Journal of Kyzylorda Scholarly Review

P-ISSN:3006-0265 | E-ISSN:3007-4681. Published by the Open University of Kyzylorda
Copyright © Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC-BY).
https://bulletin.ouk.kz/index.php/bulletin/index



THE NON-LINEAR RELATIONSHIP BETWEEN LIQUIDITY HOLDING AND BANK PROFITABILITY AN APPLICATION OF THE THRESHOLD REGRESSION MODEL: AN EMPIRICAL STUDY OF A SAMPLE OF IRAQI COMMERCIAL BANKS LISTED ON THE IRAQ STOCK EXCHANGE FOR THE PERIOD 2018–2024

Ali Mohammed Ibrahim
College of Management and Economics, Department of Business Administration,
ali.rwsd@tu.edu.iq

Abstract. This study investigates the relationship between holding liquidity and profitability of Iraqi commercial banks and analyzes the impact of the liquidity changes based on its level. The sample consists of a balanced panel of 6 commercial banks listed on the Iraq Stock Exchange, during the period 2018-2024, which consists of 42 observations. Profitability is assessed through return on assets (ROA) and liquidity is measured by the ratio of cash and balancing with the central bank and other banks to customer deposits, calculated on financial statements based on audited statements controlling for capital adequacy, non-performing loans and bank size. Fixed-effects models in linear and quadratic shape are estimated and then the panel threshold regression model of is estimated, the significance of the thresholds are tested by bootstrapping over 1,000 replications, and also by carrying out eleven robustness checks. There is no significant liquidity effect for either the linear model ($p = 0.549$), or the threshold model ($F = 13.22$, $p = 0.071$). The direction of the effect depends on the period when the liquidity is determined. Liquidity and profitability are positively correlated and this correlation is stronger below the threshold (+2.87 percentage points) than above the threshold (+1.07). If the profitability of each year depends on the liquidity of the previous year, then liquidity decreases ROA by 3.81 percentage points for banks having liquidity below 1.07 ($p < 0.001$) and does not affect the ROA above 1.07. The results indicate that there is a non-linear relation at the 10% level, with the threshold test significant in seven of eleven tests and the threshold location and the sign of the effect depending on the timing and measurement of liquidity. The positive same-year association is more likely to reflect the profits in the cash balances as the opportunity cost of liquidity is more likely to show up after one year and is more evident in low liquidity banks, which helps explain why the earlier Iraqi studies came up with mixed results. The research suggests a common public liquidity indicator as well as a requirement for low liquidity banks to link extra liquidity provision to real operating requirements.

Keywords: bank liquidity, profitability, threshold regression, non-linearity, opportunity cost, Iraqi banks.

Introduction

Bank management are always in a quandary between two competing goals; to have enough liquidity to satisfy depositors who may wish to withdraw funds and the short-term obligations they have to pay shareholders the largest possible return. Liquid assets provide a buffer against insolvency for a bank, but they will not offer significant or any returns and will be accompanied by the opportunity cost of higher expected returns from lending and investments.

The costs of liquidity on profitability have yet to be answered. Some studies have determined that liquidity has a positive impact [1] while others have reported a negative impact [2], [3]. Recent research indicates that the relationship is not linear, but has an optimum level [4], [5]. This is especially concerning in Iraq. Private commercial banks' level of liquidity is also high: the average cash and balances in the study sample were 1.47 times the customer deposits in 2018–2024, which was quite stable between 1.37 and 1.64 times. The return on assets rose from 0.27% in 2018 to 3.13% in 2024 during the same time period. [6] concluded that there is a linear relationship between the two, while [7] and [8] found that the relationship is non-linear.

Therefore, this study explores the nature of the relationship prior to estimation of its magnitude, and uses the panel threshold regression model of [9] as well as the quadratic model. This study has five parts: the research methodology, previous studies, theoretical framework, empirical framework and conclusions and recommendations.

Methods

Research Problem

The level of liquidity of Iraqi commercial banks is high compared to the regulatory requirements, and the profitability is highly different among banks and years. The results of previous studies have been inconclusive regarding the direction of the relationship between liquidity and profitability, and most studies have not investigated whether the relationship between liquidity and profitability is different at different levels of liquidity. The following questions summarize the research problem:

a. Is the liquidity statistically significant in explaining the profitability of Iraqi commercial banks and what is its effect?
b. Does the relationship between liquidity and profitability remain constant or is the effects of liquidity shaped by the level of liquidity?
c. Is there a statistically significant threshold in the liquidity ratio that the liquidity-profability relationship turns negative or becomes more or less strong?

Significance of the Study

a. Scientific significance: The study moves from asking "What is the effect of liquidity?" to asking "What is the form of the relationship?" It seeks to contribute to the local literature by applying Hansen's (1999) threshold model to Iraqi banks, an application that remains limited in local studies to the best of the researcher's knowledge.
b. Practical significance: The study provides bank management and the Central Bank of Iraq with quantitative evidence regarding the cost of excess liquidity and the level at which its effect changes.

Objectives of the Study

a. Determine whether liquidity holding has a statistically significant effect on the profitability of Iraqi commercial banks, and measure the direction and magnitude of this effect.
b. Test whether the relationship between liquidity and profitability is linear or whether the effect of liquidity changes with its level, using a quadratic specification and identifying the turning point.
c. Estimate the threshold value of the liquidity ratio and test its significance using Hansen's (1999) model, while measuring the effect of liquidity below and above the threshold.

Research Hypotheses

H1: Liquidity holding has a statistically significant effect on return on assets.
H2: The relationship between liquidity and profitability is non-linear.
H3: There is a statistically significant threshold in the liquidity ratio, such that the effect of liquidity differs below and above it.

