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## Financial Inclusion as a Determinant of Short-Term Liquidity Risk in Tunisia's Banking Sector

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### Abstract

*This paper empirically examines the effect of financial inclusion on the resilience to short-term liquidity stress of commercial Tunisian banks using data for the period 2010–2021. We utilize the two-step generalized method of moments (GMM) estimator. We mainly draw the inference that financial inclusion and bank profitability have a positive influence on bank liquidity risk resilience. We also give proof that the bank size has a negative impact. Nevertheless, bank capital and economic growth have no impact. Eventually, the findings support the view that bank resilience to short-term liquidity shocks can be enhanced by a stable macroeconomic environment. According to the author's current knowledge, no previous empirical research has been carried out in the banking sector in Tunisia in which the impact of financial inclusion on bank resilience to liquidity stress is examined.*

**Keywords:** Financial inclusion; Liquidity; Bank resilience; Short-term liquidity risk; Basel III; Tunisian banks; Panel data; System GMM.

### Introduction

In recent years, the promotion of financial inclusion has become a key priority for many governments and international organizations, positioning it as a central pillar in broader socio-economic development strategies. From a historical perspective, the literature has remained some definitions of financial inclusion. Financial inclusion is widely recognized as a means of enabling individuals and businesses to access essential banking products and services at reasonable costs. It is designed to support income generation, facilitate savings, and stimulate investment flows (Fungacova & Weill, 2015).

The World Bank views financial inclusion a key and practical instrument for alleviating poverty and fostering economic prosperity in emerging and developing countries. The definitions of the BIS and the OECD emphasize that financial inclusion should be extended to all segments of society in a safe, secure, and sustainable manner. According to the definitions put forth by the IMF, financial inclusion is regarded as an essential mechanism for safeguarding households and businesses against macroeconomic shocks while enhancing their ability to manage risks. It facilitates the stabilization of household income and the accumulation of wealth over time, while simultaneously providing businesses with the requisite financial resources to invest, establish enterprises, and contribute to sustained economic growth.

As banks expand their outreach to underserved and unbanked populations in pursuit of financial inclusion, it becomes increasingly important to assess how this strategic shift affects

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their profiles. Financial inclusion can promote human development by enabling adults who are not yet connected to banking institutions to become active and use the financial products and services necessary to support a country's economic growth. This link, which can be attributed to increased access to deposit and credit accounts, is attributed to the largest banking sector (Owen & Pereira, 2018).

In this context, there are various strategies for promoting financial inclusion. One approach involves developing financial services that fulfil diverse purposes such as accounts for income transfers or payments, savings accounts for secure deposit storage, personal or business loans, and insurance products. Another approach, from the perspective of financial service providers, suggests that financial inclusion can be achieved by broadening the range and availability of financial products and services. From the user's perspective, financial inclusion refers to the number of businesses and investors receiving credit from banks. It may also be assessed by the percentage of individuals holding accounts with financial institutions, disaggregated by gender and income level. Additionally, it may reflect the share of people who use financial accounts to receive or send money, borrow funds, or access insurance services (Jahan et al., 2019).

On this account, this study explores whether broader access to financial services enhances or challenges short-term liquidity resilience under the Basel Committee on Banking Supervision framework (Basel III). Indeed, the new regulatory framework established by the Basel III introduces liquidity requirements aimed at strengthening banks' resilience to liquidity risk. Among these requirements, the liquidity coverage ratio (LCR) is a short-term metric that requires financial institutions to hold a sufficient amount of high-quality liquid assets to withstand a 30-day period of financial stress.

A few studies have already addressed the financial inclusion on the Tunisian banking sector (Gharbi et Kammoun, 2022). Moreover, most of recent studies examine the impact of financial inclusion on bank stability as measured by Z-score (Vo et al. 2021; Srivastava et al. 2025; Wang & Luo, 2022; Khémiri et al., 2024), bank profitability (Yakubu & Musah, 2024, Vo & Nguyen, 2021; Al-Chahadah et al., 2020), bank credit risk (Yang & Masron, 2024; Jungo et al., 2024) and bank systemic risk (Xie, 2025). In our study, we aim to move beyond treating stability, liquidity, and risk as distinct constructs, and instead propose that resilience to liquidity risk offers a comprehensive framework that both integrates and redefines these dimensions.

To fulfill the objectives of this research, the paper is structured as follows. Section 2 examines the related literature. Section 3 describes the data and the research methodology. Section 4 discusses the empirical results. Eventually, section 5 concludes the paper, outlines the implications, and suggests avenues for future research.

