

Bank- specific determinants of liquidity risk for commercial banks in Algeria: Panel data analysis during 2005-2020

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Fatma Benchenna, <https://orcid.org/0009-0003-5173-8849>

Associate professor A, Department of Finance and Accounting, Faculty of Economic Sciences and Commercial Sciences and Management Sciences, Kasdi Merbah University, Ouargla, Algeria

Corresponding author: benchenna_fatma2008@hotmail.com

Abstract

This study aims to monitor a group of factors that cause liquidity risks and contribute to the occurrence of liquidity problems by testing the determinants of liquidity risk and the explanatory factors of the liquidity problem in Algerian commercial banks. This study seeks to highlight the importance of commercial banks' liquidity in financing investments to generate profits and the need to maintain appropriate levels to meet liquidity needs. Using panel data for a sample of nine Algerian banks during the period 2005–2020, the study found that the explanatory variables of the liquidity risks that cause liquidity problems in Algerian commercial banks by using the liquid assets to total assets index ratio are: return on assets, return on equity, and capital adequacy ratio, with an explanatory capacity of 59.44%. Analysis of the results of the fixed effect model showed an inverse correlation between the return on assets and liquidity risks. There was a statistically significant positive relationship between the return on equity, capital adequacy ratio, and liquidity risk. There was a negative, but not statistically significant, relationship between bank size, the loan loss provisions to total loans ratio, and liquidity risk. The study recommends that to increase the volume of assets, there should be a corresponding increase in liquid assets as a precaution against liquidity risks in Algerian banks. Also, other determinants are not addressed in the study, which requires further research into the determinants of liquidity risk in Algerian banks.

Keywords: liquidity risk, liquid assets to total assets, bank- specific determinants, panel-data model, Algerian banks.

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Introduction

Algeria's banking sector is a critical source of financing for the development process of an economy lacking other sources of financing, such as markets. It is seen as a mediator between surplus and deficit. Since the 2014 oil crisis, this situation has limited the role of bank intermediaries in Algeria, where saving compared to investing is impossible. However, the Bank of Algeria continues to prioritize loans.

Liquidity is one of the biggest challenges commercial banks face, as there are many reasons for low liquidity. Therefore, liquidity risk is one of the complex problems faced by commercial banks, especially bank loans. Therefore, it is necessary to evaluate the performance of banks, understand the main negative factors that lead to liquidity risk, and try to deal with, reduce, and avoid them in the future.

After the 2008 global financial crisis, increased focus on liquidity risk made banks more vulnerable to credit problems. This increases liquidity risk for banks, especially those that rely on money markets. In response to this situation, international regulatory agencies have formulated regulatory standards for liquidity risk management, such as the decision of the Basel III Committee, which emphasized the necessity of liquidity risk management. Disclosure of the determinants of liquidity risk is critical for supervisors concerned with financial stability. Especially after the recent crisis, much research has been done on the determinants of liquidity risk, focusing on macroeconomic factors such as inflation, gross domestic product (GDP), etc., as well as bank-specific variables such as bank size, capital adequacy ratio, return on equity, etc.

Therefore, this study aims to emphasize the importance of commercial banks' liquidity in financing investments to generate profits and the need to maintain appropriate levels to meet liquidity needs. Since risk factors are inherent in banking activities, ensuring the continuity and growth of banks depends mainly on adopting effective liquidity management strategies, adopting advanced methods for estimating and measuring liquidity risks and identifying the factors that affect them.

The importance of this study lies in the need to find an appropriate formula to allow Algerian banks to identify factors affecting liquidity risks to address these risks and to identify indicators that best reflect these risks in Algerian commercial banks. Based on the above, this paper attempts to answer the following question:

What is the extent of the contribution of Bank-Specific determinants of liquidity risk to the liquidity problem in Algerian commercial banks during the period 2005–2020?

To answer this question, the following hypotheses were formulated:

Hypothesis 1: Increasing bank size leads to increased liquidity risk.

Hypothesis 2: Increasing the return on assets leads to a decrease in liquidity risk.

Hypothesis 3: Increasing return on equity leads to an increase in liquidity risk.

Hypothesis 4: A high capital adequacy ratio leads to an increase in liquidity risk.

Hypothesis 5: Increasing the ratio of loan loss provisions to total loans leads to an increase in liquidity risk.

