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Determinants of Liquidity Risk in Deposit Banks in Türkiye: 2012-2022 Analysis[1]

Türkiye'deki Mevduat Bankalarının Likidite Riskinin Belirleyicileri: 2012-2022 Analizi

Melek Yıldız[2], Dagan Said Aden[3]

Abstract

This article identifies the bank-related and macroeconomic factors determining liquidity risk for the top 10 deposit banks, based on asset size, using panel regression analysis. The liquidity ratio (liquid assets to the total of deposits and non-deposit sources) from 2012 to 2022 is the dependent variable. The bank-related independent variables include bank size, ROA, ROE, bank capital, deposit-to-credit conversion ratio, credit size, and non-performing loans. The macroeconomic independent variables are economic growth, inflation, and the unemployment rate for the same period. Results show a positive relationship between bank size, ROE, bank capital, credit size, and economic growth with the liquidity ratio. Banks with larger assets, higher ROE, more capital, and higher credit volume have lower liquidity risk. Liquidity risk is also lower in periods of economic growth. Additionally, a negative relationship exists between ROA, deposit-to-credit conversion ratio, inflation, and liquidity ratio. Banks with higher asset profitability and conversion ratios face higher liquidity risk. Inflation also increases liquidity risk for banks.

Keywords: *Liquidity Ratio, Liquidity Risk, Deposit Banks, Panel Regression Analysis.*

Öz

Bu makale, aktif büyüklüğüne göre en büyük 10 mevduat bankasının likidite riskini belirleyen banka özel ve makroekonomik faktörleri panel veri regresyon yöntemini kullanarak tespit etmeyi amaçlamaktadır. Bankaların 2012-2022 yılları arasındaki likidite rasyosu (likit varlıkların mevduatlar ve mevduat dışı kaynakların toplamına oranı) çalışmanın bağımlı değişkenini; banka büyüklüğü, ROA, ROE, banka sermayesi, mevduat-kredi dönüşüm oranı, kredi büyüklüğü ve takipteki krediler bankaya özgü bağımsız değişkenlerini; aynı dönemdeki ekonomik büyüme, enflasyon ve işsizlik oranı makroekonomik bağımsız değişkenlerini oluşturmaktadır. Analiz sonuçları banka büyüklüğü, ROE, banka sermayesi, kredi büyüklüğü ve ekonomik büyüme ile likidite oranı arasında pozitif bir ilişki olduğunu göstermektedir. Bu bulguya paralel olarak, daha yüksek varlık düzeyine sahip, yüksek özkaynak karlılığı, daha fazla sermaye ve daha yüksek kredi hacmine sahip bankaların daha düşük likidite riskine sahip olduğu söylenebilir. Ayrıca, ekonomik büyüme ortamında bankaların likidite riskinin daha düşük olduğu tespit edilmiştir. Bunun yanı sıra, analiz, ROA, mevduat-kredi dönüşüm oranı, enflasyon ile likidite oranı arasında negatif bir ilişki olduğunu ortaya koymuştur. Bu ilişkiye göre, daha yüksek aktif karlılığı ve mevduat-kredi dönüşüm oranlarına sahip bankalar daha yüksek likidite riskiyle karşı karşıyadır. Öte yandan, enflasyon oranı, bankaların likidite riskini artıran bir etkiye sahiptir.

Anahtar Kelimeler: *Likidite Rasyosu, Likidite Riski, Mevduat Bankaları, Panel Veri Regresyon.*

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[2]Assoc. Prof. Dr., Çankırı Karatekin University, Department of Finance and Banking, Çankırı, Türkiye, melekyildiz@karatekin.edu.tr, ORCID: https://orcid.org/ https://orcid.org/ 0000-0002-9716-9245.

[3]Master's Graduate, Çankırı Karatekin University, Institute of Social Sciences, Department of Banking and Finance, Çankırı, Türkiye, dagan.said.aden@gmail.com, ORCID: https://orcid.org/ 0000-0001-8586-8615.

Introduction

Risks have been encountered in every period during which activities encompassing humans and the economy have been carried out. The fundamental risk factors that have existed throughout human history include wars, natural disasters, and pandemics. Over time, the nature of the risk phenomenon has changed: in agricultural societies, risk stemmed from climatic conditions; in industrial societies, it resulted from unexpected changes in supply and commodity prices; and in information societies, it has been associated with communication quality and global crises. Therefore, the definition of risk may vary depending on the time period and the sector in which it's evaluated (Yarız, 2012: 3).

The banking sector, which is significant and privileged in terms of national economies, has operated under public supervision and regulation since its establishment. On the other hand, the banking sector is exposed to various risks at general, sectoral, and micro levels (Yarız, 2011: 2). Banks are one of the fundamental pillars of the financial system and the largest traditional intermediaries. These institutions collect funds from surplus holders through deposits and other financial instruments, then extend credit to those in need with a certain margin. Naturally, banks, aiming to generate profits and increase their market value, encounter various risks in pursuit of these goals (Şenol et al., 2019: 102). One of the risks banks face is liquidity risk, which has the potential to trigger financial crises and is critically important for the financial soundness and sustainability of banks.

In economic theory, liquidity denotes to the capacity of an economic unit to transform their existing assets into goods, services, or alternative assets (Nikolaou, 2009: 10). According to Türküner (2016, p.3), there are three fundamental definitions of liquidity: (i) The liquidity of financial instruments refers to their ability to be quickly converted into cash while retaining their value as much as possible. (ii) Market liquidity, another definition, indicates the likelihood of buying and selling a certain volume of assets or securities in the market without causing price changes. (iii) Lastly, monetary liquidity focuses on the amount of cash in circulation and liquid assets that can be rapidly converted into money in an economy.

The probability of illiquidity indicates the presence of liquidity risk. As liquidity risk increases, the probability of illiquidity rises accordingly, leading to a decline in liquidity (Nikolaou, 2009: 5-16). Liquidity risk is a significant risk faced by the banking sector, demonstrating that a bank doesn't have sufficient liquidity to meet its obligations. This risk arises from the inability to predict when and in what amount depositors will withdraw their deposits, as well as when and how much credit customers will need. For this reason, banks must maintain an adequate level of liquid funds to sustain their lending and investment activities while also meeting depositors' demands (Çelik & Akarım, 2012: 1). Otherwise, the failure to fulfill obligations on time may lead to a loss of confidence, prompting depositors to withdraw large sums, which can impact the entire banking sector (Akan, 2008: 66).

Based on this, it can be explicitly stated that liquidity risk not only leads to the bankruptcy of financial institutions but can also create systemic risk factors, as seen in the 2008 Global Financial Crisis, potentially triggering a broader economic crisis. This is precisely why identifying the factors that determine liquidity risk remains a consistently popular topic in financial literature. Researchers and academics in finance conduct empirical studies using up-to-date data, producing findings that inspire bank management and industry regulators.

