The Impact of Liquidity Risk on the Performance of Algerian Banks

أثر مخاطر السيولة على أداء البنوك الجزائرية

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A B S T R A C T

This research aims to examine the impact of liquidity risk on the performance of Algerian banks. The study utilizes a sample of all functioning banks in Algeria, comprising twenty (20) banks, over a period of ten (10) years from 2010 to 2019. To achieve this objective, the panel data regression method is employed. We investigated the influence of several variables on the performance of banks, measured by the return on assets (ROA) ratio. The result of the multivariate analysis revealed that liquidity risk has a significant and positive impact on the performance of Algerian banks. As for the other determinants, the findings showed a significant positive relationship between ownership structure, diversification, gross domestic product growth, and the performance of Algerian banks, along with a significant negative relationship between the variable operational expenses and Algerian banks' performance.

Key words : Liquidity risk; Banking performance; Panel data; Algerian banks.
JEL Classification: G32, G21, L25

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الملخص

يهدف هذا البحث إلى دراسة تأثير مخاطر السيولة على أداء البنوك الجزائرية، حيث تشمل الدراسة عينة من جميع البنوك العاملة في الجزائر، والتي تضم عشرين (20) بنكًا، على مدى عشر (10) سنوات من 2010 إلى 2019 . لتحقيق هذا الهدف، تم استخدام أسلوب الانحدار الخطي المتعدد للبيانات بانل .قمنا بدراسة تأثير عدة متغيرات على أداء البنك المقاس بنسبة عائد الأصول. أظهرت نتائج التحليل متعدد المتغيرات أن مخاطر السيولة لها تأثير كبير وإيجابي على أداء البنوك الجزائرية. أما بالنسبة للمتغيرات الأخرى، فقد أظهرت النتائج علاقة إيجابية كبيرة بين الملكية، التنويع، نمو الناتج المحلي الإجمالي، وأداء البنوك الجزائرية، إلى جانب علاقة سلبية كبيرة بين متغير نفقات التشغيل وأداء البنوك الجزائرية.

الكلمات المفتاحية :خطر السيولة، الاداء البنكي ، معطيات بانل، بنوك جزائرية.

تصنيفات **JEL** : L25, G21, G32 .

1. Introduction

The banking sector is critical for the financial system's stabilization. It supports economic development and progress by facilitating the flow of funds and ensuring that financial resources are allocated effectively. Banks emerged as one of the most essential providers of funds for businesses. As a result, the banking system serves a crucial role in society, and its performance is a severe determinant of a country's financial health. A bank's primary function is to enable the movement of funds between its lenders and depositors. However, their intermediation status exposes them to an array of risks referred to as "banking risks," such as credit risk, market risk, and liquidity risk.

Banks are inherently exposed to liquidity risk due to the maturity transformation of short-term deposits (liquid liabilities) into long-term loans (illiquid assets). Hence, they face the tradeoff between maintaining liquid assets to reduce their exposure to liquidity risk and investing in illiquid assets that generate greater returns. Consequently, the issue in liquidity management is striking a balance between liquidity and profitability.

The 2007 financial crisis put considerable strain on the banking system, emphasizing the necessity of liquidity to ensure the functioning of financial markets and the banking sector. The change in market circumstances demonstrated how quickly liquidity may drain and how long illiquidity can continue (BCBS, 2008). As a result of this turmoil, financial bodies such as the Basel Committee on Banking Supervision have displayed an international framework for liquidity risk measurement, standards, and monitoring, known as the Basel III agreement.

Since the subprime mortgage crisis, liquidity risk and its influence on banks' performance have been an increasingly prominent topic in the financial literature. Therefore, several studies on the subject have been conducted, including a recent study by Thi Xuan Huong et al. (2021) for banks in 9 Southeast Asian countries, Chen et al. (2018) for commercial banks in 12 advanced economies, Marozva (2015) for South African banks, Ruziqa's (2013) study for Indonesian conventional banks, and Arif and Anees (2012) for Pakistani banks. All of these researchers have found that liquidity risk influences banks' performance.

The liquidity problem in both developed and developing countries has become a serious concern; it appears that the concept of liquidity is more widespread than ever. Algeria, as a developing country with 20 banks, requires an alert system to foresee the impact of this sort of risk on the financial health of Algerian banks.