1. Literature review

Many researchers have been interested in studying bank liquidity risk determinants because they are critical for evaluating commercial banks' performance. This is done using the Bank's internal factor variables as well as looking for external factors related to macroeconomic determinants and their contribution to liquidity problems. These studies yielded a range of different results.

Laurine (2013) examines the factors that affect Zimbabwean commercial banks' liquidity risk. To evaluate monthly data from March 2009 to December 2012, according to the Panel model's findings, capital adequacy and the Bank's size have significantly negative effects on liquidity risks. Spreads have a positive impact on liquidity risk; however, there is a significant positive correlation between liquidity risk and the non-performing loans ratio. The significance of liquidity risk was also influenced by reserve requirement ratios and inflation.

A study conducted by Ben Jedidia & Hamza (2015) used a sample of 60 Islamic banks in the MENA during 2004–2012 to analyze the factors that determine the liquidity risk of Islamic banks. The results of the panel model showed that return on assets, capital adequacy ratio, investment ratio, and foreign ownership had a negative relationship with liquidity risk. The Bank's size and macroeconomic conditions were not determinants of the liquidity risks of Islamic banks.

Yimer (2016) aimed to identify the factors that affect liquidity in Ethiopia's private commercial banks. Using sample data from six banks from 2000 to 2015. The fixed impact model's findings showed that the Bank's size and loan growth rate negatively influence liquidity (as measured by the ratios of liquid assets to deposits, liquid assets to total assets, and loans to deposits). Profitability, inflation, and non-performing loans all have a significant positive effect on the liquidity risk of private Ethiopian banks. Other variables

(capital adequacy ratio, interest rate margin, real GDP growth rate, loan interest rate, and short-term interest rate) have no statistically significant impact on the liquidity of Ethiopian private commercial banks.

Also, Leykun (2016) examined the factors affecting liquidity risk in a sample of 11 Ethiopian banks from 2005 to 2014. The results of the fixed effect model found that the capital adequacy ratio, the total loan ratio to total assets, and the total deposit to total assets ratio affect liquidity risk negatively in Ethiopian commercial banks.

The study by Zaghdoudi & Hakimi (2017) used data from ten banks between 1980 and 2015 to find key determinants of liquidity risk in Tunisian banks. The panel model analysis results show that loans, bank size, international crises, and the concentration index (HHI) are the main determinants of Tunisian banks' liquidity risk. Economic growth and inflation have no significant impact.

The study by Muchtar & Rustimulya (2019) identified the factors affecting liquidity risk for a sample of 25 banks listed on the Indonesian Stock Exchange during 2008–2017. Using Panel models, all of the Bank's size, profitability, cost of funds, and quality of assets have a negative impact on liquidity risk. While deposits, capital adequacy, the economic cycle, and inflation have no impact on liquidity risk.

Addou & Bensghir (2021) examined the variables affecting the liquidity risk (ratio of liquid assets to total assets) of four Islamic banks in the UAE during 2014–2020. The variables include return on equity, return on assets, bank size, liquidity gap, non-performing loans, and capital adequacy. The results using multiple linear regression show that the return on assets and non-performing loan ratio have a negative impact on liquidity risk, while the capital adequacy ratio and return on equity both have a positive impact on liquidity risk.

Using bank-specific characteristics and macroeconomic variables, Ghenimi & all (2021) sought to highlight the similarities and differences between liquidity risk determinants between traditional and Islamic banks. Using a sample of 49 conventional banks and 27 Islamic banks in the MENA region between 2005 and 2015. The results of using dynamic Panel models showed that the liquidity risk determinants for the two banking systems were different, with return on equity, the ratio of non-performing loans, and the ratio of capital adequacy determining the liquidity risk for both systems, while the external determinants for only traditional banks were the financial crisis, inflation, and economic growth.

2. Liquidity risk and Bank- specific determinants:

Vodova (2013) defined liquidity as the capacity of commercial banks to finance asset growth and pay their commitments when they become due without suffering unintended losses. Also, the essential function of banks in converting short-term resources into long-term credit, which occurs in a system of imperfect markets and asymmetric information, gives rise to liquidity risk (Rakhrour & Benilles, 2022, p. 58). And any banking organization depends on liquidity; its absence will affect how smoothly banking operations run. Liquidity is thus essential for the effectiveness, viability, and stability of banks. Therefore, if a bank cannot satisfy its maturing debts without suffering a big loss, it may be considered illiquid. Also, liquidity refers to the cash and other resources available to banks to promptly meet their short-term trade and financial commitments as they come due. In other terms, it refers to how easily a bank may transform its non-cash assets into cash so that it can pay its maturing debts with little to no loss (Ayinola & Gumel, 2023, p. 17).