In this context, this study, which examines the bank-specific and macroeconomic determinants of liquidity risk in Türkiye during the 2012-2022 period, makes several significant contributions to the literature. In particular, the study's focus on a period that includes critical macroeconomic shocks such as the 2018 currency crisis and the COVID-19 pandemic, and the policy decisions taken as a result of these developments, is of particular importance. In this regard, the study is expected to provide more targeted and up-to-date information for policymakers.

In light of the gaps identified in the literature review, the key contributions of the study can be summarized as follows. For further details, please refer to Table 1:

- While many previous studies in the literature (Berger and Bouwman, 2009; Dinger, 2009; Ayaydın and Karaaslan, 2014; Muzır and Şeker, 2015; Singh and Sharma, 2016; Akkaya and Azimli, 2018; Ersoy and Aydın, 2018; Ahamed, 2021; Karakaş and Acar, 2022; Çakmak and Sunal, 2023; Elçeri and Karaaslan, 2023) focus on broader samples, this study offers a more specific analysis.
- Although the panel regression analysis used is common in the literature, the use of up-to-date data and the selection of a targeted sample based on clear criteria help to more clearly reveal the changing dynamics of liquidity risk and provide valuable insights.

1. Literature Review

Relevant studies in the national and international literature have been examined and evaluated using a methodological approach. As summarized in the studies below, it has been observed that the independent variables in these studies

consist of bank-related and macroeconomic indicators. Given that the studies have both a unit and time dimension, the analysis method is generally panel regression analysis. While the scope of the studies typically includes deposit banks selected based on certain criteria (such as asset size, stock exchange listing, bank size, etc.), there have also been studies that include a limited number of participation banks.

Consistent with the literature, this article aims to determine the bank-related and the macroeconomic indicators of liquidity risk for the top 10 deposit banks[4] in terms of asset size between 2012 and 2022, using the panel regression analysis method. It is believed that this article can provide flexibility to bank management, financial experts, and financial sector regulators by helping them understand, determine, and take preventive measures against the factors that could positively or negatively affect liquidity risk of banks. Furthermore, it's expected that this article, which addresses a frequently discussed topic in the literature with up-to-date data, will provide insights for on future research and contribute to the advancement of knowledge in the field.

Table 1. Literature Review on the Topic

Author(s)	Scope	Period	Method	Findings
Berger & Bouwman (2009)	All U.S. banks	1993-2003	Panel regression analysis	The banks that create the most liquidity are large banks, holding banks, retail banks, and recently merged banks. As the bank value increases, more liquidity is created.
Dinger (2009)	378 banks from Central and Eastern European economies	1994-2004	GMM	A negative relationship has been identified between the liquidity ratio and bank size, deposit interest rate, economic growth, and GDP per capita, while a positive relationship has been found between the liquidity ratio and bank capital as well as the interbank interest rate.
Akhtar et al. (2011)	12 banks (6 conventional banks, 6 Islamic banks)	2006-2009	Panel regression analysis	In both types of banks, bank size and the net working capital-to-net assets ratio are positively but insignificantly associated with liquidity risk. However, the capital adequacy ratio in conventional banks and ROA in Islamic banks have a positive effect on liquidity risk.
Çelik & Akarım (2012)	Banks listed on the stock exchange	1998-2008	Panel regression analysis	A negative correlation was observed between liquidity risk and risky liquid assets with ROE, while a positive correlation was found between external financing and asset profitability.
Ayaydın & Karaaslan (2014)	23 banks operating in Türkiye	2003-2011	GMM	It was found that liquidity risk is positively related to profitability variables and negatively related to variables such as foreign share, ownership structure, and global financial crisis.
Muzır & Şeker (2015)	All deposit banks operating in Türkiye	2003-2009	Logistic Regression, MARS	Country risk forecasts, which are dependent on foreign trade performance, influence liquidity risk.
Laurine (2013)	15 Zimbabwean commercial banks	from March 2009 to December 2012	Panel regression analysis	Liquidity risk is negatively influenced by capital adequacy and bank size, whereas it is positively affected by interest spreads and non-performing loans.

[4]According to the Banking and Group Information Report (Quarterly, Latest Period Comparative Balance Sheet Information) published by The Banks Association of Türkiye in June 2024.

Işıl & Özkan (2015)	Four participation banks operating in Türkiye	2006-2014	Seemingly Unrelated Regression	As the past period financing gap/total assets and total loans/total assets ratio increase, a rise in liquidity risk of participation banks is observed.
Singh & Sharma (2016)	59 Indian banks	2000-2013	Panel regression analysis	The variables that have a negative effect on liquidity are size and GDP, while the variables that have a positive effect are deposit volume, profitability, capital adequacy ratio (CAR), and inflation.
Işık & Belke (2017)	13 deposit banks listed on the stock exchange	2006-2015	Panel regression analysis	Liquidity risk is negatively related to variables including ROE, bank capital, growth in deposits, provision for loan losses, and inflation; and positively related to variables including size and economic growth.
Firuzan & Firuzan (2017)	16 banks operating in Türkiye	2009-2016	Dynamic Panel Data Model	Inflation, interest rates, GDP, net interest margin, and deposit variables increase liquidity risk.
Akkaya & Azimli (2018)	28 banks operating in Türkiye	2005-2015	Panel regression analysis	Liquidity risk is influenced by variables such as GDP, the exchange rate, the unemployment, inflation, bond issuance, the interest income-to-expense ratio, the deposit-to-total liabilities ratio, and ROA.
Ersoy & Aydın (2018)	27 deposit banks operating in Türkiye	2005-2015	Panel regression analysis	A positive relationship was found between liquidity level and capital, asset quality, and deposit level; an inverse-U relationship with size; and a negative relationship with economic growth, unemployment, and global crisis variables.
Al-Homaidi et al. (2019)	37 commercial banks that are listed on the stock exchange in India	2008-2017	Panel regression analysis	The variables that positively affect banks' liquidity are size, CAR, deposit ratio, operational efficiency, and ROA, while the variables that negatively affect it are asset quality, asset management ratio, ROE, and net interest margin. Additionally, the interest rate and exchange rate also have a significant impact on liquidity.
Ahamed (2021)	23 commercial banks in Bangladesh	2005-2018	Panel regression analysis	The factors negatively related to liquidity risk are asset size and inflation. The factors positively related to liquidity risk include ROE, CAR, GDP, domestic credit, and the loan-to-asset ratio. However, the positive relationship between ROE and CAR with liquidity risk is statistically insignificant
Akbaş (2022)	5 participation banks operating in Türkiye	2016-2019	Balanced Panel Data Method	The relationship between liquidity risk and the CAR is positive.
Karakaş & Acar (2022)	20 deposit banks operating in Türkiye during the relevant period	2002-2020	Panel regression analysis	A negative relationship between banks' liquidity and profitability ratios was found.
Çakmak & Sunal (2023)	19 deposit and 4 participation banks operating in Türkiye	2015-2021	Panel regression analysis	Relationships between liquidity level and deposit, loan-to-deposit ratio, ROE, CAR, equity and asset size, money supply, credit default swap, and Covid period were identified.