Research Variables and Their Measurement

Table 1. Research Variables and Their Measurement Methods

Code	Variable	Type	Measurement
ROA	Return on assets	Dependent	Net profit ÷ total assets × 100
ROE	Return on equity	Dependent (robustness test)	Net profit ÷ shareholders' equity × 100
LIQ	Liquidity ratio	Independent and threshold variable	(Cash and balances with the central bank + balances with banks) ÷ customer deposits; expressed as a multiple and calculated from audited financial statements
CAR	Capital adequacy	Control	Regulatory capital ÷ risk-weighted assets (multiple)
NPL	Non-performing loan ratio	Control	Non-performing loans ÷ total loans and advances
SIZE	Bank size	Control	Natural logarithm of total assets

Source: Prepared by the researcher based on the cited literature.

Population, Sample, and Study Period

The study population is commercial banks listed in the Iraq Stock Exchange. The banks were selected in a purposive manner based on the following criteria: the banks were necessary to be listed on the market for the entire study period; the bank's annual financial statements had to be audited for the past 6 years (2018-2024); the annual financial statements were required to be prepared on the basis of the International Financial Reporting Standards (IFRS) in order to enable the comparability of data; all research variables were supposed to be calculated according to a uniform approach.

These criteria were met by six banks: Bank of Baghdad, Ashur International Bank, Mosul Bank for Development and Investment, Mansour Bank for Investment, National Bank of Iraq, and Iraqi Middle East Investment Bank. Therefore, a balanced panel was formed, with a total of 6 banks × 7 years = 42 observations. The years 2018–2024 refer to the pre- and post-COVID-19 phases, and to the rise in commission and foreign-currency revenues in the years 2023–2024.

Information was gathered from audited financial statements in banks' annual reports. The liquidity indicator is calculated directly from the statements with a uniform formula for all banks as the ratios reported by banks differ in definition: some of them report the ratio as defined by the law, while others report the Liquidity Coverage Ratio (LCR). Capital adequacy and non-performing loan ratio are based on banks' disclosures.

Scope of the Study

a. The spatial scope were Iraqi commercial banks that are listed in the Iraq Stock Exchange, and represented by six commercial banks, which are: Baghdad, Ashur International, Mosul for Development and Investment, Mansour for Investment, National Bank of Iraq, and Iraqi Middle East Investment.
b. Temporal scope: Seven years from 2018 to 2024, on the basis of the audited annual financial statements of the banks.
c. Scope of the study: The study focuses on the liquidity holding (the ratio of cash and balances with central bank and other banks to customer deposits) and profitability (return on assets) relationship, controlling for capital adequacy, the non-performing loan ratio, and bank size.

Econometric Model and Methods of Analysis

The linear fixed-effects model is estimated first, where μ denotes the fixed effect for each bank.

$$ROA_{it} = \mu_i + \beta_1 LIQ_{it} + \theta_1 CAR_{it} + \theta_2 NPL_{it} + \theta_3 SIZE_{it} + \varepsilon_{it}$$

A quadratic specification is then added to test for curvature, and the turning point is calculated from the relationship $-\beta_1/(2\beta_2)$.

$$ROA_{it} = \mu_i + \beta_1 LIQ_{it} + \beta_2 LIQ_{it}^2 + \theta' Z_{it} + \varepsilon_{it}$$

Finally, a single-threshold model is estimated [9], where I(·) is an indicator function, γ is the threshold value, and Z is a vector of control variables.

$$ROA_{it} = \mu_i + \beta_1 LIQ_{it}\, I(LIQ_{it} \le \gamma) + \beta_2 LIQ_{it}\, I(LIQ_{it} > \gamma) + \theta' Z_{it} + \varepsilon_{it}$$

The threshold γ is estimated using a grid search procedure and the value which minimizes the sum of squared residuals is selected after discarding 10 percent of the data from the tails of the distribution of liquidity. f1 is used to test the null hypothesis (β1 = β2), and the p-value is computed via a bootstrap with 1,000 replications due to the non-identification of γ at the null. The likelihood ratio LR(γ) evaluated at the critical value 7.35 (95% confidence level) is used to build the confidence interval for the threshold.

Diagnostic tests performed prior to estimation consist of descriptive statistics, the correlation matrix, variance inflation factor (VIF), the F-test for fixed effects, and Hausman test. White heteroskedasticity-consistent standard errors are used. Robustness of the results is tested in eleven different ways, such as different values of the dependent variable, different timing for measuring the liquidity of banks, longer sample period (2016–2024) for banks whose financial statements are available for this time period.

Section Two: Previous Studies

Studies can be classified into three categories: firstly, Iraqi studies that assumed that the relationship between the factors would be linear; secondly, international studies about the factors determining profitability that had mixed results; and thirdly, recent studies that directly tested the non-linear relationship.

Previous Iraqi Studies

Table 2. Summary of Previous Iraqi Studies

Study	Sample and period	Method	Main finding
[8]	5 banks, 2016–2023	GLS	The current ratio and cash reduce profitability, while the loans-to-deposits ratio increases it.
[10]	10 banks, 2014–2023	Multiple linear regression	Recommends balancing profitability and liquidity.

