margin of safety in critical circumstances (Classens, 2014). Meanwhile, it guarantees the ability to seize

highly profitable investment opportunities requiring immediate payment (Diamond and Rajan, 2001).

In the wake of these theories, the literature highlighting the link between bank liquidity and financial performance is diversified, covering a range of regions and countries. Nevertheless, the specific nature of this relationship is ambiguous, and varies according to many factors, such as bank size, asset type and regulatory environment (Sahyouni and Wang, 2019). Demirgüç-Kunt and Huizinga (1999) used banks' data for 80 countries over the period 1988-1995 to show that financial entities with higher liquidity ratios are more profitable, because of their ability to access cheaper funding sources and effective risk management. Actually, in equal conditions of banking activity, leveraged and macroeconomic environment, banks realize poorer margins when the ratio of banking assets to net banking income is higher and market concentration is lower. Similarly, Bonner and Hilbers (2015) found that banking institutions with higher liquidity are less susceptible to solvency problems, as they are better protected against financial shocks and market stress. In addition, Horváth et al (2014) showed that banks with a stronger liquidity ratio have better asset quality, due to their ability to select less risky investments and manage loan losses efficiently.

More recently, Jedlane and El Moussaoui (2023), based on a sample of six countries (Benin, Burkina Faso, Ivory Coast, Mali, Morocco, Niger) over the period 1999-2020, found a positive connection between liquidity and banks performance measured by return on assets (ROA) and ROE. However, liquidity can have negative effects on banking performance, particularly banks profitability and operational efficiency. In this regard, Bourke (1989) explains that financial entities with higher liquidity are less profitable, due to holding lower-return liquid assets and inefficient capital allocation. Similarly, Dietrich and Wanzenried (2011) found that banks with larger liquidity have lower operational efficiency, because of the costs of managing liquid assets and missed investment opportunities. Also, Schaeck and Cihák (2014) revealed that banks with higher liquidity ratios are likely to take excessive risks and incur capital losses, due to financial leverage and risk-taking incentives.

In Morocco, few studies have examined the relationship between liquidity and performance. In this sense, Ferrouhi (2014) analyses this link using data of eight Moroccan banks over the period 2001-2012. Therefore, he finds that their performance is driven by seven determinants: the liquidity ratio,

bank size, the logarithm of total assets squared, external financing in relation to total liabilities, the bank's share of equity capital in relation to the bank's total assets, foreign direct investment, the unemployment rate and the financial crisis realization variable. In another research, Quamar et al., (2020) sampled with eight Moroccan banks to investigate the factors affecting the liquidity risk from 2011 to 2018. Their findings show that ROE and solvency ratio have a positive impact on the liquidity risk, while loan-to-deposit ratio and ROA show a negative association. Finally, Alami et al., (2021) analyzed the financial performance of three Moroccan banks over the period 2005-2018, based on three fundamental indicators: ROE, ROA and cost/income ratio.

The theoretical and empirical literature reviewed above suggests that the relationship between bank liquidity and profitability is not necessarily linear or unidirectional. Liquidity constitutes a fundamental source of financial resilience because it enables banks to meet withdrawal demands, honor short-term obligations and withstand funding pressures. However, maintaining a high proportion of liquid assets may also generate an opportunity cost, since liquid instruments generally provide lower returns than loans and other productive assets. Consequently, the relationship between liquidity and profitability reflects a fundamental trade-off between financial safety and the efficient allocation of bank resources. This trade-off provides the theoretical basis for examining whether different dimensions of liquidity have significant effects on the profitability of Moroccan commercial banks.

3. Empirical methodology and data

This study adopts a positivist epistemological positioning and follows a hypothetico-deductive reasoning process. This positioning is consistent with the objective of the research, which is to identify and empirically test statistical relationships between observable measures of bank liquidity and financial performance using objective secondary data. The hypothetico-deductive approach consists of deriving testable propositions from theoretical arguments and previous empirical evidence and subsequently confronting these propositions with observations from the Moroccan banking sector. Accordingly, the theoretical and empirical literature provides the basis for formulating hypotheses concerning the expected relationship between liquidity and bank profitability, while econometric analysis is used to assess whether these relationships are supported by the data.