Elçeri & Karaaslan (2023)	Turkish banking sector	2011-2022	Time Series - Least Squares Estimator	A positive relationship between liquidity risk and NPL/total cash loans and cash loans/total deposits; a negative relationship with ROA, policy interest rate, CPI, and GDP variables was identified.
Güzel (2023)	15 largest deposit banks operating in Türkiye	2003-2022	Panel regression analysis	Liquidity risk is positively affected by variables such as ROE, total assets, deposit ratio, foreign exchange position, inflation rate, and economic growth; and negatively affected by credit ratio and risk, financial asset ratio, fixed asset ratio, Central Bank overnight interest rate, and exchange rate variables.
Alev (2024)	8 private deposit banks operating in Türkiye	2010-2021	Correlation Analysis And Panel regression analysis	The profitability of private deposit banks in Türkiye is negatively influenced by variables like the ratio of liquid assets to short-term liabilities and the proportion of loans to total assets.
Şahut & Afşar (2024)	Four deposit banks listed on BIST30	2013-2023	Panel regression analysis	Relationships between liquidity risk and interest rates, CDS, and the proportion of total deposits to total assets were identified.

2. Dataset, Hypotheses and Methodology

This article aims to identify the bank-related and macroeconomic factors that determine liquidity risk in banks. The sample of the study consists of the top 10 deposit banks in terms of asset size, as reported in the Bank and Group Information (Quarterly, Most Recent Comparative Balance Sheet Information) report published by the Banks Association of Türkiye for the period of June 2024 (See Table 2).

The primary rationale for composing the sample from the 10 largest deposit banks according to asset size is that these banks represent a significant portion of the assets in the Turkish banking sector and hold a determinative position in shaping the liquidity risk dynamics of the sector. Another important consideration is that these large-scale banks have systemic importance for the robustness and stability of the financial system.

At this point, the reasons for selecting the 2012–2022 period should also be specified. This period is significant because it was marked by major transformations in the Turkish economy. In particular, the 2018 currency shock impacted banks' risk structures. Additionally, fluctuations in the interest rate policies of the Central Bank of the Republic of Türkiye, the uncertainty caused by the COVID-19 pandemic in financial markets, the transformation in banks' operational processes and digital banking channels due to the pandemic, the high inflation problem in Türkiye especially after 2018, decisions by the Banking Regulation and Supervision Agency that altered banks' liquidity outlook, the expansion of credit with government support, and the increased intermediary role of public banks in this regard are among the factors influencing the choice of the 2012–2022 period.

Table 2. Top 10 Deposit Banks by Asset Size

Bank Name	Year of Establishment	Total Assets (TRY)
Ziraat Bank	1863	4.548.225
VakıfBank	1954	3.237.503
İşbank	1924	2.886.231
Halkbank	1938	2.611.039
Garanti BBVA	1946	2.313.106
Akbank	1984	2.180.576
Yapı Kredi	1944	2.178.173
QNB Finansbank	1987	1.258.883
Denizbank	1997	1.229.166
TEB	1927	498.674

Kaynak: The Banks Association of Türkiye, Bank and Group Information (Quarterly, Most Recent Comparative Balance Sheet Information), June 2024.

The liquidity level of the banks mentioned in Table 2 between 2012 and 2022 is represented by the ***liquidity ratio***, which is the ratio of liquid assets to the total of deposits and non-deposit liabilities, and this ratio has been included as the dependent variable in the model. Non-deposit liabilities include interbank market, borrowed funds, securities issued, and other sources offered to the market. A high ratio indicates that the bank can easily cover a potential reduction in deposits and non-deposit liabilities with its liquid assets. However, a decrease in this ratio suggests that the bank might face difficulties in compensating for a reduction in its deposits and non-deposit liabilities (Gürel, 2002: 62). In summary, when this ratio, used as a measure of liquidity risk, increases, liquidity risk decreases, and conversely, when the ratio decreases, liquidity risk increases. Therefore, the impact of the independent variables, which are explained below, on liquidity risk has been evaluated in this context.

The independent variables of the study consist of bank-related and macroeconomic indicators. These variables also cover the period from 2012 to 2022. Explanations regarding the independent variables are provided below.

The first of the bank-related variables, ***bank size (scale)***, is measured by the share of total assets within the sector. Asset size is an indicator of both a bank's total assets and receivables, and its total equity and liabilities, and it's an important indicator of business volume (Navruz, 2019: 167). Larger banks tend to engage more in derivative transactions, and due to these transactions, they have the potential to cover various expenses such as the employment of qualified personnel and the implementation of internal control systems (Yong et al., 2007: 13). On the other hand, because larger banks have a wider customer diversity and a larger number of customers, the number and volume of financial transactions are also higher. In particular, the large volume of deposits and loans makes larger banks more vulnerable to liquidity risk. Therefore, the share of asset size within the sector is also included as one of the bank-related variables.

The return on assets (ROA), used as a measure of bank profitability, is one of the most effective and widely used financial ratios for indicating company performance. ROA expresses how efficiently a bank generates profit with its assets. Therefore, the larger this ratio, the higher the bank's capacity to generate profit from its assets can be considered (Türkmen, 2018: 81). Another ratio that indicates the financial performance of the bank is ***the return on equity (ROE)***. This ratio shows the profitability with which the funds invested by the bank's shareholders are being utilized (Düzer & Önce, 2017: 642). Similarly, one of the key indicators representing bank profitability is ***the net interest margin***. Unlike the ROA and ROE ratios, the net interest margin emphasizes on the profit the bank earns from its interest-bearing activities (Reis et al., 2016: 22).

In this study, instead of the Capital Adequacy Ratio, which is frequently used to measure banks' capital strength in a standardized manner, the bank capital representing the total amount of resources available to absorb risks was used. ***The bank's capital,*** which is an indicator of performance, is crucial in covering and undertaking the risks of the banks (Tan, 2016: 91). Based on this, it is considered that the bank's capital is related to liquidity risk, and therefore, the bank capital variable has been included in the model.