## **2. Literature review and hypothesis development**

### **2.1. Financial inclusion and bank resilience to liquidity risk**

Financial inclusion plays an essential role in maintaining a resilient financial system. In fact, recognizing the interdependence between financial inclusion and financial stability is essential for coherent and sustainable policy implementation (Vo et al., 2021). A growing number of publications have pointed that the financial inclusion could indirectly benefit bank resilience to liquidity crises. In fact, Srivastava et al. (2025) evince that financial inclusion, especially in rural areas, enhances Indian bank stability by reducing liquidity risk. This occurs through strengthening the banking system resilience, or via lowering banks' funding costs. Furthermore, the access to appropriate financial solutions for households and SMEs through financial inclusion

strengthens the resilience and stability of the financial system (Vo et al., 2021). Moreover, Ahamed and Mallick (2019) prove that financial inclusion leads to higher deposit mobilization, which in turn strengthens bank liquidity by ensuring access to stable and affordable funding sources. In addition, Yang & Choi (2007) demonstrate that, while transaction costs and remittances may play a significant role in insurance networks, digital finance contributes to enhanced liquidity and increased savings. Hence, digital financial inclusion can influence risk-sharing by households (Wang & Wang, 2022). That being the case, in the absence of a bank account linked to their mobile wallet, agents are required to visit a financial institution to convert physical cash into electronic value. Consequently, this process introduces liquidity constraints, which may lead to prolonged delays, increased transaction costs, and, ultimately, the risk of financial exclusion (GSMA, 2019).

By virtue of what is mentioned above, we formulate our hypothesis as follows:

**Hypothesis: Financial inclusion improves banks' resilience to short-term liquidity risk.**

## **2.2. Internal factors and bank resilience to liquidity risk**

It is of great significance to examine the impact of bank-specific factors, such as profitability, capital and size, on bank liquidity risk resilience.

First, some studies substantiate that profitability positively influences banks liquidity, suggesting that higher profitability strengthens their capacity to fulfil short-term obligations (Mahdi & Abbas, 2018; effendi & disman, 2017; Tran et al., 2019). Other studies have corroborated that bank stability depends on bank profits. In fact, Ghenimi et al. (2017) highlight the positive effect of ROA on bank stability. In addition, Dahir et al. (2018) outline that an increase in bank profits reduces bank risk-taking. Moreover, Shabir et al. (2021) underline that bank with high profitability are more stable. In the same vein, Tran et al. (2022) report a positive relation between net interest margin and the Z-SCORE in emerging and developing countries. In contrast, other studies find a negative impact of profitability in liquidity (Riahi, 2019). Indeed, to enhance profitability, banks need to allocate a greater proportion of their funds to higher-yielding, yet inherently illiquid, assets such as long-term investments.

Second, the bank capital can be linked to liquidity risk. On the one hand, more capital indicates that the bank encounter fewer problems and/or risky situations. Indeed, the risk absorption hypothesis states that the regulatory capital is positively related to the liquidity creation. It predicts that increased capital enhances the ability of banks to create liquidity because it allows them to absorb more risk (Repullo, 2004). Moreover, some studies confirm the positive impact of capital on liquidity (e.g. Distinguin et al., 2013). Thus, adequate capital makes it possible to manage any shocks to the balance sheet, and it also offers some protection to depositors. Several recent studies have found a positive impact of capital on bank stability. That is to say, more capital means that the bank encounters fewer problems and risky situations (Bermpei et al., 2018 ; Shabir et al., 2023 ; Shabir et al., 2021 ; Tran et al., 2022 ; Alouane et al., 2022 ; Almaskati, 2022; Ghenimi et al., 2021). Furthermore, Ghenimi et al. (2017) prove that the capital acts as a safety net for MENA banks in times of crisis, reducing the risk of bank insolvency. This confirms the results of Imbierowicz and Rauch (2014), stating that the capital ratio is negatively related to the probability of failure of US banks. Similarly, Dahir et al. (2018) report that well-capitalized BRICS banks tend to take less risk. This result is also in line with previous literature (Bonner et al., 2015; Khan et al., 2017). Moreover, Riahi (2019) suggests that

higher capital adequacy is an important indication of a bank's stability in GCC countries. In accordance with Yin (2019), a higher capital ratio is associated with a higher Z-SCORE, suggesting greater stability or a lower overall risk of bank failure. On the other hand, the financial fragility theory denotes that the capital is negatively linked to the liquidity creation. That is to say, higher capital is associated with lower supervision, leading to lower liquidity creation (Diamond & Rajan, 2000). Several works have affirmed the negative impact of capital on bank liquidity (e.g. Roman & Sargu, 2015). Moreover, banks with higher capital have an incentive to take on more risk (Acharya & Naqvi, 2012).