The purpose of this research is to examine the effect of liquidity risk on the performance of Algerian banks. To achieve this objective, we used annual data gathered from the National Trade Register Center (CNRC) of twenty (20) banks, operating in Algeria from 2010 to 2019, i.e. 10 years, in which a linear regression model on panel data was employed for the analysis.

This paper is organized in the following manner: the first section will present a theoretical and empirical literature review of liquidity risk impact on the performance of banks. The second section will be dedicated to the

methodology element of the study. Finally, the third section will be relied on to estimate the model and interpret the results, followed by a conclusion.

2. Literature review

Banks are converting short-term deposits into long-term and illiquid assets, exposing themselves to the bank's most dangerous risk: liquidity. Liquidity issues can impact a bank's earnings and capital, and in extreme cases, they can cause the bank to underperform (Central Bank of Barbados, 2008). Several background theories have tried to explain how liquidity risk can affects the performance of banks.

2.1. Theoretical literature review

- **The risk-return trade-off:**

The risk-return tradeoff concept is used to explain the relationship between risks and return (Markowitz, 1952). This theory holds that the risk of a financial asset correlates with its return, and therefore, when the risk rises, so will the return. Liquid assets are less risky than other assets. As a result, their returns are not comparable to those of illiquid financial assets (Markowitz, 1999). From this vantage point, keeping more liquid assets to reduce liquidity risk may harm a bank's financial performance because, as a financial intermediary, interest income from lending is its primary source of income. Therefore, liquidity risk should positively impact bank financial performance.

- **Free cash-flow:**

The free cash flow hypothesis (Jensen, 1986), consistent with agency costs theory, may also explain why banks with higher liquidity do not perform better financially. The increase in free cash flow raises the likelihood that managers will engage in activities that conflict with the interests of the shareholders, thereby increasing agent-principal conflicts and, as a result, agency costs. High liquidity allows managers to indulge in self-aggrandizement by pursuing low-benefit projects and other behaviors that inevitably lead to poor financial performance. Furthermore, Acharya and

Naqvi (2012) contend that when banks are flush with liquidity, they relax lending standards, fueling credit growth and asset price bubbles.

- **Transaction cost:**

Another theory that could explain the effect of liquidity risk on banks' financial performance is the transaction cost theory. Transaction costs drive a chasm between an asset's buying and selling prices, for instance, brokerage commissions, exchange fees, transaction taxes, bid-ask spreads, and price impact (Vayanos and Wang, 2011). This theory proposes that organizations keep extra cash on hand to reduce transaction costs (Keynes, 1936). In the absence of sufficient cash to meet its obligations, a firm might have to borrow funds from outside sources until it can liquidate its noncash assets, incurring additional interest and transaction costs. It is due to the presence of capital market imperfections. Information asymmetry in imperfect financial markets exposes firms to an external finance cost premium. Thereby, the Pecking Order Theory suggests that firms prefer using internal finance like cash or retained earnings rather than external finance such as bank loans, debt, and equity to avoid such costs (Myers, 1984).

2.2. Empirical literature review

In recent years, liquidity risk has emerged as one of the most severe risks to banks. It attracted the interest of researchers and professionals, who investigated its impact on banks' performance.

The study by Thi Xuan Huong et al. (2021) used unbalanced panel data from Bankscope from 171 banks in nine countries in Southeast Asia over the period 2004–2016 and the Generalized Method of Moments (SGMM) to analyze the impact of liquidity risk on bank performance in Southeast Asian countries. The results indicated that liquidity risk, as measured by FGAP and net loans-to-total assets (NLTA), has a positive statistical relationship with bank performance, as measured by ROA and NIM. On the other hand, FGAP, NLTA, and net loans-to-customers funding and short-term funding (NLST) showed a negative correlation with ROE. Furthermore, this study revealed that during a crisis, banks will seek to increase liquidity assets to

improve profitability, increasing financial costs and decreasing bank efficiency. In addition, this research investigated the effect of asset structure variables on the bank performance (liquid assets-to-total assets, liquid assets-to-total loans, and liquid assets-to-short-term customer deposits). The results demonstrated a positive effect in the model with ROA and a negative impact in the model with NIM, implying that bank performance is quite sensitive to changes in asset structure. If banks typically reserve liquid assets at an optimal level to ensure business operations, their performance can be monitored in the event of shocks. However, if banks hold too many liquid assets, banks' performance will suffer as financial expenses rise faster than revenue.