This liquidity risk stems from a maturity mismatch on both sides of the balance sheet, resulting in too much cash available to invest or not enough liquidity available for financing. Liquidity risk also arises from difficulties in raising cash at a reasonable cost. With the ban on interest-based lending, Islamic banks are unable to borrow funds to meet liquidity needs when needed. Also, the sale of debt is not permitted (Ben Arab & Elmelki, 2008, p. 86). Liquidity risk is divided into two categories: market liquidity risks and financing risks. In contrast, the first type makes assets less liquid, which makes it challenging for the bank to fulfill its financial responsibilities. The second kind is incapable of borrowing money at an affordable rate to raise capital.

Liquidity risk determinants are not limited to macroeconomic factors, which are external factors affecting the banking industry. Instead, factors related to internal capabilities and management decisions are expected to influence the evolution of banks' liquidity problems. The most important of these bank-specific determinants of liquidity risk are:

2.1. Size Bank: The natural logarithm of total assets is generally used as a metric of bank size in research (Ben Jedidia & Hamza, 2015, p. 140). Vodova (2011) offers an analysis of Czech commercial banks during the period from 2001 to 2009. He concludes that larger banks exhibit less liquidity, which is consistent with the "too big to fail" hypothesis. Because they rely on government intervention in times of shortage, larger banks are less driven to hold liquidity (Ghenimi & all, 2021, p. 72). Where the size of a bank increases with the number of assets it has. Banks that have a lot of assets could be at liquidity risk. Depending on the size of the bank, this results in various amounts of liquidity being created in each bank (Mughtar & Rustimulya, 2019, p. 463). According to the researchers Deléchat and all (2014), According to Lucchetta (2007), Isshaq (2009), and Bokpin (2009), bank size positively impacts the liquidity ratio (Ben Jedidia & Hamza, 2015, p. 140).

According to Ahmed and all (2011) analysis, the relationship between bank size and liquidity risk is negligibly weak. The size of the bank has a negligible negative impact on liquidity risk (Ahmed & all, 2011, p. 101), according to Mugenyah's (2015) study on the factors that determine liquidity risk in Kenyan commercial banks.

2.2. Profitability: The direction of the relationship between bank performance and liquidity risk is unclear. Greater performance indicates banks have high revenue that may be used to fulfill their short-term obligations. Performance refers to a company's capacity to turn a profit for shareholders (Ghenimi & all, 2021, p. 71). According to a study by Nandakumar & all (2012), the more profitable a bank is, the greater the liquidity risk (Nandakumar & all, 2012, p. 2). A study by Alzoubi (2017) examined the liquidity risk in Islamic banks between 1994 and 2009, and it demonstrates that the ROA ratio has a positive effect on this risk. This conclusion also suggests that banks are more vulnerable to liquidity risk since they switch their portfolios to more lucrative assets to increase profits (Alzoubi, 2017, p. 147). As previous research has also discovered, profitability and liquidity risk have a notable positive relationship. This is because one way to create liquidity is through profitability (Mughtar & Rustimulya, 2019, p. 464). The ability of banks to address liquidity demands increases with bank profitability. For instance, Effendi and Disman (2017) look into the factors that affected liquidity risk in 12 conventional banks and 20 Islamic banks between 2009 and 2015. They indicate that whereas the return on assets positively affects liquidity risk in conventional banks, it has no bearing on liquidity risk in Islamic banks (Effendi & Disman, 2017, p. 317). Iqbal (2012) also discovers a positive effect of profitability (ROE) on liquidity risk. According to these findings, conventional banks performed better than their Islamic counterparts in profitability and controlling liquidity risk (Ghenimi & all, 2021, p. 71). Al-Khoury, R. (2011), Naismith (2015), and Sukmana & Suryaningtyas (2016) found that return on assets has a negative impact on liquidity risk. It can be explained that banks do not use their high profits as reserves but use them to increase financing.