Third, the results of empirical studies on the impact of bank size on the bank liquidity are mixed. In fact, when a bank increases in size, it can achieve economies of scale (increasing returns to scale). This can happen through more efficient information systems, and also via better risk and resource management (Ünvan & Yakubu, 2020 ; Mohammad et al., 2020). Some authors account for the positive impact by the fact that large banks tend to be more stable, and customers feel more secure when dealing with large banks (Alzoubi, 2017 ; Wu et al., 2021 ; Phan et al., 2022). Nonetheless, large banks presume that they are 'too big to fail'. That being the case, they have an incentive to take on more risk, and hold more loans (Vodovà, 2011 ; Abdul-Rahman et al., 2018).

### **2.3. External factors and bank resilience to liquidity risk**

In order to achieve better liquidity control, it is essential to consider the impact of macroeconomic factors on bank liquidity stress. Different studies use various macroeconomic variables in their models, but common ones include income measures (e.g., real GDP or GDP per capita) and indicators of price stability, such as the consumer price index and institutional quality, which can be measured using governance indicators as presented by Kaufmann et al. (2011).

Considering economic growth, studies have found a negative impact of the GDP (Gross Domestic Product) on bank liquidity, indicating that during periods of economic growth, banks hold less liquidity. This finding makes obvious that global liquidity shocks are less likely to break out in times of economic growth. In contrast, the GDP shows no relationship with bank liquidity (Abdul-Rahman et al., 2018 ; Mahdi & Abbes, 2018 ; Tran et al., 2019 ; Hassan et al., 2019).

Concerning political stability, a growing body of literature has examined the link between institutional quality and the soundness of the banking sector. Mohammad et al. (2020) make obvious that establishing a high-performance atmosphere, guaranteed by the rule of law, enhances the confidence of customers and deposit accounts. This moderates and mitigates the exposure to liquidity risk, and leads to a successful political economy for the overall functioning of the banking system. Indeed, political instability provokes negative feelings among investors who become increasingly concerned about losing their money. This spurs them on to reorganize their portfolios by shifting their investments from riskier to safer assets, thereby reducing funding (Shleifer and Vishny, 2010). Political risk, characterized by fluctuations in investor sentiment, reduced credit growth, earnings volatility, and an elevated likelihood of default, is generally associated with greater banking sector fragility (Brandt & Gao, 2019; Lu et al., 2020). Bermpei et al. (2018) observe that the stabilizing effects of capital regulations and activity restrictions are amplified when political stability is high. This is consistent with Ghosh (2016), who found that political turmoil in the Middle East during the Arab Spring adversely affected bank stability. Strong institutional quality, reflected in political stability, tends to reduce adverse selection and

moral hazard among borrowers, improve lending conditions, and enhance credit repayment performance (Bae & Goyal, 2009).

### 3. Data and research methodology

#### 3.1. Data description

Our study focuses on a sample of 12 commercial banks in Tunisia, listed on the Tunis Stock Exchange (TSE): 9 private banks (Amen Bank, ATB, UBCI, UIB, BT, Attijari, BIAT, Wifak and BTE) and 3 state-owned banks (STB, BNA and BH). The period considered for this study runs from 2010 to 2021.

##### 3.1.1. Description of variables

###### 3.1.1.1. Dependent variable

The relationship between bank resilience to liquidity risk and the investment in digital financial inclusion remains insufficiently explained in the existing literature. We use the liquidity coverage ratio, as an indicator of financial resilience to short term liquidity shocks, following previous studies (Li et al. 2017; Akram & Hushmat, 2024; Barongo & Mbelwa, 2024). This ratio differs significantly from the Z-score (reflecting a bank's long-term financial stability) given that it targets short-term liquidity risk. Moreover, it is distinct from traditional bank liquidity ratios such as the current ratio or loan-to-deposit ratio (which measure the general balance between assets and liabilities). Indeed, LCR emphasizes resilience under stress conditions by focusing on liquidity availability in times of financial turmoil.