The deposit-to-loan conversion ratio is found by comparing the total credit granted by banks to the amount of deposits collected (Yücel, 2021: 63). This ratio, which typically measures how much of the credits are funded by stable funding from households and non-financial institutions, is considered a primary indicator of liquidity risk. When credits surpass the deposit base, banks encounter a funding gap and are compelled to seek solutions in the financial markets (Van den End, 2016: 237).

The credit size variable is expressed as the ratio of total loans to total assets, whereas the non-performing loans (NPL) variable is determined by the share of NPL in total loans. Despite the positive correlation between the volume of loans issued and interest income, banks may face circumstances where loans remain unpaid due to various factors. Non-payment of loans leads to a deterioration in asset quality, which in turn results in liquidity risk. This is because an increase in NPL means that the bank has not been able to collect from its customers and there is no cash inflow to the bank. On the other hand, due to the deposits entrusted to the bank, customers' requests for withdrawal create an obligation for the bank to meet this demand. It's precisely at this point that banks are likely to face liquidity issues (Zengin & Yüksel, 2016: 83).

The macroeconomic indicators are also used in this article. The first of these is **economic growth**. Economic growth theory, which encompasses efforts to understand and explain changes in countries' economic production and income levels (such as endogenous and exogenous economic growth theories), focuses on the factors supporting long-term growth, capital accumulation, technological innovations, and productivity improvements. A significant increase in the level of economic growth contributes to the overall efficiency of the economy. At this point, businesses increase their investments during the growth process, and households and businesses demand more credit. This situation puts pressure on banks to provide funding, making it essential for banks to manage liquidity risk carefully (Hidayat, 2024: 20). Another macroeconomic variable is ***inflation***. During periods of high inflation, the central bank increases interest rates to

control inflation, which raises the financing costs for banks and can restrict access to liquidity. The decline in the value of money reduces the real value of debt while increasing credit risk. On the other hand, the decrease in the value of money can also affect the amount of deposits collected and the real value of those deposits. All these changes are reflected in the liquidity position of banks (Hidayat, 2024: 20). The last of the macroeconomic variables is the ***unemployment rate***. According to Hackethal et al. (2010), a high unemployment rate indicates a deterioration in the overall economic conditions. This situation leads to a reduction in liquidity. At the same time, a high unemployment rate causes credit customers to experience income loss, and banks face pressure to cover this gap (Laštůvková, 2016: 972-973).

The formulas of the dependent and independent variables mentioned above, along with the data source, are presented in Table 3.

Table 3. Explanations of the Variables Used in the Article

Dependent Variable			
Code	**Variable Name**	**Formula**	**Source**
LR	Liquidity Ratio	Liquid Assets / (Deposits + Non-deposit Liabilities)	The Banks Association of Türkiye
Independent Variables: Bank-Related			
BS	Bank Size	Share of total assets within the sector	The Banks Association of Türkiye
ROA	Profitability (ROA)	Average Return on Assets	
ROE	Profitability (ROE)	Average Return on Equity	
NIM	Net Interest Margin	(Interest Income - Interest Expenses) / Total Assets	
BC	Bank Capital	Equity / Total Assets	
DCR	Deposit-to-loan conversion ratio	Total Credit / Total Deposit	
CS	Credit Size	Total Credit / Total Assets	
NPL	Non-performing Loans (NPL)	NPL divided by Total Loans	
Independent Variables: Macroeconomic			
EG	Economic Growth	Annual GDP growth rate	World Bank
INF	Inflation	Annual inflation rate (CPI)	Turkish Statistical Institute (TurkStat)
UR	Unemployment Rate	Percentage of unemployed individuals in the labor force	Turkish Statistical Institute (TurkStat)

The hypotheses developed through literature review regarding the variables whose theoretical framework and formulas are presented within the scope of the study are shown in Table 4.

Table 4. Hypotheses with Relevant Literature References

Hypothese	**References**
BS ⟶ LR	Akhtar et al. (2011), Moussa (2015), Singh and Sharma (2016), Zengin and Yüksel (2016), Al-Homaidi et al. (2019), Ahamed (2021), Güzel (2023)
ROA ⟶ LR	Akhtar et al. (2011), Moussa (2015), Singh and Sharma (2016), Zengin and Yüksel (2016), Al-Homaidi et al. (2019), Elçeri and Karaaslan (2023)
ROE ⟶ LR	Akhtar et al. (2011), Moussa (2015), Al-Homaidi et al. (2019), Ahamed (2021), Güzel (2023)
BC ⟶ LR	Moussa (2015), Diep and Nguyen (2017), Al-Homaidi et al. (2019), Güzel (2023)
DCR ⟶ LR	Moussa (2015), Wójcik-Mazur and Szajt (2015), Diep and Nguyen (2017), Elçeri and Karaaslan (2023)

CS ⟶ LR	Moussa (2015), Al-Homaidi et al. (2019), Güzel (2023)
NPL ⟶ LR	Waemustafa and Sukri (2016), Zengin and Yüksel (2016), Elçeri and Karaaslan (2023), Güzel (2023)
EG ⟶ LR	Moussa (2015), Singh and Sharma (2016), Zengin and Yüksel (2016), Ahamed (2021), Güzel (2023)
INF ⟶ LR	Moussa (2015), Singh and Sharma (2016), Zengin and Yüksel (2016), Ahamed (2021), Güzel (2023)
UR ⟶ LR	Singh and Sharma (2016), Zengin and Yüksel (2016), Akkaya and Azimli (2018), Ersoy and Aydın (2018)

In accordance with the objective of the study, the logarithm of the variables expressed in percentage terms, used in the established model, was taken. The model was tested using the panel regression analysis method with the Eviews 13 and Stata/IC 12.0 software packages. The procedural steps of the applied analysis method are explained below.