A quantitative panel-data approach is particularly appropriate for this research because the analysis combines observations across several Moroccan commercial banks and over a relatively long period, from 2004 to 2022. The panel structure makes it possible to exploit both the cross-sectional and temporal dimensions of the data while controlling for unobserved characteristics that may differ across banks but remain relatively constant over time. The fixed-effects estimator is therefore adopted to account for time-invariant bank-specific heterogeneity that could otherwise bias the estimated relationships between liquidity and profitability. In addition, the use of Driscoll and Kraay standard errors is justified by the potential presence of heteroskedasticity, serial correlation and cross-sectional dependence in banking-sector panel data. Driscoll and Kraay (1998) show that their covariance estimator provides standard errors robust to broad forms of spatial and temporal dependence, while Hoechle (2007) demonstrates its applicability to fixed-effects panel regressions. This methodological choice therefore strengthens the reliability of statistical inference and is particularly suitable for a banking system in which institutions may be simultaneously exposed to common macroeconomic, regulatory and financial shocks.

3.1. Data description

This study aims to examine the relationship between liquidity and financial performance of Moroccan banks. To achieve this, we have selected a section of six Moroccan banks listed on the Casablanca Stock Exchange: “Attijariwafa Bank”, “Bank of Africa, Banque Populaire du Maroc, Banque Marocaine du Commerce et de l'Industrie, Crédit du Maroc, and Crédit Immobilier et Hôtelier.

We mainly evaluate the liquidity position and financial performance of these banks using different ratios in order to test their implications and impact on the banks' performance. Besides, it should be noted that the period covered by our study (from 2004 to 2022) coincided with significant regulatory changes and liberalization reforms in Morocco's banking system, which undoubtedly affected the entire economic and financial system.

3.1.1. Endogenous variables

Bank performance is primarily defined by a bank's ability to generate profits while maintaining its stability, as emphasized by Derbali (2021). In this context, two fundamental indicators are used to assess this variable. The first one is the ROA, which measures the bank efficiency to generate profits (Demirgüç-Kunt and Huizinga, 1999). Another higher ROA ratio indicates better profitability, as it demonstrates the ability to make profits with the same asset amount. Even though this indicator does not account for off-balance sheet items, Golin (2001) considers it the most used one in the banking sector.

The second major indicator is the ROE, which evaluates profitability from the shareholders' perspective by relating net income to invested equity, as established by Berger and al., (2005). Also, Naceur and Kandil's (2009) showed that this ratio is influenced by various factors, including liquidity, operational efficiency, and macroeconomic conditions. Finally, Dietrich and Wanzenried (2011) clarified that a higher ROE signifies the bank's efficiency and ability to generate profits per dollar invested, making it a relevant indicator of profitability.

3.1.2. Exogenous variables

Measuring banks' liquidity is crucial for examining the resilience of financial institutions to possible shocks. The three primary ratios complement each other to provide a comprehensive view of a bank's liquidity position.

The liquidity ratio (L1), which measures liquid assets as a percentage of total assets, is widely recognised as a fundamental indicator of a bank's shock-absorbing capacity (Diamond and Dybvig, 1983). This ratio is achieved by the loan-to-deposit (L2) identified by Berger and Bouwman (2009), who show that an increased ratio of this latter can be a signal of high vulnerability to liquidity risk, which has become relevant since the 2008 financial crisis, as highlighted by Cornett et al., (2011), who determined its importance in assessing banks' autonomy during strained periods in the interbank markets. This multi-ratio approach, supported by Borio et al., (2014) work, provides a thorough examination of banks' liquidity positions, specifically in the prudential supervision context.

The measurement of a banking institution can be determined by the logarithm of its resources. This criterion raises a significant concern regarding its impact on performance. On the first hand, some advocate for the economies of scale related to large organizations; on the other hand, however, others emphasize the complexity management and large banking structures and costs.