Hacini et al. (2021) conducted a research to examine the effect of liquidity risk management on the financial performance of selected conventional banks in Saudi Arabia from 2002 to 2019, applying the panel data method (pool, fixed-effects, and random-effects). The loan-to-deposit ratio (LTD) and cash-to-deposit ratio (CTD) were used to assess liquidity risk, while ROE was used to evaluate financial performance. The findings revealed that CTD has a significant negative effect on ROE. CTD rises when banks hold more cash than deposits. The increase in CTD gives the bank's customers confidence that it will be able to provide their deposits when they are requested. When CTD rises above a certain level, funds become idle, and the bank bears the opportunity costs and deposit interest, negatively impacting the bank's performance. As a result, Saudi banks may hold a large percentage of cash (liquidity surplus) to meet the demand for deposit withdrawals. The ratio LTD has a negative impact on the financial performance indicator, explaining that because the LTD ratio contributes to assessing the bank's liquidity and assists investors in determining whether the bank is adequately managing its liquidity; if the ratio is excessive, it means that the bank lacks sufficient liquidity to cover any financing needs, such as loan defaults or an economic recession, leading to a significant and negative impact on the bank's performance.

Golubeva et al. (2019) investigated the impact of liquidity risk on bank profitability following the implementation of the Basel III regulations using a data set of 45 European banks with 180 observations between 2014 and 2017 and 37 observations in 2018, proposing a quantitative model based on ordinary least squares (OLS) techniques supplemented by weighted least squares (WLS) regression analysis. This research utilized three liquidity risk measures: FGAP, liquid coverage ratio (LCR), and loan-to-deposit (LTD), as well as traditional profitability measures: ROA, ROE, net profit margin (NPM), and EBITDA margin. The main reason they excluded 2018 was that the Basel III liquidity restrictions (LCR) went into effect at the start of that year, so they examined whether this new regulation for liquidity risk changed its impact on profitability. The research showed that the LTD ratio has a positive relationship with EBITDA margin and ROE but a negative relationship with ROA and NPM. These findings suggest that increasing the loans-to-deposits ratio increases liquidity risk while increasing profitability. The influence of FGAP on the EBITDA margin proxy is statistically significant with a positive sign, which primarily consists of interest income, explaining that banks with a high level of illiquid assets in loans may earn a higher interest income than banks with a lower level of illiquid assets. Therefore, an increase in illiquid assets may lead to higher interest income and, as a result, a higher EBITDA margin. FGAP, on the other hand, has a significant and negative impact on ROA, which can be explained by the fact that banks with a higher financing gap ratio lack stable and cheap funding and must eventually rely on costly external sources to meet their funding demands. Thus, the banks' profitability suffers. The authors revealed that LCR was a minor contributor to all return proxies, which warrants further investigation.

Chen et al. (2018) sought to investigate the causes of liquidity risk and the relationship between bank liquidity risk and performance in 12 advanced economies from 1994 to 2006. This research contributes by employing alternative liquidity risk measures rather than the liquidity ratio. The findings revealed that liquidity risk, as measured by FGAP, is both

negatively and significantly related to banks' performance (ROAA and ROAE). It indicates that banks with a significant funding gap lack stable and cheap funds, forcing them to use liquid assets or more external funding to meet funding demand, which consequently increases their cost of funding and reduces profitability. On the other hand, liquidity risk (FGAP) is positively and significantly related to NIM. Banks with higher FGAPRs tend to make riskier loans to earn more NIMs. Indeed, market funding costs for the funding gap rise as banks take on risky loans. As a result, banks with higher liquidity risk have higher NIMs and lower average total asset and equity returns (ROAA and ROAE).