Study	Sample and period	Method	Main finding
[11]	Bank of Baghdad and Iraqi Middle East Bank, 2014–2023	Comparative financial analysis	Iraqi Middle East Bank has higher liquidity, while Bank of Baghdad has higher profitability.
[7]	Iraqi banks, 2011–2020	Regression	Positive relationship between liquidity and return on equity.
[12]	9 banks, 2012–2021	MMQR	Liquidity increases ROA, and sustaining this increase requires a certain level of liquidity.
[13]	38 banks, 2010–2022	GMM	Cash liquidity increases ROA across the full sample but reduces it in conventional banks.
[6]	3 private banks	Analytical	A statistically significant negative effect of liquidity on profitability.

Source: Prepared by the researcher based on the cited literature.

The table shows that Iraqi studies are divided: four identify a negative effect or a trade-off between liquidity and profitability, two find a positive effect, and one reports mixed results depending on the type of bank. To the best of the researcher's knowledge, none has tested the form of the relationship using a threshold model. The closest is the study by [12], which used quantile regression and concluded that sustaining an increase in return on assets requires a certain level of liquidity.

International Studies on the Determinants of Profitability and Liquidity

[1], in a study of 14 Ethiopian banks over 2008–2019, found a positive effect of the liquidity ratio on profitability. [14] found that liquidity increases return on equity and recommended that threshold effects be examined in future research. In contrast, [2], studying ten of the largest British commercial banks over 2015–2021, found that the Liquidity Coverage Ratio reduces profitability because excessive holdings of liquid assets lock funds into low-yielding assets. [3] reached the same conclusion for 39 banks in Jordan, Palestine, Lebanon, and Syria over 2017–2023, a banking environment relatively close to that of Iraq.

From a risk perspective, [15], examining 71 banks in the Middle East and North Africa over 2012–2022, found that liquidity risk increases return on equity, meaning that lower liquidity is associated with higher profitability. [16] confirmed the effects of liquidity risk, credit risk, and capital on profitability in an emerging market. [17], examining approximately 1,200 banks in 101 countries, showed that the effects of profitability determinants vary according to the bank's profitability level.

Studies of the Non-Linear Relationship

The study most closely related to the present research is [4], which identified, using GMM, an inverted U-shaped relationship between the Liquidity Coverage Ratio and profitability among 20 Vietnamese banks over 2015–2022. [5] found a concave relationship between liquid assets and profitability in South Asian banks over 2016–2021, with the optimal liquidity level declining during the COVID-19 pandemic.

[18] used threshold regression for 34 Islamic banks over 2005–2017 and found that liquidity reduces profitability below a certain threshold of the loans-to-assets ratio and increases it above that threshold. [19], using a PSTR model for 74 banks in the Middle East and North Africa over 2005–2020, identified a threshold of 4.42% for the non-performing loan ratio, beyond which its negative effect on net interest margin becomes statistically significant. Using the same model, [20], studying 83 banks over 2005–2020, found that the loans-to-deposits

ratio reduces bank stability only above a certain threshold.

Research Gap and Contribution

The conflicting findings of Iraqi studies may result from their assumption of a linear relationship in a context where the relationship may be non-linear. The present study seeks to address this gap in three ways:

a. It tests the form of the relationship using two complementary approaches: gradual curvature through a quadratic specification and an abrupt shift through a threshold model.
b. It uses a uniform liquidity indicator calculated directly from the audited financial statements of all banks for 2018–2024, a period that includes the COVID-19 pandemic and the increase in commission and foreign-currency revenues during 2023–2024.
c. It responds to the recommendation of [14] to examine threshold effects in an environment characterized by chronic excess liquidity.

Section Three: Theoretical Framework

Concept and Importance of Bank Liquidity

Bank liquidity is defined as a bank's ability to provide cash or obtain it easily in order to meet its obligations when they fall due [21]. This includes the depositors' withdrawals and the ability to satisfy the credit requirements of the customer without the need to make significant losses from asset sales. There are two kinds of liquidity: asset liquidity and funding liquidity, that is, the facility of the bank to source the funds at reasonable costs.

The need for liquidity comes from the very nature of banking: banks use short term deposits to fund long term assets. This maturing process is referred to as "liquidity creation." A study by [22] of 298 banks in 11 Arab and Middle Eastern countries showed that the higher the liquidity creation, the greater the ROA and ROE. [23] concluded that it plays a role in bridging the relationship between capital and bank stability. Thus, a bank that ties up liquidity in cash would give up its basic purpose, and its main source of income.

Liquidity Measurement Indicators

a. Statutory liquidity ratio: Liquid assets divided by current liabilities. This is the indicator monitored by the Central Bank of Iraq. It differs from the indicator adopted in this study, which is calculated from audited financial statements as cash and balances with the central bank and other banks divided by customer deposits.
b. Loans-to-deposits ratio: An inverse indicator; an increase indicates lower liquidity and greater deployment of funds.
c. Liquidity Coverage Ratio (LCR): High-quality liquid assets divided by net cash outflows over 30 days, with a minimum requirement of 100%.
d. Net Stable Funding Ratio (NSFR): Available stable funding divided by required stable funding over one year, with a minimum requirement of 100%.

[24] linked these two ratios to the stability of banks in emerging countries, including Middle Eastern banks. [25], studying 40 banks in 11 emerging economies over 2011–2016, found that pressure from the Liquidity Coverage Ratio was associated with higher, rather than lower, profitability, contrary to expectations.

Concept of Bank Profitability and Its Indicators

Profitability is a bank's ability to generate profits from its resources. It is a source of internal capital accumulation and investor confidence. Most recent empirical studies use three indicators to measure profitability: return on assets, return on equity, and net interest margin [26], [27].

a. Return on assets (ROA): Calculated by dividing net profit by total assets [26], [28]. It measures management's efficiency in operating all of the bank's assets and is not affected by the financing structure; therefore, it is adopted as the principal dependent variable.
b. Return on equity (ROE): Calculated by dividing net profit by equity [26]. It measures the return earned by shareholders and is affected by financial leverage. It may therefore increase in a less-capitalized bank without any improvement in the efficiency of its asset operations. It is used in the robustness test.

c. Net interest margin: The difference between interest income and interest expenses relative to average total assets. It reflects the bank's efficiency in its intermediation activity between deposits and lending [26], [27].