- After the panel data was created, descriptive statistics were calculated.
- A cross-sectional dependence test was conducted for each variable. Cross-sectional dependence, also referred to as inter-unit correlation, indicates the relationship between the error terms computed for each unit in the panel data model. To establish the correct model, a cross-sectional dependence test must be performed (Yerdelen Tatoğlu, 2021: 9). In this article, cross-sectional dependence was tested using the Breusch-Pagan LM, Pesaran scaled LM, Bias-corrected scaled LM, and Pesaran CD tests.
- A unit root test was conducted to determine the appropriate analysis method for the panel data set. However, since the cross-sectional dependence test revealed the existence of cross-sectional dependence among units, the CIPS statistic, one of the second-generation unit root tests, was used. The first differences of non-stationary variables at the level were taken, and the unit root test was repeated. While variables that were stationary at the level were included in the model with their original values, variables that became stationary after differencing were included in the model using their first differences.
- Following the unit root test, the steps of panel regression analysis were implemented. However, in panel data consisting of multiple units and time periods, each unit or time period may have unique characteristics. Variables reflecting the characteristics of the units are referred to as unit effects, while variables reflecting the characteristics of the time periods are referred to as time effects (Yerdelen Tatoğlu, 2021: 5). Therefore, the first step of the analysis was to determine the presence or absence of unit effects, time effects, or both in the model.
- After determining that the model is two-way, meaning it includes both unit and time effects, the next step was to decide whether it should be estimated using random or fixed effects. For this purpose, the Hausman test was conducted. According to the test results, the regression model was estimated using the fixed effects model under the assumption that both unit and time effects are present. From a methodological perspective, it is prudent to anticipate and clarify a potential question from readers regarding whether macroeconomic variables can be included in the model, given that they are the same for all banks within the same year but vary across different years. The fixed effects model, which eliminates variables that are entirely invariant across units over time, does not exclude variables that vary across time, even if they are identical across all units in a specific year. According to Greene (2012: 404–405), in fixed effects models, variables that remain constant across both units and time are automatically absorbed by individual fixed effects, and thus their coefficients cannot be estimated separately. However, variables that vary over time - even if identical across all units within a given year - can be included in the model and their coefficients reliably estimated due to their temporal variation. Indeed, Yerdelen Tatoğlu (2021:10), referencing the work of Baltagi and Levin (1992), provides an example related to panel data. In this example, it is emphasized that factors which do not vary across units but change over time (e.g., cigarette advertisements) can be controlled for by including them in panel models. Similarly, in this study, the macroeconomic variables included in the model (inflation, economic growth, and unemployment rate) are common across all banks within the same year, but vary over time. Therefore, following Greene (2012) and Yerdelen Tatoğlu (2021), these time-varying macroeconomic variables were appropriately included in the fixed effects model without violating its assumptions. Their coefficients were successfully estimated, and their impact on banks' liquidity risk was analyzed.

3. Findings of the Study

Under this section, after presenting the findings related to descriptive statistics, cross-sectional dependence tests, and unit root tests, the results of the panel regression model are provided.

3.1. Descriptive Statistics, Cross-Sectional Dependence, and Unit Root Test Results

Descriptive statistics for the variables used in the study have been calculated. Additionally, each variable was subjected to a cross-sectional dependence test, and based on the results, an appropriate unit root test was selected and applied. The results of these tests are presented in Table 5.

Table 5. Findings Related To Descriptive Statistics

Variables	Mean	Standard Deviation	Minimum	Maximum	Cross-Sectional Dependence	Unit Root Test I(0)	Unit Root Test I(1)
LR	1.40495	0.15436	0.99958	1.68973	Cross-sectional dependence exists	Stationary	-
BS	0.87878	0.23525	0.32180	1.24616	Cross-sectional dependence exists	Non-stationary	Stationary
ROA	0.16482	0.21829	-0.71964	0.82793	Cross-sectional dependence exists	Non-stationary	Stationary
ROE	1.15439	0.19549	0.54268	1.75927	Cross-sectional dependence exists	Non-stationary	Stationary
NIM	0.40802	0.17693	-0.26758	0.81583	Cross-sectional dependence exists	Non-stationary	Non-stationary
BC	1.00760	0.09430	0.68366	1.17855	Cross-sectional dependence exists	Non-stationary	Stationary
DCR	2.00804	0.05635	1.77843	2.09162	Cross-sectional dependence exists	Stationary	-
CS	1.79547	0.03688	1.64202	1.86892	Cross-sectional dependence exists	Non-stationary	Stationary
NPL	0.54703	0.20485	0.03419	1.01905	Cross-sectional dependence exists	Non-stationary	Stationary
EG	0.63054	0.31215	-0.09691	1.05690	Cross-sectional dependence exists	Stationary	-
INF	1.11162	0.27449	0.87448	1.85919	Cross-sectional dependence exists	Stationary	-
UR	1.03170	0.06250	0.91907	1.13767	Cross-sectional dependence exists	Stationary	-

In order to obtain more robust results when testing for cross-sectional dependence of the variables used in the study, four different tests were applied, as done by Yıldırım and Kaya (2021). The first of these is the Breusch-Pagan LM test, the most well-known panel data cross-sectional dependence test. However, this test may provide erroneous results in panel data with a large cross-sectional dimension. Therefore, the Pesaran scaled LM test, proposed by Pesaran (2004) as an alternative to the Breusch-Pagan LM test, was also applied. To address the dimensional distortions in the Lagrange Multiplier (LM) statistics used by these two tests, the Pesaran CD test, developed by Pesaran (2004), was also

applied. Finally, the Bias-corrected scaled LM test, which takes into account asymptotic deviation correction, was used. Thus, the cross-sectional dependence of the variables was thoroughly investigated (Yıldırım and Kaya, 2021: 272-273)

Since cross-sectional dependence exists in each of the variables in the model, the second-generation unit root test, the CIPS statistic, was applied in the panel unit root test phase. In this test, the stationarity decision is made based on the CIPS statistic and critical values. If the absolute value of the CIPS statistic is greater than the critical values given at the 10%, 5%, and 1% confidence levels, the series is considered stationary, meaning it does not have a unit root (Yerdelen Tatoğlu, 2020: 87). According to the test results, the liquidity ratio (LR) variable is stationary at the 99% level, while the deposit-to-credit conversion ratio (DCR), economic growth (EG), inflation (INF), and unemployment (UR) variables are stationary at the 95% confidence level. The variables of ROA, ROE, bank capital (BC), and non-performing loans (NPL) are stationary at the 99% confidence level, while the credit size (CS) variable is stationary at the 95% level, and the bank size (BS) variable becomes stationary at the 90% confidence level when first differenced. The net interest margin (NIM) variable did not become stationary either at the level or after first differencing, so it was excluded from the model in the subsequent steps. The variables that became stationary after first differencing were included in the model in their first differenced form.

3.2. Findings Related To Panel Data Model Selection

In panel data analysis, identifying the effects of individual units and time periods is essential to obtain robust, reliable, and unbiased estimation outcomes (Bozkurt and Akman, 2016: 277). Therefore, several tests were conducted within the scope of the study, and the results are summarized in Table 6. According to the test results in Table 6, both unit and time effects are present in the panel data model. In other words, the model is two-way.