The capitalisation ratio, calculated by dividing shareholders' equity by total assets, is a fundamental indicator of a bank's soundness. The financial literature acknowledged: empirical studies show a positive correlation between the level of capitalisation and profitability. This connection has been highlighted in many studies across different markets and time frames. (García-Herrero et al., 2009; Liu & Wilson, 2010; Naceur & Omran, 2011; Menicucci & Paolucci, 2016).

The size of the banking sector is related to the logarithm of the assets within the banking system. In our analysis, we calculated the logarithm of the total revenues of six banks. Based on the economic and financial literature, we anticipate a negative effect on profitability.

In fact, bank concentration is quantified by the following ratio: total assets of the large banks (i.e., total assets of AWB, BCP, and BMCE Bank) divided by the major holdings of all the banks studied. Consequently, we expect a positive effect on bank profitability.

The interbank ratio refers to the interest rate applied to short-term transactions. This percentage is correlated to the banks' rates and expectations. We have particularly obtained its evolution for the study period from BAM data.

Economic growth measured by the GDP aims at capturing the macroeconomic environment. During the growth phase, consumption and investment recover, which shows why studies include GDP evolution as an independent variable. We expect that GDP boost have a positive effect on bank profitability.

Moreover, inflation is introduced to incorporate the general variation in the price level, which can affect bank profitability. For this target, it was included in our study as we obtained its evolution over the period from economic and financial dashboards of the Moroccan economy.

In fact, our database is set by complementary sources from 2004 to 2022. To collect internal bank data, we worked on annual reports on the websites of the six banks under study. Besides, all information was obtained from banking supervision reports published by Bank Al-Maghrib. As for macroeconomic variables, they were collected from three main sources: Morocco's economic and financial dashboards, the High Planning Commission and the World Bank's databases.

The descriptive statistics in Table 1 indicate average but heterogeneous profitability performance within the sample of banks, ROA averages 1.1%, reflecting satisfactory efficiency in asset allocation, yet the significant standard deviation of 1.2% and the range of 0.2% to 11.2% reveal a notable gap in institutional performance. Similarly, ROE shows an average of 12.3%, with considerable variation as indicated by the standard deviation of 6.7% and an important range of 1.5% to 64.9%. Therefore, these indicators suggest that while some banks are generating exceptional returns, others are operating lower margins.

The banking position liquidity level remains stable. On average, banks maintain a ratio of liquid assets to total assets (L1) of around 20.4%, providing them with a substantial cushion against potential shocks. The loan-to-deposit measure (L2), at 95.2%, reflects efficient intermediation, as banks optimise the use of their deposit base while maintaining a prudent level of lending. However, the ratio of liquid assets to deposits (L3), with an average of 28% but a significant standard deviation of 35.6%, reveals a wide variety of liquidity management practices. This distinction highlights the existence of multiple strategies to balance liquidity needs and profitability targets.

Table 1 : Descriptive statistics

<i>Variables</i>	Mean	Std. Dev.	Min	Max
<i>ROA</i>	0.011	0.012	0.002	0.112
<i>ROE</i>	0.123	0.067	0.015	0.649
<i>Liquid assets/total assets (L1)</i>	0.204	0.154	0.112	0.994
<i>Loans/deposits (L2)</i>	0.952	0.287	0.381	2.48
<i>Liquid assets/deposits (L3)</i>	0.28	0.356	0.003	3.295
<i>Bank size</i>	7.732	1.33	0.013	8.56
<i>Sector size (S_bank)</i>	20.403	0.344	19.662	20.909
<i>Concentration (Concent)</i>	80.617	1.199	78.836	82.502
<i>Interbank rate (Ibr)</i>	2.632	0.584	1.5	3.37
<i>GDP growth</i>	3.439	3.107	-7.178	8.021
<i>Inflation (Inf)</i>	1.727	1.443	0.303	6.657

Source : Authors' calculations.