Muriithi and Waweru (2017) used panel data techniques of random effects estimation and the generalized method of moments (GMM) to conduct a study on liquidity risk and financial performance of commercial banks in Kenya for 43 registered commercial banks from 2005 to 2014. LCR and NSFR were used to assess liquidity risk, while ROE was used to evaluate financial performance. The research reveals that NSFR is negatively associated with bank profitability in both the long and short run, whereas LCR has no significant influence on Kenyan commercial banks' financial performance in both the long and short run, explaining that Kenyan commercial banks are reliant on short-term investments and assets with low maturities, which have a negative impact on profitability. Moreover, competitive pressures will constrain banks if higher available stable funding, consisting of capital and retail deposits, is required, resulting in competition for loans, deposits, and even sources of equity and debt investments. This competition will raise business costs, resulting in instability.

The study by Saeed and Rahman (2015) applied data from 21 Malaysian commercial banks between 2005 and 2013 to examine the liquidity risk exposure of Malaysian banks and its effects on banks' performance. This study used three liquidity indicators to represent liquidity exposure from the asset and equity sides of a bank's balance sheet, namely the loans-to-deposits ratio, the liquid assets-to-total assets ratio, and the total equity-to-total assets

ratio. ROA and ROE were used to measure the performance of banks. The findings revealed that the loan-to-deposit ratio has insignificant effects on changes in bank performance. This result could be attributed to the banks' lending policies, which have a moderate loan-to-deposit ratio of 63.8%. The result of the liquid assets-to-total assets ratio revealed a negative impact on both ROA and ROE, implying that banks have a disadvantage in holding high liquid assets. Because of their low return relative to other assets, high-liquid assets impose an opportunity cost on the bank, reducing profitability. Furthermore, the capital ratio has a significant positive impact on ROA but a significant negative impact on ROE. It shows that banks are well capitalized if they do not engage in excessive lending and have an adequate liquid asset-to-total asset ratio.

Ruziqa (2013) investigated the impact of credit and liquidity risk on the financial performance of Indonesian conventional banks with total assets exceeding 10 trillion Rupiah from 2007 to 2011. ROA, ROE, and NIM were used to measure banks' financial performance, whereas the liquidity ratio (liquid assets-to-total liabilities) was used to measure liquidity risk. The results showed that liquidity risk has a positive and significant relationship with ROA, implying that banks with low liquidity must use more external funding to meet their demand for funds, increasing the bank's cost of funding and thus decreasing their returns. Furthermore, liquidity risk has a significant positive relationship with ROE; the higher the liquidity ratio, the more liquid and less vulnerable the bank is to failure. Banks with low liquid assets may need to increase their cash reserves to reduce their liquidity risk. As a result, during a liquidity crisis, a bank may be forced to borrow from the market at unusually high rates, lowering its returns. Notwithstanding, there is a negative relationship between liquidity ratio and NIM; this result may occur because banks with a high level of liquid assets may receive lower interest income than banks with a lower level of liquid assets. The relationship between the liquidity ratio and NIM is insignificant; one possible explanation for this result is that the liquidity ratio is not an optimal variable that can affect NIM.

3. Empirical study

3.1. Sample and data collection

This study will use a sample that includes a panel of 20 banks, composed of fourteen (14) private banks and six (06) public ones, operating in Algeria over the period 2010-2019, i.e. 10 years. This represents a set of 200 observations.

The data used in the empirical study was gathered from the National Trade Register Center (CNRC), by reviewing the balance sheets and income statements of the chosen sample from 2010 to 2019. Additionally, macroeconomic data were extracted from the World Bank's official website. These data enabled the creation of a comprehensive database, which was used to estimate the linear regression model on panel data.

3.2. Model variables' determination

In order to present the variables of the model, it is necessary to distinguish the dependent variables from the independent variables.

- **The variable to be explained:**

The dependent variable chosen for this study is the return on assets ratio. The ROA is a profit ratio, defined as net income divided by total assets. This ratio reveals how much each dinar invested in the bank returns. Hence, it reflects how well a bank manages its assets to generate profits.

- **Explanatory variables:**

In order to investigate the impact of liquidity risk on the performance of Algerian banks, the study relies on the liquidity risk variables and the control variables utilized by prior research, aiming to explain the banking performance of Algeria. The following table illustrates the chosen variables, their measurements, and their assumptions on their influence on the performance of banks.