Table 6. Summary of Test Results Conducted Within The Scope of The Study

Tests	(1) LR Test	(2) F Test	(3) LR Test	(4) LM Test	(5) ALM Test	(6) Score Test	(7) LR Test
Regression Model	**Random Unit and Time Effects**	**Fixed Effects Model**	**Random Effects ML Model**	**Random Effects GLS Model**	**Random Effects GLS Model**	**Random Effects ML Model**	**Random Time Effects ML Model**
Panel I: Key Model Statistics							
F Statistic	-	25.49					
Chi^2 Statistic	79.26	-	123.31	147.72	147.72	123.31	67.56
Probability	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Panel II: Statistical Tests							
Chi^2 Statistic	38.79	7.76	26.99	0.00	14.13	633.71	7.04
Probability	0.00	0.00	0.00	1.00	0.00	0.00	0.00
H_0	Reject	Reject	Reject	Accept	Reject	Reject	Reject
Panel III: Analysis Results							
Unit Effect	✓	✓	✓	✗	✓	✓	✓
Time Effect	✓	-	-	-	-	-	✓
Pooled OLS	✗	✗	✗	✓	✗	✗	✗

The tests conducted and the findings obtained from the results are explained in the following order:

(1) The Likelihood Ratio (LR) test is used to determine whether the classical model is valid in panel data models, or in other words, whether there is at least one unit effect or time effect. The null hypothesis of the LR test is based on the assumption that the classical model is correct. Therefore, if the null hypothesis is disproved, it's concluded that at least one of the unit effect or time effect exists, meaning the classical model is not appropriate (Şahin, 2018: 86). According to

the result of the LR test, since the probability value is significant, it is concluded that at least one of the unit effect or time effect exists in the panel data model, meaning the classical model is not appropriate.

(2) The null hypothesis of the F test, which is used to test the validity of the classical model, is based on the assumption that all unit effects are equal to zero. Therefore, if the null hypothesis is disproved, it's concluded that the unit effect exists in the panel data model, meaning the classical model is not appropriate. According to the result obtained, the probability value is significant. Thus, the null hypothesis is disproved, and it's concluded that the unit effect exists in the panel data model, meaning the classical model is not appropriate.

(3) After determining the existence of the unit effect through the above tests, it's necessary to estimate the unit effect using the Likelihood Ratio (LR) test under the assumption that it's random (stochastic). The null hypothesis of this test is based on the assumption that the standard errors of the unit effects are equal to zero. Therefore, if the null hypothesis is disproved, it's concluded that the unit effect exists, meaning the classical model is not appropriate (Yerdelen Tatoğlu, 2021: 185). According to the result of test, the null hypothesis based on the assumption that the standard error of the unit effect is equal to zero is disproved, and it's concluded that the unit effect exists in the panel data model, meaning the classical model is not appropriate.

(4) Breusch-Pagan (1980) developed the Lagrange Multiplier (LM) test based on the residuals of the classical model to test the appropriateness of the classical model. The null hypothesis of this test is based on the assumption that the variance of the unit effects is zero. According to the results of the test, the null hypothesis, based on the assumption that the variance of the unit effects is zero, was accepted, and it was concluded that the classical model is appropriate.

(5) To determine the existence of the unit effect, the Adjusted Lagrange Multiplier (ALM) test, which is resistant to autocorrelation, is also conducted. The null hypothesis for all tests with two-sided and one-sided random effects is based on the assumption that the variance of the unit effects is zero. According to all test results, the null hypothesis is disproved, and the existence of the unit effects is accepted.

(6) Bottai (2003) derived the Score test from the LR test, starting from the random effects model, to determine the appropriateness of the classical model. To conduct this test, the model is estimated using the maximum likelihood method under the assumption of random effects (Yerdelen Tatoğlu, 2021: 191). The null hypothesis of the Score test is based on the assumption that the standard error of the unit effect is zero (Yerdelen Tatoğlu, 2021: 192). Based on the probability value of the Score test result, the null hypothesis is disproved, and it is understood that the standard error of the unit effect is not equal to zero, meaning the classical model is not appropriate.

(7) The null hypothesis of the Likelihood Ratio (LR) test is based on the assumption that the standard error of the time effect is zero. Thus, if the null hypothesis is disproved, it's concluded that the classical model is not appropriate. According to the result, the standard error of the time effect is not equal to zero. This result shows that the time effect exists in the model and the classical model is not appropriate.

After this stage, since it will be decided whether the two-way model will be solved according to random or fixed effects model, the Hausman test was conducted.

3.3. Findings Related to the Hausman Test

The Hausman (1978) specification test was developed to detect specification errors. In panel data models, this test is used to choose between estimators (Yerdelen Tatoğlu, 2021: 195).

The null hypothesis of the Hausman test is based on the assumption that at least one of the unit or time effects is random. Therefore, if the null hypothesis is disproved, the model is estimated using the fixed effects model. However, in this case, the Hausman test was performed in three stages (two-way model, unit effect, and time effect). Since the model is two-way, the Hausman test of the Two-Way Model, based on the alternative hypothesis that at least one effect is correlated with the independent variable, was applied, and the result is summarized in Table 7.

Table 7. Hausman Test Results for the Two-Way Model

	(1) Two-Way Model	(2) Unit Effect	(3) Time Effect
chi²	25.86	633.71	40.67
Probability >chi²	0.0039	0.000	0.000
	Hypotheses		**Decision**

(1)	H_o: At least one of the unit or time effects is random.	Reject
(2)	H_o: Unit effect is random.	Reject
(3)	H_o: Time effect is random.	Reject

In light of the Hausman test result presented in Table 7, although the null hypothesis was disproved, this test alone is not sufficient to make a final decision. In addition to this test, another Hausman test based on the assumption that the unit effect is random and a further Hausman test assuming the time effect is random were also conducted. The overall conclusion is that the two-way fixed effects model is valid. However, before performing the panel regression analysis, the assumptions of the test should be examined.

3.4. Testing the Assumptions of the Fixed Effects Model

The Modified Wald test was used to test for heteroscedasticity across units. The null hypothesis of this test is based on the assumption that the variances are homoscedastic across units (Yerdelen Tatoğlu, 2021: 244). Subsequently, to test for the presence of autocorrelation in the model, the Durbin-Watson test and Baltagi-Wu LBI test were conducted. In both tests, if the value is less than 2, autocorrelation is considered to be an issue in the model (Yerdelen Tatoğlu, 2021: 248-250). Finally, a test based on the sum of rank correlation coefficients, as proposed by Frees (1995, 2004), was conducted to detect inter-unit correlation. In this test, the critical values at the 99%, 95%, and 90% confidence levels are examined. If Frees' test statistic surpasses the critical value, the null hypothesis, which posits no correlation between the units, is disproved (Yerdelen Tatoğlu, 2021: 262-263). It should be emphasized that in panel data models, the large number of observations and the available information from units make multicollinearity a less significant issue. Therefore, multicollinearity was not tested (Yerdelen Tatoğlu, 2021: 274).