Banking system characteristics show a significant concentrated market. Indeed, the average concentration ratio of 80.62% suggests an oligopolistic structure, with a small number of dominant banks in the market. The size of banks, measured logarithmically with a mean of 7.732 and a modest standard deviation, suggests a homogeneously sized sector. Hence, the total dimension of banks (S_bank) shows steady but controlled growth, as indicated by the low average variation of 0.344.

The macroeconomic environment shows moderate volatility within banks' operations. The interbank rate is stable with the average of 2.63% and controlled fluctuations, shown by the standard deviation of 0.584%. However, with GDP growth, the economy as a whole remains unstable. Besides, inflation has occasionally reached peaks of 6.66%, reflecting periods of price instability. In this volatile macroeconomic environment, banks have to manage shifting economic conditions and compliance with their risk management practices while ensuring the efficiency of their operations.

3.1. Econometric methodology

To analyze bank profitability with different variables presented above, we adopt Derbali's (2021) linear formulation:

$$Profitability_{it} = \alpha_{it} + \beta_i X_{it} + \gamma_i Z_{it} + \varepsilon_i$$

Where the profitability of bank i at time t is represented by two major indicators: ROA and ROE. Bank-specific characteristics (X) are measured by five distinct variables. Bank liquidity (L) is composed of three components ($L1, L2, L3$), bank size (S), and the capitalization ratio (CR) shows the level of equity.

Notably, external variables (Z) define the bank operating environment through five measures: the size of the banking sector (S_bank), bank concentration ($CONC$), economic growth (GDP), the interbank rate (IBR), and inflation (INF).

Therefore, to estimate the impact of different bank liquidity factors, we adopted a panel data econometric approach. By using fixed effects estimation and Driscoll-Kraay standard errors (1998), this approach allows us to enhance the robustness of our results by accounting for the specificity of each bank and the potential correlation of errors over time.

Fixed effects estimation is particularly important in this context because it controls for unobserved time-invariant heterogeneity among banks. According to Wooldridge, 2010, with focusing on within-bank variation, the risk of omitted variable bias is mitigated.

However, using fixed effects only may not be sufficient when dealing with panel data in the context of Moroccan banks. In fact, the potential presence of cross-sectional dependence—where error terms are correlated across banks—can lead to biased standard errors and unreliable inferences. Thus, the application of Driscoll-Kraay standard errors (1998) is crucial as it provides a robust estimator consistent in the presence of heteroscedasticity, autocorrelation, and cross-sectional dependence.

The Driscoll-Kraay estimator is compatible with our impact study of different bank liquidity factors on performance in Morocco, as it does not impose restrictive assumptions on the nature of cross-sectional dependence, allowing for various forms of spatial and temporal correlation (Hoechle, 2007).

4. Results and interpretations

The outcomes of the econometric estimations and their interpretations are listed below. As a reminder, three types of regressions are run for each endogenous variables: Model 1 with liquidity variables only, Model 2 with both bank-specific and system-wide variables and Model 3 with all our variables.

The empirical analysis in Table 2 examines the relationship between bank liquidity and performance in the Moroccan banking sector, using ROA as the dependent variable. Therefore, the results show the negative and statistic impact of (L1) on bank performance in the three models, with quantities ranging from -0.010 to -0.009. Hence, these results suggest the excessive resources hold by Moroccan banks, which can be profitable opportunities due to their lower returns. Consequently, this result is significant in the Moroccan context, where banks often maintain high levels of liquidity pertaining to regulatory standards for risk management. In fact, (L2) does not show a significant correlation with ROA across the models, indicating that this typical measure of liquidity might not be a vital factor of bank profitability in Morocco. Thus, this reflects the Moroccan banking characteristics, which have diversified funding sources beyond traditional deposits.

The loan-to-deposit ratio (L2) does not show a statistically significant relationship with ROA in all models, suggesting that this traditional measure of liquidity may not be a crucial determinant of bank profitability in Morocco. This may reflect the unique characteristics of the Moroccan banking sector, where banks have diversified funding sources beyond traditional deposits.