Table No. 01: List of explanatory variables

Variables	Abbreviations	Measurements	Hypotheses	Sources
Liquidity risk (Independent variables)	**LATA**	Liquid assets/Total assets	H1a : -	Saeed and Rahman (2015)
	FGAP	Loans-Deposits/Total assets	H1b : -	Golubeva et al. (2019)
	LTD	Loans/Deposits	H1c : +	Hacini et al. (2021)
Bank-specific (Control variables)				
Ownership	**OWN**	0: Public Bank 1: Private Bank	H3 : +	Micco et al. (2007)
Diversification	**DIV**	Non-interest income/Operating income	H2a : +	Moudud-Ul-Huq et al. (2018)
Operational expenses	**OPEX**	Overheads/Total assets	H2b : -	Staikouras and Wood (2004)
Macro-economic (Control variable)				
Gross domestic product growth	**GDPG**	Selected from the world bank database	H2c : +	Lee and Hsieh (2013)

Source: Elaborated by the researchers on the basis of the literature review

3.3. Model specification

The purpose of this research is to examine the influence of liquidity risk on the performance of Algerian banks using panel data analysis as a statistical tool.

Before we estimate the parameters of every factor under consideration, we must first identify the model we intend to analyze and interpret. It is presented as follows:

$$ROA_{it} = C + \alpha_0\,LATA_{it} + \alpha_1\,FGAP_{it} + \alpha_2\,LTD_{it} + \alpha_3\,OWN_{it} + \alpha_4\,DIV_{it} +$$
$$\alpha_5\,OPEXC_{it} + \alpha_6\,GDPG_{it} + \varepsilon_{it}$$

3.4. Descriptive Analysis

Before estimating the parameters of the panel data regression model, we must first undertake a descriptive analysis of the explanatory variables and the variable to be explained.

- **Descriptive statistics of variables**

Given the Algerian banking market's bifurcation between the public and private banks, this part of the research attempts to provide a descriptive statistics of the two banking sectors as well as a comparison of them.

Table No. 02: Descriptive statistics of variables by the banking secto

OWN	Stats	ROA	LATA	FGAP	LTD	OPEX	DIV
Public banks	**Mean**	0.0100	0.4046	-0.1353	0.6651	0.0102	0.2148
	Sd	0.0061	0.1321	0.1173	0.1894	0.0039	0.1559
	Min	0.0002	0.1671	-0.4557	0.2153	0.0039	0.0155
	Max	0.0233	0.7537	0.0856	1.0166	0.0176	0.6850
Private banks	**Mean**	0.0238	0.4105	-0.0161	0.8752	0.0214	0.3762
	Sd	0.0106	0.1520	0.1980	0.3540	0.0073	0.1687
	Min	-0.0083	0.0912	-0.5839	0.2677	0.0080	0.0652
	Max	0.0658	0.8137	0.4244	3.0607	0.0520	0.7787
Total	**Mean**	0.0197	0.4088	-0.0519	0.8122	0.0180	0.3278
	Sd	0.0114	0.1460	0.1856	0.3279	0.0082	0.1805
	Min	-0.0083	0.0912	-0.5839	0.2153	0.0039	0.0155
	Max	0.0658	0.8137	0.4244	3.0607	0.0520	0.7787

Source: Output of the STATA 11.2 software

According to the descriptive statistics of the Algerian banking sector; the average ROA of all banks during the ten years has been 1.97%, and the lowest value of return on assets belonged to private banks, with -0.83% in 2017, while the highest value was 6.58% in 2010. Furthermore, the results indicate that public banks generate a lower average return on assets than private banks (1% against 2.38%). Because this ratio reveals how much each dinar invested in the bank returns, the result reflects the effectiveness of private banks in terms of investment. Based on the Student test and the Mann-Whitney test, this result is statistically significant.

Among the three liquidity risk indicators, the loan-to-deposit ratio has the highest average, which is around 81.2%, with standard deviations of 32.79%. The outcome demonstrates the Algerian banks' reliance on deposits as a source of financing for their clients. The average LTD in public banks is 66.51%, while in private banks is 87.52%, indicating that the private banking sector's deposit-to-loan transformation rate is greater than that of the public one. According to the Student test and the Mann-Whitney test, this result is statistically significant.