Table 8. Test Results For The Basic Assumptions of The Fixed Effects Model

Tests	**Test Results**	
Modified Wald Test Statistic	chi2 (10) = 57.53	p-value > chi2 = 0.0000
Durbin-Watson Test	Test statistic = 1.2503682	
Baltagi-Wu LBI Test	Test statistic = 1.3684744	
Frees' Test	Test statistic = 1.472	

The results in Table 8 reveal the presence of heteroscedasticity, autocorrelation, and inter-unit correlation in the model. Consequently, the model was estimated using fixed effects regression with Driscoll-Kraay standard errors, which is appropriate given the conditions of heteroscedasticity, autocorrelation, and inter-unit correlation

3.5. Findings on the Fixed Effects Regression Model with Driscoll-Kraay Standard Errors

Driscoll-Kraay estimators provide robust estimators in the presence of heteroscedasticity, autocorrelation, and cross-sectional correlation among units.

Table 9. Fixed Effects Regression Results With Driscoll-Kraay Standard Errors

Fixed Effects Regression with Driscoll-Kraay Standard Errors					Observations: 100	
Grouping Variable: Bank					Number of Groups: 10	
Maximum Lag: 2					F(10,9)= 1131.22	
					Probability Value > F = 0.0000	
					R^2= 0.7611	
LO	**Coefficient**	**Driscoll-Kraay Std. Error**	**t-statistic**	**p-value**	**95% Confidence Interval**	
D.BS	0.67010	0.20624	3.25	0.010[a]	0.20354	1.13666
D.ROA	-0.80983	0.28021	-2.89	0.018[b]	-1.44373	-0.17594
D.ROE	0.88839	0.24419	3.64	0.005[a]	0.33598	1.44081
D.BC	0.98064	0.20751	4.73	0.001[a]	0.51121	1.45007
DCR	-1.44725	0.31344	-4.62	0.001[a]	-2.15631	-0.73819
D.CS	1.27598	0.63358	2.01	0.075[c]	-0.15728	2.70926
D.NPL	0.08122	0.13056	0.62	0.549	-0.21413	0.37658
EG	0.24207	0.03531	6.85	0.000[a]	0.16218	0.32196
INF	-0.47859	0.06134	-7.80	0.000[a]	-0.61735	-0.33982

UR	-0.09380	0.22659	-0.41	0.689	-0.60639	0.41878
CONSTANT	4.78549	0.59299	8.07	0.000[a]	3.44405	6.12694

Note: The superscripts a, b, and c in the probability values represent 99%, 95%, and 90% confidence intervals, respectively.

The F-test result in Table 9 shows that the model is statistically significant, with an R^2 of approximately 76%. According to the test results, there is a significant and positive relationship between ***bank size*** and ***the liquidity ratio***. Notably, a 1% increase in the bank's size results in approximately a 0.67% increase in the liquidity ratio. This finding aligns with the evidence presented by Abdullah and Khan (2012), Laurine (2013), Ahamed (2021), yet it departs from the conclusions drawn by Dinger (2009) and Işık and Belke (2017) who identified a differing relationship between bank size and liquidity.

A significant and negative relationship is found between ***ROA*** and **liquidity ratio.** According to this result, a 1% increase in ROA leads to a decrease of approximately 0.81% in the liquidity ratio. This finding is consistent with the studies conducted by Akhtar et al. (2011), Çelik and Akarım (2012), Ayaydın and Karaaslan (2014).

The relationship between ***ROE*** and ***the liquidity ratio*** is positive and significant. Based on this, it can be concluded that a 1% increase in ROE causes an approximate 0.89% increase in the liquidity ratio. This finding is consistent with the results of studies conducted by Akhtar et al. (2011), Abdullah and Khan (2012), Çelik and Akarım (2012), and Işık and Belke (2017). However, Ayaydın and Karaaslan (2014) and Ahamed (2021) reported a negative relationship.

Another variable that is significantly and positively related to ***the liquidity ratio*** is ***bank capital***. Bank capital is determined by dividing equity by total assets, as stated previously. According to the analysis, when the share of equity in total assets increases by 1%, the liquidity ratio also increases by 0.98%. This finding is consistent with the results of studies conducted by Bunda and Desquilbet (2008), Dinger (2009), Singh and Sharma (2016), Işık and Belke (2017), Al-Homaidi et al. (2019), and Kocaman et al. (2021). However, it contradicts the findings reported by Akhtar et al. (2011) and Ayaydın and Karaaslan (2014).

The most significant determinant of liquidity risk is the deposit-to-credit conversion ratio. The relationship between ***the liquidity ratio*** and ***the deposit-to-credit conversion ratio*** is significant and negative. This means that a 1% increase in the share of total loans in total deposits leads to an approximate 1.45% decrease in the liquidity ratio. The result obtained is consistent with the findings of the studies conducted by Abdullah and Khan (2012) and Diep and Nguyen (2017). However, this finding is not consistent with the result reported in the study conducted by Singh and Sharma (2016).

Another important variable affecting liquidity risk is the credit size, which shows the share of total loans in total assets. The relationship between ***credit size*** and ***the liquidity ratio*** is significant and positive. The coefficient indicates that a 1% increase in the share of total loans in total assets results in an approximate 1.28% increase in the liquidity ratio. The positive relationship obtained in this study is consistent with the findings of Bunda and Desquilbet (2008), but it does not align with the results reported by Işıl and Özkan (2015) and Moussa (2015).

Although a positive relationship was identified between ***NPL to total loans*** (also referred to as "followed loans") and ***the liquidity ratio***, this relationship is not statistically significant. The expected outcome is a negative and significant relationship between liquidity and non-performing loans, as evidenced by the findings of Laurine (2013).

A strong positive relationship was observed between ***economic growth*** and the ***liquidity ratio***. Specifically, a 1% increase in the annual GDP growth rate leads to a 0.24% increase in the liquidity ratio. This result is consistent with the findings of Al-Homaidi et al. (2019), but there are also studies that identify a negative relationship between economic growth and liquidity (Dinger, 2009; Ayaydın and Karaaslan, 2014; Işık and Belke, 2017). Inflation is also one of the key variables determining liquidity risk. A significant negative relationship exists between ***inflation*** and the ***liquidity ratio***. The coefficient suggests that a 1% increase in inflation results in approximately a 0.48% decrease in the liquidity ratio. The positive relationship between the two variables has also been found in various studies (Ayaydın and Karaaslan, 2014; Wójcik-Mazur & Szajt, 2015; Işık and Belke, 2017; Ahamed, 2021). However, there are also studies that have identified a negative relationship between inflation and the liquidity ratio (Waemustafa and Sukri, 2016; Kocaman et al., 2021). Finally, a negative relationship was identified between ***unemployment rate*** and ***liquidity ratio***, but this relationship is not statistically significant. Singh and Sharma (2016), on the other hand, identified a positive but insignificant relationship between unemployment and liquidity.