2.3. Capital adequacy: A bank's ability to absorb operational expenditures and maintain fund liquidity is measured by its capital adequacy. According to the study by Ayele (2012), as cited by Mugenyah (2015), a crucial factor in determining liquidity risk is the regulatory requirement on the minimum capital that banks must keep and the ratio of core capital to client deposits as a measure of capital adequacy. Adequate capital also demonstrates the bank's capacity to take on new business. Banks and other financial entities have financial freedom due to capital requirements (Tuga, 2019, p. 15). In some research, capital adequacy is chosen as the bank-specific determinant of liquidity risk. Regarding the relationship between capital and liquidity production, contending theories might be put forward. The authors, Berger and Bouwman (2009), identify two distinct ideas. According to the first "financial fragility-crowding out" hypothesis, capital is inversely related to the production of new liquid assets. Diamond and Rajan's (2000) explanation of this claim states that banks raise money from depositors to make loans, which adds to the bank's vulnerability. Also, banks' financial structures become vulnerable in the absence of total deposit security, so to win over their depositors' confidence and lessen the possibility of a bank run, they need a sizable portion of liquid deposits. As a result, banks with larger regulatory capital may see less liquidity being created. The second "risk absorption out" concept, however, contends that regulatory capital is positively correlated with the generation of liquidity. According to Allen and Gale (2004), banks that provide high levels of liquidity are more exposed to risk because they are more likely to suffer losses when they must sell liquid assets to meet the needs of their customers (Berger & Bouwman, 2007, pp. 7-8). According to Al-Khoury (2012), bank

capital boosts bank liquidity by enhancing its capacity to bear risk; as a result, the higher the bank's capital ratio, the greater the generation of liquidity (Yimer, 2016, p. 16).

2.4. Credit risk: The ratio of non-performing loans to total loans is employed to calculate credit risk. The ratio of loan loss provisions to total loans can also be used to measure credit risk. An improvement in the quality of banking assets is shown by a decline in non-performing loans. A high non-performing loan ratio also denotes a high level of credit risk. This ratio is regarded as the primary indicator used by banks to assess the stability and safety of their systems (Ghenimi & all, 2021, p. 73). A study by Ruoyu Cai and Mao Zhang (2017) demonstrated that there is a positive correlation between credit risk and liquidity. The study's findings showed that banks with high levels of non-performing loans may be unable to meet depositor withdrawal requests, which could decrease cash flow and cause a decline in the value of loans, increasing the risk of liquidity (Ruoyu & Zhang, 2017, p. 21). According to research by Diamond and Rajan (2005), Acharya and Viswanathan (2011), Gorton and Metrick (2012), He and Xiong (2012), and Munteanu (2012), defaulting investment projects cannot satisfy depositor demand if they are financed by bank loans. And as these assets depreciate, an increasing number of depositors will come forward to recover their funds. As a result, increased depositor demand will increase liquidity risk as credit risk increases (Ghenimi & all, 2021, p. 70).

3. Research Methodology

3.1. Sample and Data:

The study population consists of Algerian banks, which numbered twenty (public and foreign). Nine banks were selected as a sample for the study, which included three public banks (National Bank of Algeria BNA, External Bank Algeria BEA, and Loan Popular Algeria CPA) and six private foreign banks (Al Baraka Bank Algeria, Bank Arab Banking Corporation ABC), Societe Generale SGA Bank, Algerian BNP Bank, Algerian TRUST Bank, and Algerian Gulf Bank (AGB). The data were collected through the annual reports of banks, in addition to data from the Bankscope database and Data Stream. The study duration included sixteen years, which extends from 2005 to 2020, for the banks under study. The study uses Balanced Panel Data.

3.2. Variables description

- **Dependent variable:** Is represented in the liquidity risk measurement index, which is the ratio of liquid assets to total assets. The ratio reflects the Bank's ability to absorb the liquidity crisis, and the higher this ratio is, the higher the Bank's ability to overcome the liquidity crisis. However, the high proportion may translate into inefficiency because liquid assets generate poor income. The positive relationship with the ratio means the inverse relationship with liquidity risk.
- **Independent variables:** the determinants that are thought to have an explanation and impact on liquidity risk include: Bank size, return on assets (ROA), return on equity (ROE), capital adequacy ratio (CAR), and loan loss provisions to total loans ratio (CR).
- To build the model, we identified the variables of the study, as we used the most important previous studies to select these variables and Table No. (01) summarizes the variables.