For the LATA ratio, Algerian banks have an average of 40.88% liquid assets-to-total assets, indicating that liquid assets account for about half of the total assets, with standard deviations of 14.60%. This result shows that the Algerian banking sector was quasi-liquid from 2010 to 2019. According to the Student and Mann-Whitney tests, the difference between public and private banks is not statistically significant for this variable.

In contrast, the FGAP ratio has a negative mean (-5.16%). This finding reveals that deposits are higher than loans on average, which is consistent with the LTD ratio findings. Moreover, FGAP has standard deviations above its mean (18.56%), showing a significant degree of variance among banks. The FGAP of private banks (-1.61%) is higher compared to the public banks (-13.53%), indicating that private banks face greater liquidity risk. According the Student and Mann-Whitney tests, this result is statistically significant.

In terms of other variables, the statistics reveal that private banks are more diversified and have more overhead than public ones on average. These differences are statistically significant.

Regarding GDPG, considering that it is a macroeconomic measure and hence sector-independent, it gives the following figures:

Table No. 03: Descriptive statistics of the variable GDP

Stats	GDPG
Mean	0.0269
Min	0.01
Max	0.038

Source: Output of the STATA 11.2 software

The highest reported value of gross domestic product growth (GDPG) from 2010 to 2019 is 3.8% whereas the minimum value is 1%.

- **Correlation matrix**

The relevance of studying the correlation between the various variables stems from the requirement to know what types of associations may exist between the components. The table below illustrates the correlations between the variable to be explained (ROA) and all of the other explanatory factors, along with the correlations between the explanatory variables:

Table No. 04: Correlation matrix between model variables

	ROA	LATA	FGAP	LTD	OWN	OPEX	DIV	GDPG
ROA	1.0000							
LATA	-0.0642	1.0000						
FGAP	0.3859*	-0.3670*	1.0000					
LTD	0.3394*	-0.6082*	0.6446*	1.0000				
OWN	0.5569*	0.0188	0.2948*	0.2945*	1.0000			
OPEX	0.2295*	-0.3435*	0.4712*	0.5172*	0.6235*	1.0000		
DIV	0.4711*	0.4180*	0.1880*	-0.0672	0.4109*	0.1590*	1.0000	
GDPG	0.1860*	0.2640*	0.0485	-0.1135	0.0000	-0.0055	0.3044*	1.0000

(*) Significant at the 5% threshold

Source: Output of the STATA 11.2 software

This table indicates that return on assets (ROA) is positively and significantly correlated with two of the liquidity risk ratios (FGAP and LTD), ownership (OWN), operational expenses (OPEX), diversification (DIV), and gross domestic product growth (GDPG). Conversely, the third liquidity risk ratio (LATA) shows a negative and insignificant association with ROA.

We also observe a positive relationship between the liquidity risk ratio (LATA) and the control variables (OWN, DIV, and GDPG), but only significant with DIV and GDPG and negatively significant with OPEX. Furthermore, we notice that FGAP has a positive connection with the control variables (OWN, OPEX, DIV, and GDPG), yet, this association is insignificant with GDPG. The last liquidity risk ratio (LTD) is demonstrated to be positively significant with OWN and OPEX but negatively significant with DIV and GDPG.

In order to corroborate the absence of multicollinearity problem, the study proceeds to a complementary examination of the VIF test (and tolerance). The test results are presented in the table below:

Table No. 05: Result of the VIF test

Variable	VIF	1/VIF
LTD	2.57	0.389498
LATA	2.27	0.440619
OPEX	2.25	0.443653
OWN	2.09	0.478113
FGAP	1.97	0.507219
DIV	1.75	0.572159
GDPG	1.17	0.854963
Mean VIF	2.01	

Source: Output of the STATA 11.2 software

According to the test, the average VIF is 2.01, with a maximum VIF of 2.57, which is significantly below the threshold of ten (10) set by the authors. This result reveals weak collinearity between the variables utilized in this model, implying that each variable provides information that the others do not.