The hypotheses tested in the study, the decisions made regarding the hypotheses, and the direction of the effects are summarized in Table 10.

Table 10. Hypotheses, Decisions, And Effect Direction For The Model

Hypotheses on the Model	Decision	Effect
The bank size (scale) affects the liquidity ratio.	Accepted	+
ROA affects the liquidity ratio.	Accepted	−
ROE affects the liquidity ratio.	Accepted	+
The bank capital affects the liquidity ratio.	Accepted	+
The deposit-to-credit conversion ratio affects the liquidity ratio.	Accepted	−
The credit size affects the liquidity ratio.	Accepted	+
Non-performing loans affect the liquidity ratio.	Insignificant	
Economic growth affects the liquidity ratio.	Accepted	+
Inflation affects the liquidity ratio.	Accepted	−
The unemployment rate affects the liquidity ratio.	Insignificant	

Conclusion and Evaluation

This article aims to examine the bank-related and macroeconomic factors affecting liquidity risk for the top 10 deposit banks by asset size between 2012 and 2022, utilizing the panel regression analysis method. In alignment with the study's objective, the liquidity ratio, which serves as the dependent variable, is calculated by dividing liquid assets by the sum of deposits and non-deposit funding sources. According to the results of cross-sectional dependency and unit root tests, the model incorporates bank-related independent variables such as bank size, ROA, ROE, bank capital, deposit-to-credit conversion ratio, credit size, and non-performing loans (NPL). Additionally, the macroeconomic variables considered are economic growth, inflation, and unemployment rate.

In the analysis phase, based on the results of the tests (see Table 6), it was found that there are both unit and time effects in the panel data model, meaning that the model is two-way. Following this, in order to decide whether the model should be solved according to the random effects model or the fixed effects model, the Hausman test was applied, and it was determined that the fixed effects model is valid. Before proceeding with the panel regression analysis analysis, the basic assumptions of the model were tested, and heteroscedasticity, autocorrelation, and correlation between units were detected in the model. Therefore, fixed-effects regression analysis with Driscoll-Kraay standard errors, which provides robust estimators, was applied.

The regression analysis results indicate a positive relationship between bank size, ROE, bank capital, credit size, and economic growth with the liquidity ratio. In line with this finding, it can be stated that banks with large total assets, higher ROE, greater capital, and higher credit volume have lower liquidity risk. Additionally, the liquidity risk of banks is lower in an environment of economic growth. In this context:

- Large banks, in terms of total assets, may tend to work with higher liquid assets to be more cautious against economic shocks or uncertainties, to finance investment opportunities with liquid assets, or to enhance their market reputation.
- Large-scale banks, due to their more reliable image, may be able to secure funds more easily and stably from depositors and other fund providers, allowing them to maintain high levels of liquid assets.
- Banks with higher ROE may prefer to work with a higher level of liquid assets in order to gain trust and reputation in the market, be prepared for new opportunities, and reduce the likelihood of facing liquidity risk during economic shocks or uncertainties.
- Banks with higher ROE are likely to have higher financial strength and tend to operate with more liquid assets, thus reducing their liquidity risk.
- Banks with strong capital maintain their liquidity levels at a sufficient level to meet their liabilities.
- Banks with larger credit volumes tend to manage their liquidity cautiously to respond quickly to customer cash demands and maintain cash flow.

- Economic growth increases banks' ability to collect deposits and provide loans, thus enabling them to manage liquidity more effectively.

Furthermore, the analysis also revealed a negative relationship between ROA, deposit-to-credit conversion ratio, inflation, and the liquidity ratio. According to this relationship, banks with higher asset profitability and deposit-to-credit conversion ratios face higher liquidity risk. On the other hand, the inflation rate has an impact of increasing banks' liquidity risk. These findings can be interpreted as follows:

- Banks with increased asset profitability tend to operate with lower liquidity ratios.
- Banks, while attempting to increase profitability, may direct their resources to higher-yield but less liquid assets such as loans and allocate their capital to investments that enhance profitability.
- As banks increase their credit volume, they may need to use existing deposits, which could lead to cash flow constraints.
- Banks may seek to protect the value of their liquid assets from being eroded by inflation.
- During inflationary periods, banks may prefer to focus on income-generating activities or investments rather than working with high levels of liquid assets.

The relationships between NPL and unemployment rate with the liquidity ratio were found to be statistically insignificant.

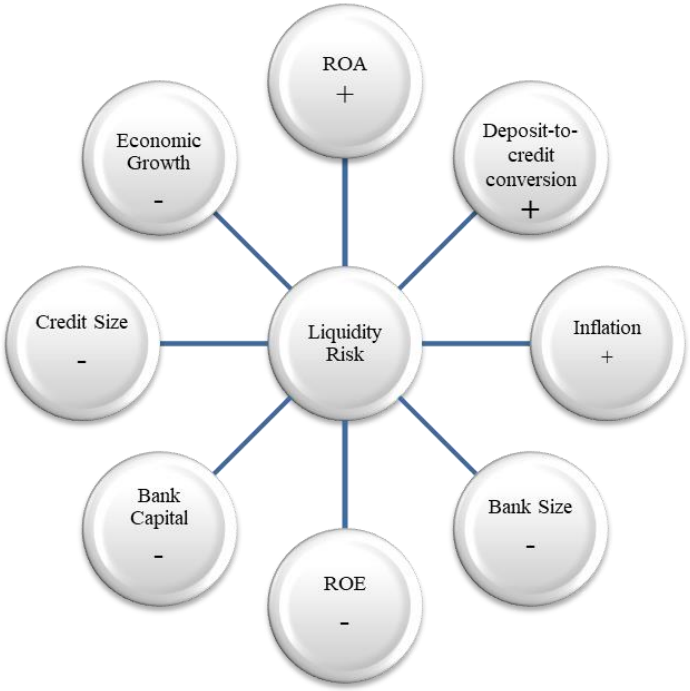

Figure 1. Factors Determining Liquidity Risk And Their Directions of Effect

This article is expected to not only provide up-to-date information on the factors determining liquidity risk but also serve as a guide for bank managers, financial experts, and authorities in the financial sector. The findings aim to offer new motivations for improving liquidity ratios and contribute to the development of more effective strategies in liquidity management. In this respect, the study is considered to be an important reference that will shed light on financial decision-making processes. Future studies may classify banks based on their capital structure or business activities and investigate the factors determining liquidity risk according to the type of bank using current data.

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