Theories of Liquidity Management

Theories of bank liquidity management have evolved through four principal approaches. The source of liquidity shifted from short-term self-liquidating loans to marketable assets, then to expected cash flows from borrowers, and finally to the liabilities side [29], [30].

a. Commercial Loan Theory: A bank remains liquid if it confines its lending to short-term loans that are self-liquidating through the business cycle. In other words, short-term working-capital financing is the source of bank liquidity [29], [30].
b. Shiftability Theory: Liquidity is achieved by holding assets that can be readily sold or discounted, such as government securities, or transferred to the central bank when needed [29], [30].
c. Anticipated Income Theory: Liquidity is linked to the expected cash flows from borrowers' instalments rather than solely to loan maturities. The bank therefore plans its liquidity on the basis of borrowers' expected income [29], [30].
d. Liability Management Theory: A bank can obtain liquidity by borrowing in the money market and therefore does not need to hold large amounts of liquid assets [30]. This theory has limited application in Iraq because of the underdeveloped interbank lending market, which encourages banks to maintain high levels of self-held liquidity.

The Relationship between Liquidity and Profitability

The relationship is based on the trade-off between return and risk. Two competing hypotheses can be identified:

a. The opportunity cost hypothesis – each dollar in cash is a dollar not being lent, and as such, it will mean that the profitability of holding cash will be lower. This is the discovery that [2] and [3] reported.
b. Safety and Confidence Hypothesis: Liquidity lowers the cost of emergency funding, avoids forced sale of assets, and raises depositors' confidence, which will lead to higher profits. This is a discovery presented by [1].
c. The two hypotheses can be merged with the notion of the optimum liquidity level. Below this level, the level of safety prevails and profit rises as liquidity rises. On top of that, the opportunity cost is important, and profits decrease. This yields an "inverted U" shape of the relationship [4], [5]. As a result, the direction of the effect detected by any study will be related to the location of the banks in the study sample on one side or the other of this level.

The Role of Capital and Credit Quality

Liquidity is not an independent variable. [31] found in their 179-bank study that regulatory capital has a simultaneous impact on liquidity, lending and profitability. [32] revealed that capital adequacy has a moderating effect on the relationship between liquidity risk and profitability. Additionally, the credit risk has a direct impact on profitability [16]. As such, the following control variables were added to the model: capital adequacy, non-performing loans, and bank size.

Results and Discussion

Descriptive Statistics

Table 3. Descriptive Statistics of the Research Variables (42 Observations, 2018–2024)

Variable	Mean	Std. Dev.	Minimum	Maximum	Skewness	Kurtosis	Jarque–Bera (p)
ROA (%)	1.512	2.049	−2.510	8.653	1.178	5.352	0.000
ROE (%)	6.913	11.151	−5.961	42.175	1.972	6.060	0.000
LIQ (times)	1.467	0.744	0.533	3.730	1.172	3.772	0.005

Variable	Mean	Std. Dev.	Minimum	Maximum	Skewness	Kurtosis	Jarque–Bera (p)
CAR (times)	0.984	0.630	0.210	2.670	1.057	3.672	0.014
NPL	0.216	0.183	0.024	0.788	1.472	4.818	0.000
SIZE	27.589	0.643	26.708	29.269	0.843	3.036	0.083

Source: Prepared by the researcher based on statistical data.

The average ROA was 1.51% (range -2.51% to +8.65% for Iraqi Middle East Bank and Bank of Baghdad respectively, 2024). The average liquidity indicator was 1.47 times, that is, cash and such balances were about one and a half times higher than the deposits of customers. It ranged from 0.53 times (National Bank of Iraq, 2021) to 3.73 times (Ashur, 2020).
Most variables are not normally distributed as shown in the Jarque–Bera tests. Therefore, the standard errors were corrected and a bootstrap test was used which does not require normality.

Table 4. Average Values of Variables for Each Bank (2018–2024)

Bank	ROA (%)	LIQ (times)	CAR (times)	NPL	Years below threshold (1.60) out of 7
Baghdad	3.113	0.868	0.688	0.464	7
National	2.059	1.018	0.377	0.065	6
Ashur	1.976	2.753	1.723	0.194	0
Mansour	1.938	1.151	1.275	0.133	7
Mosul	0.654	1.839	0.802	0.279	3
Iraqi Middle East	−0.668	1.174	1.037	0.161	7

Source: Prepared by the researcher based on statistical data.

The table shows that movement between the two regimes is limited. Baghdad, Mansour, and Iraqi Middle East remained below the threshold in all years, while Ashur remained above it in all years. Only Mosul and National Bank moved between the two regimes.