In this same regard, the (L3) shows a significant relationship with ROA, changing from negative (-0.003) in model 1 to positive (0.003) in Models 2 and 3. This reversal of sign after controlling

for specific bank characteristics suggests that the relationship between liquidity and profitability is complex and depends on other factors in the banking sector.

The introduction of specific bank variables in Model 2 shows that bank size has a small but significant positive effect on ROA (0.0008), suggesting modest economies of scale in the Moroccan banking sector. The concentration variable has a significant negative coefficient (-0.001), suggesting that increased market concentration may lead to lower profitability, possibly due to regulatory oversight or competitive pressures in concentrated markets.

Model 3 includes macroeconomic variables, where the interbank rate (IBR) shows a significant positive relationship (0.003) with bank profitability, suggesting that higher interest rates generally benefit the performance of Moroccan banks. Surprisingly, GDP growth and inflation do not show significant effects on bank profitability, which could indicate that Moroccan banks have developed robust business models capable of performing consistently under different macroeconomic conditions. The explanatory power of the models, as indicated by the R-squared values, ranges from 28.9% to 43.4%, with Model 2 having the highest explanatory power. All three models are statistically significant, as indicated by Prob > F values below 0.05.

Table 2: Estimation results of ROA

<i>ROA</i>	Model 1	Model 2	Model 3
<i>L1</i>	-0.010* (0.013)	-0.0109* (0.004)	-0.009* (0.003)
<i>L2</i>	-0.0001 (0.013)	0.0004 (0.002)	0.0001 (0.002)
<i>L3</i>	-0.003** (0.013)	0.003** (0.001)	0.003* (0.001)
<i>Size</i>	-	0.0008* (0.0004)	0.0001* (0.0004)
<i>S_bank</i>	-	0.0004 (0.002)	0.002 (0.002)
<i>Concent</i>	-	-0.001** (0.0004)	-0.001 (0.001)
<i>Ibr</i>	-	-	0.003** (0.001)
<i>GDP growth</i>	-	-	-0.0007

			(0.001)
<i>Inf</i>	-	-	0.0003 (0.0004)
<i>_cons</i>	0.012*** (0.013)	0.086** (0.031)	0.030 (0.028)
<i>R-squared</i>	0.371	0.434	0.289
<i>Prob > F</i>	0.0176	0.0227	0.0253

Source : Authors' calculations. Note : significant coefficient at *** 1%, ** 5%, * 10%, standard deviation in parentheses.

Table 3 presents the results of the relationship between bank liquidity and performance in the Moroccan banking sector, using ROE as the dependent variable. The results show that the ratio of liquid assets to total assets (L1) has a negative and statistically significant impact on ROE in Model 1 (-0.066) at the 5% level. This negative coefficient suggests that a higher holding of liquid assets relative to total assets tends to reduce bank profitability from the shareholders' perspective. This result aligns with the theoretical trade-off between liquidity and profitability, particularly relevant in the Moroccan banking context where regulatory requirements often necessitate substantial liquidity holdings. However, this significance diminishes in Models 2 and 3, suggesting that the relationship becomes less pronounced when controlling for additional factors.

The loan-to-deposit ratio (L2) does not show any statistically significant relationship with ROE in the three models. This finding is notable in the Moroccan context, where traditional banking activities remain important but may not be the primary driver of returns for shareholders. The lack of significance could reflect the nature of the Moroccan banking system, where income diversification and non-traditional banking activities play an increasingly important role.

The ratio of liquid assets to deposits (L3) shows a marginally significant negative relationship (-0.011) in Model 1, but this effect becomes statistically insignificant in the more comprehensive Models 2 and 3. This pattern suggests that the relationship between this liquidity measure and bank profitability is not robust when considering other characteristics of the banking sector and macroeconomic conditions.