4. Results and discussion

The application of a panel data regression is required with an individual dimension of twenty (20) banks and a temporal dimension of ten (10) years while following a series of econometric processes to construct this particular approach. The following are the tests run by the STATA 11.2 software and their interpretations:

A model specification test was performed to distinguish between individual and common effects. Our model stands out by the presence of a dichotomous variable (OWN), which will result in its arbitrary removal from the collection of explanatory variables in a fixed-effects regression. This requirement necessitates the application of the "Breusch-Pagan Lagrangian Multiplier test for random effects" to determine whether to employ the GLS estimator if there are random individual effects or the OLS estimator if there aren't. In other words, this test indicates whether the random effects model or the pooled model will be employed. The result of this test indicates a significant Chi-square statistic (Prob > chi2 = 0.0023). It allows us to confirm the existence of individual effects. As a result, we may infer that our model is a random effects model.

Furthermore, we utilized the Wooldridge autocorrelation test to determine whether the errors are related across time. The outcomes of this test validate the presence of autocorrelation.

Additionally, we applied the homoscedasticity test to determine if our model is characterized by the homoscedasticity or heteroscedasticity of residuals. The findings indicate the presence of heteroscedasticity (Prob > chi2 = 0.0000).

According to the results of the preceding two tests, the estimated model has two flaws: autocorrelation and heteroscedasticity. We will utilize the PCSE

(Panel-Corrected Standard Errors) approach to correct them and estimate the final model.

The regression findings using the PCSE approach are as follows:

Table No. 06: Results of the multivariate analysis of the model

Linear regression, correlated panels corrected standard errors (PCSEs)			
Variable	Expectation	Coefficient	P-value
LATA	-	-0.0188589	0.003***
FGAP	-	0.0078354	0.078*
LTD	+	0.0071796	0.015**
OWN	+	0.0150853	0.000***
OPEX	-	-0.6240842	0.000***
DIV	+	0.0211848	0.000***
GDPG	+	0.0017733	0.043**
_cons		0.0109383	0.012**
R-squared		0.5569	
Wald chi2		228.68	
Prob > chi2		0.0000***	
Number of obs		200	

(*) Significant at the 10% threshold, (**) Significant at the 5% threshold, (***) Significant at the 1% threshold

Source: Output of the STATA 11.2 software

In the table above, the relationship between the dependent and independent variables in the model studying the impact of liquidity risk on Algerian bank performance shows a total of 200 observations. We also notice that the R-squared value equals 0.5569. This figure suggests that the explanatory factors chosen account for 55.69% of the variation in the profitability ratio.

Moreover, the Wald chi2 test of the model's overall significance is significant at the 1% level (Prob > chi2 = 0.0000), implying a solid general fit and sufficient potential for the explanation.

The liquid assets-to-total assets ratio is one of the indicators used in this research to assess the bank's liquidity risk. The greater the rate of this ratio, the more liquid the bank and the less sensitive it is to liquidity risk. As a result, the greater the amount of funds saved as cash, the greater the liquidity and the lower the liquidity risk. The regression results reveal a significant negative correlation at the threshold of 1% between the liquid assets-to-total assets ratio and the return on assets ratio. The negative result indicates that banks have a disadvantage in retaining excessive liquid assets. When banks typically reserve liquid assets at an optimal level to guarantee business operations, bank performance can be controlled in the event of a shock. However, if banks hold too many liquid assets, bank performance would suffer as financial expenditures rise faster than revenue. Additionally, it imposes an opportunity cost on the bank due to its poor yield compared to other assets. This finding confirms the hypothesis H1a.

The financing gap-to-total assets ratio (FGAP) is the second metric used as a proxy for liquidity risk in this study. Since the financing gap is the difference between loans and deposits, a higher FGAP indicates an increased liquidity risk. The regression findings show a significant positive relationship at the 10% threshold between this ratio and the return on assets ratio. It can be explained by the nature of the gap, in which we find that 70% of the observations are negative values, indicating that the credits granted are less than the deposits collected. As a result, as the gap expands, so does the liquidity risk, forcing banks to obtain funding from the repo market at higher rates, rising their costs. This cost growth will eventually affect banks' profitability. However, the study's findings revealed that Algerian banks are not dependent on the repo market. They have sufficient cash to avoid their reliance on the repo market, resulting in a positive impact on banks' performance. It can also be explained by the deceleration in growth of deposits relative to credit and even negative growth in particular years, indicating a decline in deposits, which is due to non-renewing them, and a

reduction in savings rates, resulting in a significant gap and thus a positive relationship with profitability. This finding rejects the hypothesis H1b.