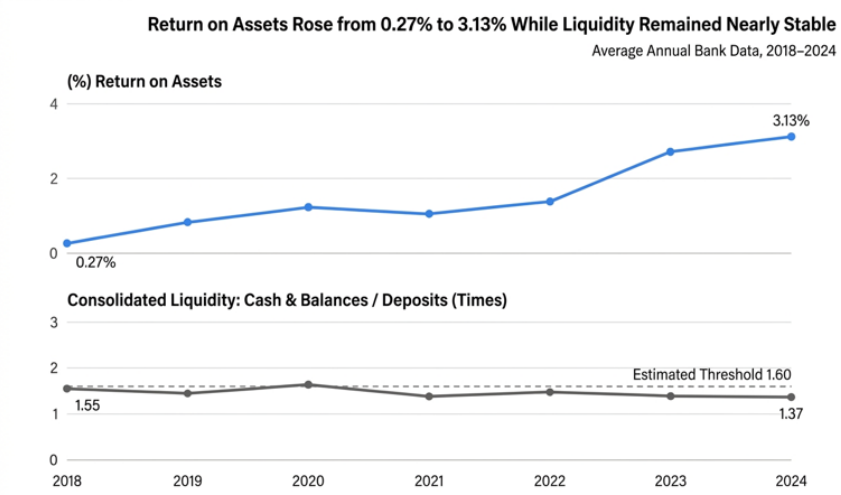

Figure 1. Annual average return on assets and liquidity ratio in the six banks (2018–2024).
Source: Prepared by the researcher based on statistical data.

As illustrated in the figure, average liquidity was maintained at a relatively low level (1.37 to 1.64 times) while the return on assets continued to rise progressively and significantly during 2023–2024. This boost followed an increase in commission income and foreign-currency exchange differences in most banks, suggesting that the increase was a shock to all banks and not attributable to a particular bank's liquidity. Therefore, a dummy variable for 2023–2024 and year fixed effects were included in the robustness tests.

Correlation Matrix and Multicollinearity Test

Table 5. Pearson Correlation Matrix

	ROA	LIQ	CAR	NPL	SIZE
ROA	1				
LIQ	−0.091	1			
CAR	−0.247	0.474**	1		
NPL	0.273	−0.044	0.097	1	
SIZE	0.662**	−0.595**	−0.499**	0.080	1

Note: * Significant at 5%; ** significant at 1%.
Source: Prepared by the researcher based on statistical data.

The correlation between liquidity and profitability is weak and statistically insignificant, as the correlation value is −0.091. The liquidity of the banks is negatively correlated with size, with the correlation coefficient between these two variables being −0.595, i.e., the bigger the bank size the less liquid the bank is in relation to the deposits held. The variance inflation factor values range between 1.03 and 1.73; therefore, there is no multicollinearity problem.

Selection of the Estimation Model

The F-test did not reject the hypothesis of equal individual bank effects ($F(5, 32) = 1.39$, $p = 0.254$), and the Hausman test did not reject the null hypothesis ($\chi^2(4) = 6.53$, $p = 0.163$). The between-subjects (or random effects) variance was estimated to be zero. This means the differences among banks are not statistically significant when the variables are taken into account. However, there were two reasons for making this choice: Firstly, the estimator remains the same for both models; and secondly, the model proposed by [9] is based on the fixed-effects model.

Estimation Results

Table 6. Estimation Results of the Effect of Liquidity on Return on Assets (Fixed Effects, 42 Observations)

Variable	Linear model (1)	Quadratic model (2)	Threshold model (3)
LIQ	0.424 (0.700)	0.474 (1.984)	—
LIQ^2	—	−0.012 (0.462)	—
LIQ × I(LIQ ≤ 1.60)	—	—	2.870*** (0.794)
LIQ × I(LIQ > 1.60)	—	—	1.066* (0.554)
CAR	−0.752 (0.502)	−0.748 (0.508)	−1.086** (0.478)
NPL	3.370 (2.160)	3.367 (2.178)	4.309** (2.069)
SIZE	2.255*** (0.524)	2.261*** (0.587)	2.442*** (0.400)
Within R^2	0.529	0.529	0.655
F (p)	8.97 (0.000)	6.95 (0.000)	11.78 (0.000)

Figures in parentheses are White-corrected standard errors. *** Significant at 1%; ** at 5%; * at 10%.
Source: Prepared by the researcher based on statistical data.

Linear and quadratic models: The liquidity coefficient is positive but statistically insignificant (p = 0.549), and the quadratic term adds no explanatory value (p = 0.979). The turning point calculated from the quadratic model ($-\beta_1/(2\beta_2) \approx -19.8$ times) lies outside the liquidity range in the sample (0.53–3.73 times); therefore, no gradual curvature is evident in the relationship.
Threshold model: The contemporaneous effect of liquidity is positive in both regimes, but it declines after the threshold:
1. Below the threshold (30 observations): a one-unit increase in liquidity is associated with a 2.87-percentage-point increase in return on assets (p = 0.001).
2. Above the threshold (12 observations): it is associated with an increase of 1.07 percentage points (p = 0.064).
The within explanatory power increased from 0.529 to 0.655. Bank size has a large, positive, and statistically significant coefficient in all three models. It is likely to capture the joint growth of banks and their profits in 2023–2024 rather than the effect of size alone. The capital adequacy coefficient is negative, indicating that banks with higher capitalization achieve lower returns on assets. The coefficient of non-performing loans is positive, contrary to expectations; this is attributable to the fact that Baghdad, the bank with the highest level of non-performing loans, also has the highest profitability from non-lending sources.

Testing for the Existence of a Threshold

Table 7. Threshold Existence Test [9]

Item	Value
Estimated threshold (γ)	1.60 times
95% confidence interval for threshold	[0.77–1.99]
F_1 statistic	13.22
Bootstrap p-value (1,000 replications)	0.071
Critical values (1% / 5% / 10%)	12.17 / 14.25 / 19.20
Observations below / above threshold	30 / 12
Trimming percentage from both tails	10%

Source: Prepared by the researcher based on statistical data.