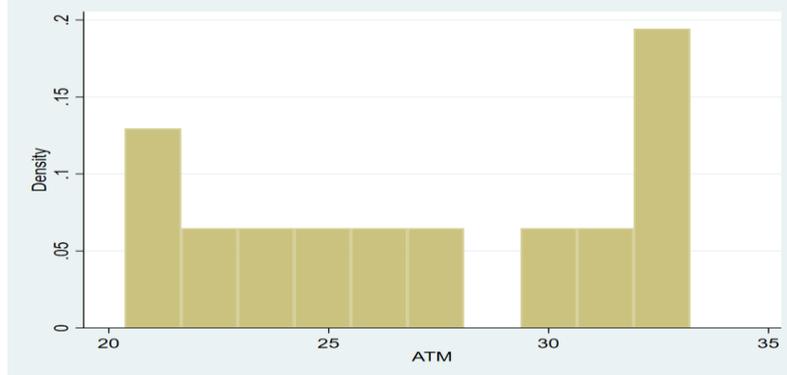
Defined under Basel III (BCBS, 2013), the LCR represents the ratio of High-Quality Liquid Assets (HQLA) to total net cash outflows expected during a 30-day liquidity stress period.

$$LCR = \frac{\text{stock of HQLA}}{\text{Net cash outflows}} > 100\%$$

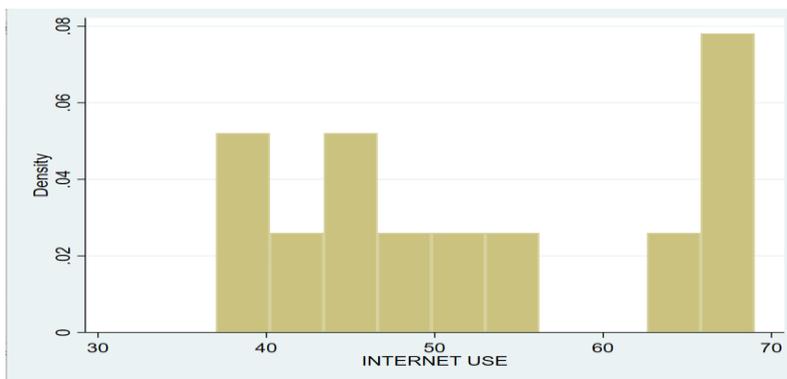
HQLA comprise only those assets that are expected to remain unencumbered and readily available during a 30-day stress scenario. Net cash outflows are defined as the difference between total expected cash outflows and total expected inflows over the same period. Fundamentally, the LCR assesses a bank's capacity to survive a 30-day period of severe liquidity stress (House et al., 2016).

###### 3.1.1.2. Independent variable

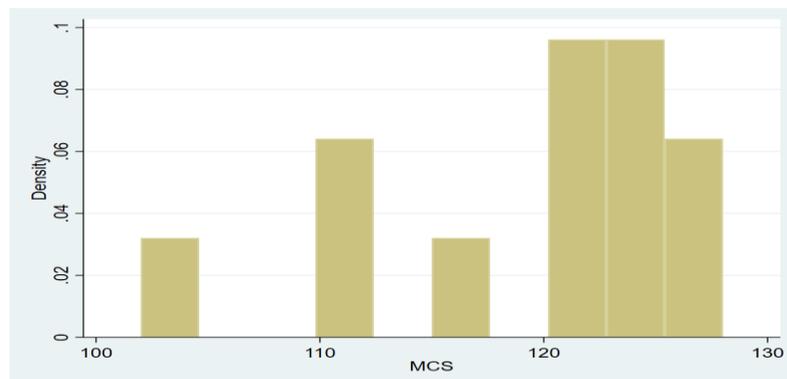
The financial inclusion index for Tunisia in the sample for the period 2010 to 2021 is constructed using data from the World Bank. In this paper, three indicators are used. The first indicator is represented by the number of automatic teller machines (ATMs per 100,000 adults). For the second indicator, we use the individuals using the Internet (% of population). The third represents the Mobile Cellular Subscriptions (% of population). The distribution histograms show the spread of the indicators in Tunisia, often revealing regional disparities: some areas have relatively low values while others reach high levels, reflecting differences in access to financial services, mobile technologies, and the Internet.



**Figure 1.** Distribution of ATMs per 100,000 Adults



**Figure 2.** Distribution of Internet Usage (% of Population)



**Figure 3.** Distribution of Mobile Cellular Subscriptions (% of Population)

**Sources.** Generated by Stata 17

Because these three indices tend to move together, we consider it reasonable to assign an equal weight to each of them. As such, in this paper, we use a technique to address their correlation. Following previous studies (Vo et al., 2021; Thatसरani et al., 2021), we use principal component analysis (PCA) to create a financial inclusion index. PCA is a useful method that is often used to examine the relationship between data and common tests. The PCA approach

considers the first component as the factor that might have the highest variation in explaining most of the fluctuations in the dataset. Successive components, in conjunction with the first component, form an orthonormal model and capture the remaining unexplained fluctuations.