Table 1. The bank-specific determinants of liquidity risk used in the study

Variable	Explanation	Expected effect	Studies and research
Bank Size	Logarithm of total	(+)	(Ahmed & all, 2011) ; (Laurine, 2013); (Ben Jedidia & Hamza, 2015); (Alzoubi, 2017); (Kaur & Sharma, 2017); (Zaghdoudi & Hakimi, 2017); (Mughtar & Rustimulya, 2019); (Ghenimi & all, 2021); (Faruque, 2021); (Addou & Bensghir, 2021)
Return on assets ROA	Net result/total assets	(-)	(Ahmed & all, 2011); (Nandakumar & all, 2012); (Ben Jedidia & Hamza, 2015); (Alzoubi, 2017); (Kaur & Sharma, 2017); (Negash & Veni, 2019); (Addou & Bensghir, 2021)

Table 1 (cont.). The bank-specific determinants of liquidity risk used in the study

Return on equity ROA	Net result / total assets	(+)	(Nandakumar & all, 2012); (Ghenimi & all, 2021); (Faruque, 2021); (Addou & Bensghir, 2021)
Capital adequacy ratio CAR	total equity / total assets	(+)	(Nandakumar & all, 2012); (Laurine, 2013); (Ben Jedidia & Hamza, 2015); (Leykun, 2016); (Zaghoudi & Hakimi, 2017); (Ghenimi & all, 2021)
Credit risk CR	Loan Loss Provisions/Total Loan	(+)	(Mughtar & Rustimulya, 2019); (Ghenimi & all, 2021)

Source: Prepared by the researcher based on previous studies.

3.3. Research Model:

This study uses panel data analysis to identify the variables influencing liquidity risk in Algerian commercial banks. The impacts of temporal change and altering sectional unit differences that are evident in the data of the study sample, however, taken into account by panel data, a type of longitudinal data. For the analysis, we will use balanced data collected over a 16 years period, from 2005 to 2020, for nine banks. The formulation of the form is provided as follows:

$$LR_{it} = \beta_0 + \beta_1 \text{Bank Size}_{it} + \beta_2 \text{ROA}_{it} + \beta_3 \text{ROE}_{it} + \beta_4 \text{CAR}_{it} + \beta_5 \text{CR}_{it} + \varepsilon_{it}$$

LR_{it} = Ratio liquid asset to total asset of bank i at time t .

Bank Size_{it} = Logarithm total assets of bank i at time t .

ROA_{it} = Return on assets of bank i at time t .

ROE_{it} = Return on equity of bank i at time t .

CAR_{it} = Capital adequacy ratio of bank i at time t .

CR_{it} = Ratio of loans loss provisions to total loans of bank i at time t .

ε_{it} = The error term.

4. Results and Discussion

4.1. Empirical Findings:

4.1.1 Correlation Analysis:

According to Gujarati, there is a problem of strong linear correlation between two independent variables if the coefficient of association between them is 0.8 or more; thus, we build the matrix of relations using the Pearson test to examine the problem of multicollinearity in a linear double-liner. The linkage matrix has shown that there is no issue of linear duplication between the variables evaluated because each of them has not exceeded 0.80, and Table 02 lists the correlation values between the variables utilized in the study. The model applies to all variables, and the findings show a connection between the determinants and the liquidity risk index, where we discover the following:

The presence of a statistically significant negative correlation between the dependent variable LR (the liquid assets to total assets ratio) and the variable bank size, with the obtained correlation coefficient estimated at -0.251, and a statistically significant positive correlation between the dependent variable LR (the liquid assets to total assets ratio) and the two variables: the return on assets and the return on equity, with the correlation coefficient obtained being estimated at 0.217 and 0.245, respectively.

Table 2. Correlation Matrix

Corrélations		LR	Bank Size	ROA	ROE	CAR	CR
LR	Pearson correlation	1	-,251**	,217**	,245**	-,086	-,024
	Sig. (two-tailed)		,002	,009	,003	,306	,772
	N	144	144	144	144	144	144
Bank Size	Pearson correlation	-,251**	1	-,529**	,015	-,566**	-,241**
	Sig. (two-tailed)	,002		,000	,861	,000	,004

Table 2 (cont.) Correlation Matrix

	N	144	144	144	144	144	144
ROA	Pearson correlation	,217**	-,529**	1	,444**	,589**	-,233**
	Sig. (two-tailed)	,009	,000		,000	,000	,005
	N	144	144	144	144	144	144
ROE	Pearson correlation	,245**	,015	,444**	1	-,336**	-,437**
	Sig. (two-tailed)	,003	,861	,000		,000	,000
	N	144	144	144	144	144	144
CAR	Pearson correlation	-,086	-,566**	,589**	-,336**	1	,106
	Sig. (two-tailed)	,306	,000	,000	,000		,207
	N	144	144	144	144	144	144
CR	Pearson correlation	-,024	-,241**	-,233**	-,437**	,106	1
	Sig. (two-tailed)	,772	,004	,005	,000	,207	
	N	144	144	144	144	144	144

** . The correlation is significant at the 0.01 level (two-tailed).

Source: Prepared by the researcher based on spss 22.