The F_1 statistic exceeds the critical value at the 10% level but not at the 5% level. The hypothesis of linearity is therefore rejected only at the 10% level, and the evidence for a threshold is marginal. The confidence interval for the threshold is very wide (0.77–1.99); thus, the value of 1.60 should not be interpreted as a precise cutoff.

Robustness Tests

Table 8. Robustness Test of the Threshold Model Results

Test	Obs.	Γ	F_1 (p)	Effect below threshold (p)	Effect above threshold (p)
Baseline: ROA, 6 banks, 2018–2024	42	1.60	13.22 (0.071)	2.870 (0.001)	1.066 (0.064)
Dummy for 2023–2024	42	1.60	18.70 (0.021)	3.128 (0.001)	1.138 (0.041)
Year fixed effects	42	1.60	18.36 (0.054)	3.082 (0.002)	1.099 (0.054)
Without NPL	42	1.73	13.69 (0.083)	3.323 (0.000)	1.363 (0.011)
Alternative longer sample: 5 banks, 2016–2024	45	1.81	10.73 (0.074)	3.657 (0.000)	2.008 (0.000)

Test	Obs.	Γ	F_1 (p)	Effect below threshold (p)	Effect above threshold (p)
Alternative sample with year effects	45	1.65	13.02 (0.264)	3.011 (0.001)	1.512 (0.008)
Dependent variable: ROE	42	1.99	6.50 (0.446)	8.442 (0.015)	2.044 (0.356)
Excluding Iraqi Middle East Bank	35	1.60	8.93 (0.455)	2.623 (0.017)	0.932 (0.195)
Excluding Ashur Bank	35	0.77	21.49 (0.040)	−5.995 (0.000)	−1.963 (0.003)
Disclosed liquidity (statutory or LCR)	42	1.68	11.72 (0.121)	−2.097 (0.004)	−0.331 (0.366)
Previous-year liquidity (LIQ t−1, 2019–2024)	36	1.07	19.42 (0.019)	−3.812 (0.000)	−0.356 (0.521)

Source: Prepared by the researcher based on statistical data.

The tests reveal three findings. First, evidence of non-linearity: the threshold test is significant at the 10% level or better in seven of the eleven tests, and loses significance when ROE or disclosed liquidity is used, or when the model is estimated without Iraqi Middle East Bank or with year effects in the alternative sample. Second, the effect below the threshold is more stable than the effect above it. Third, when previous-year liquidity is used, the effect below the threshold becomes negative and statistically significant, while no significant effect appears above the threshold.

Hypothesis Testing and Discussion of Results

Table 9. Results of the Research Hypothesis Testing

Hypothesis	Evidence	Decision
H1: Liquidity has a significant effect on profitability	Not significant in the linear model (p = 0.549); significant within the two regimes, but the direction depends on measurement timing.	Partially accepted: no stable average effect.
H2: The relationship is non-linear	The quadratic term is insignificant; the threshold is significant at 10% in 7 of 11 tests.	Accepted with marginal evidence at the 10% level.
H3: There is a significant liquidity threshold	γ = 1.60, p = 0.071; confidence interval 0.77–1.99, with estimates ranging from 0.77 to 1.99 across tests.	A specific threshold value is not conclusively accepted.

Source: Prepared by the researcher based on statistical data.

The most salient result is that the direction of the relationship is affected by the timing of the measurement of the liquidity. The contemporaneous association is positive, and it is unlikely a reverse relationship between profitability and liquidity; realized profits – especially commission income and foreign-currency revenues in 2023–2024 – build up as balances with the central

bank, thus increasing the measured liquidity in the same year. This is similar to the study conducted by [1] and [7] which concluded that ROA is higher when the liquidity is increasing, and also [12] concluded similar findings.

In contrast, previous year liquidity provides an insight into the opportunity cost as suggested by theory. In a low-liquidity bank, holdings of liquid assets are at the expense of its holdings of income-generating assets. Once a certain amount of liquidity is reached, excess liquidity is not going to evict profitable assets, and there is no cost visible. This corroborates the studies reporting a negative effect [6], [8], [2], and [18] who report that the impact of liquidity changes is only observed beyond a threshold.

This could partly explain the conflicting results from Iraqi studies and not just because of variations in sample sizes.

Conclusions and Recommendations

Conclusions

a. Iraqi commercial banks maintain high and stable liquidity: average cash and balances amounted to 1.47 times customer deposits during 2018–2024 and remained between 1.37 and 1.64 times, while average return on assets increased from 0.27% to 3.13%.
b. Liquidity has no statistically significant effect on profitability when a linear relationship is assumed ($p = 0.549$), nor under the quadratic specification.
c. Evidence of non-linearity is marginal: a threshold of 1.60 times is significant at the 10% level ($p = 0.071$) and significant in seven of eleven tests, but its value ranges from 0.77 to 1.99 depending on the test.
d. When liquidity and profitability are measured in the same year (t), higher liquidity is associated with higher profitability, with a declining effect beyond the threshold (+2.87 below it and +1.07 above it). This most likely reflects the accumulation of profits as cash rather than an effect of liquidity on profitability.
e. When each year's profitability is linked to the previous year's liquidity (t−1), liquidity reduces ROA only in low-liquidity banks: −3.81 percentage points per additional unit below the 1.07 threshold, with no effect above it. The opportunity cost therefore appears with a one-year lag and is concentrated in banks with lower liquidity.
f. The direction of the effect reverses when the timing of liquidity measurement (contemporaneous or lagged) and the measurement method (calculated from financial statements or disclosed) are changed. This explains part of the conflicting findings in previous Iraqi studies.
g. Capital adequacy has a negative effect on return on assets in the threshold model, while bank size has a strong positive effect, which is likely to capture the banks' common growth and profitability in 2023–2024.