When introducing specific bank variables in Model 2, none of the control variables show statistical significance at conventional levels. This includes bank size, sector size, and market concentration. This is particularly interesting in the Moroccan context, where bank concentration is relatively high. The absence of significant size effects could suggest that economies of scale are not a major determinant of ROE in the Moroccan banking sector.

Table 3: Estimation results of ROE

<i>ROE</i>	Model 1	Model 2	Model 3
<i>L1</i>	-0.066** (0.013)	-0.078** (0.017)	-0.061* (0.016)
<i>L2</i>	-0.011 (0.014)	0.021 (0.015)	0.016 (0.015)
<i>L3</i>	-0.011* (0.005)	0.014* (0.007)	0.012* (0.006)
<i>Size</i>	-	0.004 (0.002)	0.005 (0.003)
<i>S_bank</i>	-	-0.027 (0.019)	-0.012 (0.018)
<i>Concent</i>	-	-0.007 (0.002)	-0.001 (0.004)
<i>Ibr</i>	-	-	0.025 (0.015)
<i>GDP growth</i>	-	-	0.002 (0.001)
<i>Inf</i>	-	-	0.005 (0.004)
<i>_cons</i>	0.123*** (0.018)	1.234 (0.294)	0.382 (0.340)
<i>R-squared</i>	0.385	0.468	0.242
<i>Prob > F</i>	0.0173	0.0029	0.0000

Source: Authors' calculations. Note: significant coefficient at *** 1%, ** 5%, * 10%, standard deviation in parentheses.

Model 3, which incorporates macroeconomic variables, shows that neither the interbank rate, GDP growth, nor inflation has a statistically significant impact on ROE. This could indicate that Moroccan banks have developed relatively resilient business models that are less susceptible to macroeconomic fluctuations, possibly due to their conservative management practices and a robust regulatory framework.

The explanatory power of the models varies considerably, with R-squared values ranging from 24.2% to 46.8%. Model 2 exhibits the highest explanatory power at 46.8%, suggesting that bank-specific characteristics explain a substantial portion of the variation in ROE. All three models are statistically significant overall, as indicated by Prob > F values well below conventional significance levels.

Conclusion

The 2008 financial crisis highlighted the critical importance of liquidity management in the banking sector. This event underlined the necessity for financial institutions to balance the need to meet short-term liquidity requirements with the pursuit of their profitability targets, to avoid any risk of fragility and contribute to the overall stability of the financial system.

In this context, the aim of this study is to examine the relationship between liquidity management and bank performance, measured by ROA and ROE, for six Moroccan banks over the period 2004-2022. Thus, our study shows that the relationship between liquidity and bank performance is complex and multifaceted, reflecting the challenges banks face in maintaining sufficient liquidity while pursuing financial performance goals in a post-crisis regulatory environment.

Our empirical analysis reveals several important findings. Firstly, the ratio of liquid assets to total assets (L1) shows a negative relationship with both performance measures, which is more pronounced for ROE (-0.066) than for ROA (-0.010). This suggests that maintaining high levels of liquidity may improve stability and resilience to shocks, but at the expense of profitability. This trade-off is particularly relevant in the post-2007 context, where banks face increased pressure to maintain substantial liquidity buffers while remaining competitive and profitable.

Secondly, the role of bank-specific characteristics and macroeconomic factors differs between the ROA and ROE models. Regarding the first indicator, we find significant effects of bank size and market concentration, while these factors are less important for ROE. This divergence suggests that the mechanisms through which liquidity affects bank performance vary depending on whether one considers asset efficiency or shareholder returns.

The results presented in this paper have implications for both bank management and regulatory policy in Morocco. First, they suggest that liquidity requirements, while important for stability, can have tangible costs in terms of bank profitability. Second, they propose that Moroccan banks need to develop sophisticated liquidity management strategies that balance regulatory requirements, stability concerns, and performance goals.

In this regard, future research could explore how digital transformation and financial innovation could help Moroccan banks optimise their liquidity management while maintaining profitability. In addition, studying the impact of new liquidity regulations and their interaction with bank performance measures could provide valuable insights for policymakers and bank managers.

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