4.1.2. The Results of Estimating Liquidity Risk Determinants Using Panel Data Models:

Using the three longitudinal data models, we will estimate liquidity risk determinants using the LR index and run the tests needed to select the best model. We calculated the three models' parameters using the eviews 9 program, and the results are shown in Table 3.

Table 3. Results of estimating panel models using the LR indicator

Variables	The Pooled Regression Model.	The fixed individual effects model	The random individual effects model
C	0.524020 (*)	0.259862 (*)	0.321672(*)
Bank Size	-0.051461 (*)	-0.000650	-0.012394
ROA	4.612518 (*)	3.582977(*)	3.714476(*)
ROE	-0.260990	-0.557052 (*)	-0.519241(*)
CAR	-0.658350 (*)	-0.323053 (*)	-0.364386(*)
CR	-0.058044	-0.156424	-0.146533
R ²	0.201872 (*)	0.594473 (*)	0.062080

(*) parameter significance at 0.05

Source: Prepared by the researcher based on Eviews 9

a) Test for the presence of fixed individual effects:

We use the redundant fixed effects test to compare the pooled model with the individual fixed effects model to determine whether Algerian banks adopt uniform conduct for the fixed limit or whether each bank has its own behavior. In Table No. (04), we observe that the test probability is less than 0.05 and that the estimated F value (15.732029) is more than the tabulated d value $F_{tab}(0.05, 8, 130) = 2.01033648$. The null hypothesis is rejected, and the presence of fixed individual effects is accepted, indicating that the fixed individual effects model is preferable to the pooled model.

Table 4. Redundant Fixed Effects Test Results Using the LR Indicator

Redundant Fixed Effects Tests			
Equation: EQ02			
Test cross-section fixed effects			
Effects Test	Statistic	d.f.	Prob.
Cross-section F	15.732029	(8,130)	0.0000
Cross-section Chi-square	97.499698	8	0.0000

Source: Prepared by the researcher based on Eviews 9.

b) Test for the Presence of Random Individual Effects:

In this test, we refer to the comparison between the pooled model and the random individual effects model. For this comparison, we used the Breusch-Pagan test. This test showed the results displayed in Table (05),

where we note that the probability of the Breusch-Pagan test is less than 0.05, which indicates rejecting the null hypothesis and accepting the hypothesis of the existence of random individual effects, i.e., the random individual effects model is the best model when compared to the pooled model.

Table 5. Breusch-Pagan test results using the LR Indicator

Lagrange Multiplier Tests for Random Effects			
Null hypotheses: No effects			
Alternative hypotheses: Two-sided (Breusch-Pagan) and one-sided (all others) alternatives			
	Test Hypothesis		
	Cross-section	Time	Both
Breusch-Pagan	115.7251	4.292516	120.0176
	(0.0000)	(0.0383)	(0.0000)

Source: Prepared by the researcher based on Eviews 9.

c) Hausman test for the comparison between the random effects model and the fixed effects model:

We will compare the fixed individual effects model to the random individual effects model using a Hausman test, which indicates that the model containing random or fixed individual effects is superior to the pooled model. And the Hausman test results are given in Table No. (06). Note that the calculated χ^2 value is ($\chi^2= 11.698974$), which is greater than the tabulated value ($\chi^2= 11.0704978$), and the significance is less than 0.05, so we reject the null hypothesis and say that the appropriate model is the fixed effects model.

Table 6. Results of the Hausman test using the LR Indicator

Correlated Random Effects - Hausman Test			
Equation: EQ03			
Test cross-section random effects			
Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	11.698974	5	0.0392

Source: Prepared by the researcher based on Eviews 9.

4.2. Analysis of the results of the liquidity risk determinants study using the LR Indicator:

The results of the fixed-effects model analysis led to the selection of three statistically significant variables in explaining the dependent variable (LR) to explain and identify the liquidity risk and liquidity problems of Algerian commercial banks: return on assets, return on equity, and capital adequacy ratio. These independent variables explain 59.44% of the variation in the dependent variable (the ratio of liquid assets to total assets).