Recommendations

Central Bank of Iraq

a. Standardize the liquidity indicator disclosed by banks, because the ratios currently disclosed (statutory liquidity by some banks and LCR by others) produced a direction opposite to that of the indicator calculated from financial statements in this study.
b. Develop the interbank lending market so that a bank can obtain liquidity when needed rather than holding it in reserve.
c. Monitor banks' compliance with publishing their complete audited financial statements on time, thereby enhancing transparency and enabling their performance to be assessed.

Bank Management

a. Banks operating with liquidity close to or below their deposits (approximately one time) bear the highest cost from any increase in liquidity. Therefore, decisions to raise liquidity should preferably be linked to actual operating needs.
b. Very liquid banks (Ashur and Mosul) should consider investing a portion of their funds in productive credit or short-term, low-risk credit. This study did not find any evidence of a positive cost of liquidity for holding a large amount of liquidity above the threshold;

nor did it find any evidence that holding liquidity above the threshold increases profitability; nor was there any evidence that it does not increase profitability, as it is a part of a bank's role in creating liquidity.

c. To diversify income sources, as the rise in profits in 2023–2024 was heavily dependent on commissions and foreign-currency exchange differences, which may not be sustainable income sources.
d. Improve credit risk assessment as increased loan defaults lead banks to prioritize liquidity over loans.

Researchers

a. Apply the model to Islamic banks and compare their results with those of commercial banks.
b. Calculate the liquidity indicator directly from financial statements and introduce lagged liquidity instead of contemporaneous liquidity to address reverse causality.
c. Test a dynamic threshold model and a Panel Smooth Transition Regression (PSTR) model, and separate foreign-currency revenues from operating profitability.

References

[1] Y. N. Isayas, "Determinants of banks' profitability: Empirical evidence from banks in Ethiopia," Cogent Econ. Finance, vol. 10, no. 1, Art. no. 2031433, 2022, doi: 10.1080/23322039.2022.2031433.

[2] A. Eltweri, N. Sawan, K. Al-Hajaya, and Z. Badri, "The influence of liquidity risk on financial performance: A study of the UK's largest commercial banks," J. Risk Financial Manag., vol. 17, no. 12, Art. no. 580, 2024, doi: 10.3390/jrfm17120580.

[3] N. A. Alslaibi, R. Qawasmeh, H. Samara, and R. M. Abualrob, "Key drivers of bank financial performance: Insights from the Arab Levant region," Banks Bank Syst., vol. 20, no. 2, pp. 143–155, 2025, doi: 10.21511/bbs.20(2).2025.12.

[4] T. H. Vu, "Liquidity coverage ratio and profitability: An inverted U-shaped pattern," Cogent Econ. Finance, vol. 12, no. 1, Art. no. 2426532, 2024, doi: 10.1080/23322039.2024.2426532.

[5] K. U. Mohammad, and M. R. Khan, "Liquid asset holdings and banking profitability: Evidence from South Asia," J. Central Bank. Theory Pract., vol. 13, no. 2, pp. 129–152, 2024, doi: 10.2478/jcbtp-2024-0016.

[6] S. H. Abed, "The effect of liquidity on the profitability and value of banks listed on Iraq Stock Market (An analytical study)," J. Econ. Admin. Sci., vol. 26, no. 124, pp. 417–430, 2020, doi: 10.33095/jeas.v26i124.2048.

[7] A. K. Saeed, "Analysis of the impact of some banking risks on the profitability of a sample of Iraqi banks listed on the Iraq Stock Exchange for the period (2011–2020)," Tanmiyat Al-Rafidain, vol. 44, no. 148, pp. 65–87, 2025, doi: 10.33899/tanra.v44i148.54138.

[8] R. S. Saifadin, "The effect of liquidity on profitability: An analytical study on a sample of commercial banks listed on the Iraq Stock Exchange for the period 2016–2023," Al-Ghary J. Econ. Admin. Sci., vol. 21, no. 1, pp. 729–770, 2025, doi: 10.36325/ghjec.v21i1.17908.

[9] B. E. Hansen, "Threshold effects in non-dynamic panels: Estimation, testing, and inference," J. Econometrics, vol. 93, no. 2, pp. 345–368, 1999, doi: 10.1016/S0304-4076(99)00025-1.

[10] R. A. H. Fleih, and H. H. A. Al-Zubaidi, "The factors affecting the profitability of commercial banks: An analytical study of a sample of commercial banks listed in the Iraq Stock Exchange for the period (2014–2023)," Al-Ghary J. Econ. Admin. Sci., vol. 21, no. 2, pp. 1009–1040, 2025, doi: 10.36325/ghjec.v21i2.18924.

[11] B. S. Mohsen, and A. A. A. Al-Fatlawi, "Liquidity indicators and their relationship to the financial performance of banks: An analytical study of a sample of Iraqi banks for the period (2014–2023)," Al-Ghary J. Econ. Admin. Sci., vol. 21, no. 1, pp. 620–641, 2025, doi: 10.36325/ghjec.v21i1.18361.

[12] H. H. A. Altaee, N. H. Ghani, S. J. Azeez, and S. A. Abdulwahab, "Factors influencing

commercial bank profitability in Iraq: A quantile regression approach," Banks Bank Syst., vol. 19, no. 2, pp. 172–183, 2024, doi: 10.21511/bbs.19(2).2024.14.