The loan-to-deposits ratio is also employed to proxy liquidity risk. It reflects the bank's transforming degree of deposits into loans and it gives a simplified overview of the extent to which a credit institution funds illiquid assets with liquid liabilities. The greater this ratio, the more the bank relies on its deposits to support its lending activities and, consequently, the lower its liquidity and the higher its liquidity risk. The regression findings show a significant positive relationship at the 5% threshold between this ratio and the return on assets ratio. A positive loan-to-deposit ratio indicates a positive association between liquidity risk and profitability; however, it also implies a negative relationship between bank profitability and the amount of liquid assets retained by the bank. It is explained by the fact that the more deposits the bank converts into loans, the more interest it earns, leading to an increased income, and thus a higher profitability. This significant effect reveals Algerian banks' reliance on deposits to make loans that lead to profit. This result validates the hypothesis H1c.

The regression results also demonstrate a significant positive correlation at the 1% threshold between the ownership and profitability ratio. According to the findings, private banks have a higher profitability ratio than public banks. This result can be explained by the fact that public banks' primary goal is not usually maximizing their profit but rather the financing of vital sectors that benefit society, which exposes them to a relatively high level of risk. This finding confirms the hypothesis H3.

Regarding the diversification variable, the regression findings show a significant positive impact of this ratio on ROA at the 1% threshold. It implies that the more banks diversify and engage in non-interest activities or other activities that are external to their fundamental business, the higher their profit and the lower their risk. Hence, diversification positively impacts the bank's ROA by increasing its net income. This result confirms the hypothesis H2a.

Furthermore, the results reveal a significant negative relationship at the 1% threshold between operational expenses and Algerian banks' performance.

According to the findings, the greater the operational expenses, the more costs the bank would incur when performing its activities and the less profit it would make. In other words, operational expenses have a detrimental impact on a bank's profitability; increased overhead costs diminish the bank's net income, which in turn reduces its ROA. If a bank's expenses increase without a corresponding rise in revenue, its profitability suffers. This result validates the hypothesis H2b.

In addition, the regression results show a significant positive relationship at the 5% threshold between gross domestic product growth and banks' performance (ROA). This outcome could be explained by the fact that when the economy performs well and grows, it can lead to higher demand for loans from businesses seeking financing for expansion or investment. This increased loan demand can positively influence a bank's interest income, contributing to higher profitability (ROA). Likewise, when economic growth rates are low or negative, it may reduce borrowers' capacity for reimbursement, resulting in credit losses and increasing banks' provisions, leading to lower profitability. This result validates the hypothesis H2c.

5. Conclusion

The primary purpose of this paper is to investigate the influence of liquidity risk on the performance of Algerian banks. To address this objective, we have employed the panel data regression approach, enabling us to examine data from twenty Algerian banks from 2010 to 2019.

Previous studies of the impact of liquidity risk on the performance of banks have been controversial. Depending on the sample and time period, the results demonstrating the impact of liquidity risk differs from one banking sector study to another. Hence, some researchers have found a positive correlation, while others have found a negative correlation or no correlation at all.

Regarding the empirical component, our research addressed the influence of liquidity risk on the performance of Algerian banks. Through the empirical studies, we sought to model the relationship between liquidity risk,

measured by three ratios (liquid assets, financing gap, and transformation ratios) and banks' performance measured by the profitability ratio (return on assets). It was achieved by utilizing an econometric model, specifically multiple linear regressions.

Following the application of panel data regression, we identified a significant positive correlation between liquidity risk and Algerian banks' performance. In terms of the other factors, the results reveal that diversification (DIV) and gross domestic product growth (GDPG) have a significant positive association with the performance of Algerian banks while operating expenses (OPEX) exhibit a negative and significant impact. Furthermore, the results indicate that Algerian private banks are more profitable than those of public ones.

This study provides crucial managerial contributions by bringing attention to the measurement of liquidity risk and its influence on the performance of Algerian banks. It also considers other determinants that contribute to explaining banks' performance. By identifying these factors, banks' managers can leverage them as actionable strategies to enhance the performance of banks, particularly in terms of profitability.

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