The analysis also reveals a negative relationship, but not statistically significant, between bank size, the loan loss provisions to total loans ratio, and the dependent variable (the ratio of liquid assets to total assets), suggesting that these two variables do not explain the dependent variable. Accordingly, Hypothesis 1 and Hypothesis 5 have been rejected.

The findings show a statistically significant positive relationship between the return on assets and the dependent variable (ratio of liquid assets to total assets), implying a negative relationship with liquidity risk. A high return on assets means that banks are managed efficiently; generating higher interest income and sufficient income to service their debt, and that banks are more profitable and have a better reputation and creditworthiness when obtaining financing, enabling them to obtain funds to manage liquidity problems and thereby reducing liquidity risk. So, hypothesis 2 is accepted. This finding is consistent with the (Mughtar & Rustimulya, 2019) and (Addou & Bensghir, 2021) studies. However, it is opposed to the (Ben Jedidia & Hamza, 2015) study.

The study's findings also revealed that return on equity and the dependent variable had a statistically significant inverse relationship, demonstrating a positive relationship with liquidity risk. The high return on equity shows that banks prioritize lending to reach high levels of profitability because they choose to invest in assets rather than maintain liquidity, which exposes them to increase liquidity risk. Hypothesis 3 is therefore accepted. These results are consistent with the studies (Addou & Bensghir, 2021) and (Ghenimi & all, 2021).

The findings' analysis shows that there is a statistically significant inverse relationship between the capital adequacy ratio and the dependent variable, which means that there is a positive relationship with liquidity risk. A high capital adequacy ratio indicates that banks have control over credit risks since they have enough capital to cover predicted losses. This allows them to control liquidity risks by investing in liquid assets, which strengthens their position in the liquidity creation process. However, we discovered in Algerian banks that having strong capital adequacy does not imply managing and reducing liquidity risks. However, we provide an explanation based on the capital increase procedures used by banks, specifically public banks, and their failure to distribute dividends despite the Bank of Algeria's instructions to raise the required minimum capital for commercial banks to 10 billion DZD. Algerian banks, especially public banks, are characterized by high capital adequacy, high credit risk, and non-performing loans, not their efficiency, which explains the positive relationship between liquidity risk and capital adequacy. As a consequence, hypothesis 4 is accepted. and this result is consistent with the study of (Addou & Bensghir, 2021) and contradicts the study of (Ben Jedidia & Hamza, 2015), which found the inverse relationship. Table No. (07) summarizes the results of the hypothesis tests.

Table 7. Results of hypothesis testing for the LR model

Hypothesis	code	Expected effect	results obtained	decision
Hypothesis 1	Bank Size	(+)	(+)	rejected
Hypothesis 2	ROA	(-)	(-)(*)	accepted
Hypothesis 3	ROE	(+)	(+)(*)	accepted
Hypothesis 4	CAR	(+)	(+)(*)	accepted
Hypothesis 5	CR	(+)	(+)	rejected

(*) : parameter significance at 0.05

Source: prepared by the researcher

Conclusion

This study aimed to search for the factors that explain liquidity risks and cause liquidity problems in a sample of Algerian commercial banks during the period 2005–2020. Based on the liquid asset to total asset ratio index as a criterion for measuring liquidity risk, through the study we have reached the following results:

- Analysis of the results of the fixed effect model resulted in the selection of three determined and explanatory variables for liquidity risks and liquidity problems in Algerian banks: return on assets, return on equity, and capital adequacy ratio.
- The analysis revealed that the Bank's size and the ratio of loan loss provisions to total loans are not considered determinants or explanations of the liquidity risk in Algerian banks.
- The results indicated an inverse correlation between the return on assets and liquidity risks. There is a positive relationship between the return on equity and capital adequacy ratio with liquidity risk.
- Based on the study's findings, we recommend the following:
- An increase in the volume of assets requires a corresponding increase in liquid assets as a precaution against liquidity risks in Algerian banks.
- Ensure compliance with Basel III standards by maintaining liquidity ratios to meet unexpected losses and the need for transparency and supervision in Algerian banks.
- The study found that the processed determinants were interpreted by 59.44% using the liquid asset to total asset ratio index, which means that 40.56% is due to other unaddressed determinants, which requires further research of liquidity risk determinants in Algerian banks.

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