[13] S. T. Saeed, "The impact of cash liquidity and financial leverage on the performance of Iraqi banks: A comparative study between Islamic and conventional banks," J. Econ. Admin. Sci., vol. 30, no. 143, pp. 389–404, 2024, doi: 10.33095/40xmbq39.

[14] W. A. Pratomo, A. Warokka, R. Yudaruddin, and A. Z. Aqmar, "Economic freedom and banking performance: Capital buffers as the key to profitability and stability in liberalized markets," J. Risk Financial Manag., vol. 18, no. 10, Art. no. 544, 2025, doi: 10.3390/jrfm18100544.

[15] B. Abu Khalaf, and A. B. Awad, "Exploring the bearing of liquidity risk in the Middle East and North Africa (MENA) banks," Cogent Econ. Finance, vol. 12, no. 1, Art. no. 2330840, 2024, doi: 10.1080/23322039.2024.2330840.

[16] I. Saleh, M. Abu Afifa, and L. Murray, "The effect of credit risk, liquidity risk and bank capital on bank profitability: Evidence from an emerging market," Cogent Econ. Finance, vol. 8, no. 1, Art. no. 1814509, 2020, doi: 10.1080/23322039.2020.1814509.

[17] A. B. Bortoluzzo, R. R. Ciganda, and M. M. Bortoluzzo, "Determinant factors of banking profitability: An application of quantile regression for panel data," Future Bus. J., vol. 10, no. 1, 2024, doi: 10.1186/s43093-024-00347-z.

[18] K. Ben Jedidia, and I. Ben Salah, "Asymmetric causal linkages between liquidity and profitability for MENA Islamic banks," J. Islamic Monetary Econ. Finance, vol. 8, no. 4, pp. 501–516, 2022, doi: 10.21098/jimf.v8i4.1546.

[19] K. Alnabulsi, E. Kozarević, and A. Hakimi, "Non-performing loans and net interest margin in the MENA region: Linear and non-linear analyses," Int. J. Financial Stud., vol. 11, no. 2, Art. no. 64, 2023, doi: 10.3390/ijfs11020064.

[20] M. A. Khemiri, "Testing the non-linear relationship between liquidity risk and bank stability in the MENA region," Int. J. Econ. Financial Issues, vol. 13, no. 4, pp. 125–133, 2023, doi: 10.32479/ijefi.14536.

[21] D. Stevcevska-Srbinoska, and V. Gjelevska, "Liquidity-profitability dynamics: Is the banking industry resilient in times of crisis? Facta Universitatis, Series: Economics and Organization, 21(1), 1–23," , 2024, doi: 10.22190/FUEO231129001S.

[22] H. El-Chaarani, R. Abraham, and G. Azzi, "The role of liquidity creation in managing the COVID-19 banking crisis in selected MENA countries," Int. J. Financial Stud., vol. 11, no. 1, Art. no. 39, 2023, doi: 10.3390/ijfs11010039.

[23] T. H. Vu, and T. T. Ngo, "Bank capital and bank stability: The mediating role of liquidity creation and moderating role of asset diversification," Cogent Bus. Manag., vol. 10, no. 2, Art. no. 2208425, 2023, doi: 10.1080/23311975.2023.2208425.

[24] M. Asghar, A. Rashid, and Z. Abbas, "Basel III effects on bank stability: Empirical evidence from emerging countries," J. Asian Finance Econ. Bus., vol. 9, no. 3, pp. 347–354, 2022, doi: 10.13106/jafeb.2022.vol9.no3.0347.

[25] T. Mashamba, "The effects of Basel III liquidity regulations on banks' profitability," J. Governance Regul., vol. 7, no. 2, pp. 34–48, 2018, doi: 10.22495/jgr_v7_i2_p4.

[26] P. D. Nguyen, "Determinants of bank profitability in Vietnam: A focus on financial and COVID-19 crises," J. Bus. Econ. Manag., vol. 25, no. 4, pp. 709–730, 2024, doi: 10.3846/jbem.2024.22070.

[27] S. Laporšek, B. Švagan, M. Stubelj, and I. Stubelj, "Profitability drivers in European banks: Analyzing internal and external factors in the post-2009 financial landscape," Risks, vol. 13, no. 1, Art. no. 2, 2025, doi: 10.3390/risks13010002.

[28] T. M. Antony, "Determinants of liquidity risk: Empirical evidence from Indian commercial banks," Banks Bank Syst., vol. 18, no. 3, pp. 101–111, 2023, doi: 10.21511/bbs.18(3).2023.09.

[29] A. A. Dahiyat, S. R. Weshah, and M. Aldahiyat, "Liquidity and solvency management and its impact on financial performance: Empirical evidence from Jordan," J. Asian Finance Econ.



Bus., vol. 8, no. 5, pp. 135–141, 2021, doi: 10.13106/jafeb.2021.vol8.no5.0135.

[30] I. Hacini, A. Boulenfad, and K. Dahou, "The impact of liquidity risk management on the financial performance of Saudi Arabian banks," Emerg. Mark. J., vol. 11, no. 1, pp. 68–75, 2021, doi: 10.5195/emaj.2021.221.

[31] I. Oino, and D. McMillan, "Regulatory capital: Implications on credit creation and profitability," Cogent Econ. Finance, vol. 9, no. 1, Art. no. 1955470, 2021, doi: 10.1080/23322039.2021.1955470.

[32] Meliza, N. Abu Hasan, and H. Saputri, "The influence of banking liquidity risk on profitability: The moderating role of capital adequacy ratio," Banks Bank Syst., vol. 19, no. 2, pp. 140–151, 2024, doi: 10.21511/bbs.19(2).2024.11.