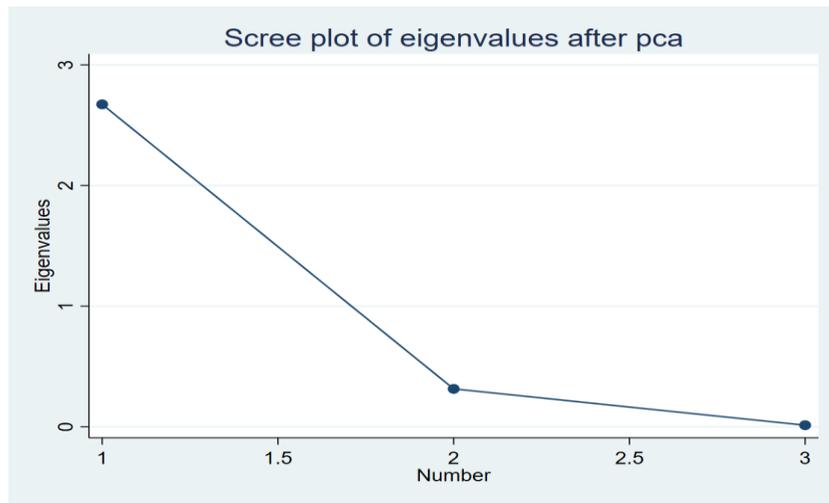
Table 1 shows the PCA results. It consists of transforming the correlated variables into a composite variable. The first component, with an eigenvalue greater than 1, explains up to 89.1% of the variations in the sample, indicating that it captures almost all of the information in the dataset. Since the remaining components have eigenvalues below 1, they are excluded according to the Kaiser criterion, and the composite financial index is therefore constructed using the loadings of the first principal component.

**Table 1.** PCA results

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	2.673	2.359	0.891	0.891
Comp2	0.314	0.301	0.105	0.996
Comp3	0.013	.	0.004	1.000
Principal components (eigenvectors)				
Variable	Comp1	Comp2	Comp3	Unexplained
INTUSE	0.589	-0.464	0.662	0
ATM	0.601	-0.296	-0.742	0
MCS	0.540	0.835	0.104	0

**Source.** Authors' calculations using PCA on Stata 17

The three principal components (PCs) have eigenvalues of 2.67, 0.31, and 0.013, respectively. As only the first component exceeds the threshold of 1, it is the sole component retained for deriving the weights of the PCs. Figure 4 provides a visual confirmation of this result.



**Figure 4.** Scree plot of eigenvalues

**Source.** Generated by Stata 17

**3.1.1.3. Control variables**

In our study, we select as internal variables the bank profitability measured by ROA, bank capital as measured by ratio of equity to risk weighted assets and bank size measured by the log total asset. Yet, external factors, which are not under the control of bank management, are GDP growth and political stability and absence of violence governance index.

Table 2 presents all of these variables.

**Table 2.** Variable definitions

<b>Variables</b>	<b>Definitions</b>	<b>Abbreviations</b>	<b>Data Source</b>
<b>Dependent variable</b>			
Bank liquidity resilience to short term stress	Liquidity coverage ratio	LCR	Annual Report
<b>Independent variable</b>			
Financial inclusion	Index of financial inclusion, measured by three indicators (Number of ATM, MCS and INTERNET USE)	FI	World Bank
Bank profitability	Return on asset= Ratio of net income to total assets	ROA	Annual Report
Bank capital	Capital adequacy ratio= Ratio of equity to risk weighed assets	CAR	Annual Report
Bank size	Natural logarithm of total asset	SIZE	Annual Report and Financial Statements
GDP growth	Real Gross Domestic Product growth rate	GDP	World Bank
Political stability and absence of violence	likelihood of a government being destabilized or overthrown through unconstitutional or violent means. It is measured on a scale ranging from -2.5 to +2.5	PS	World Governance Indicators

**Source.** The authors

**3.2. Research methodology**

It is worth reminding that this study investigated the relation between liquidity risk resilience measured by liquidity coverage ratio and financial inclusion. In this study, the estimation was performed using GMM-system. The control variables ROA, CAR, SIZE, GDP growth and institutional quality in term of political stability and absence of violence were added into our model. Then, our estimation was performed over the period running from 2010 to 2021. The choice of this period is explained by the fact that efforts toward financial inclusion in Tunisia began to emerge around 2010 (see figure 5). Moreover, in December 2010, the Basel Committee published the Basel III reforms, which were adopted to enhance banking regulation in the

aftermath of the financial crisis, including measures such as the Liquidity Coverage Ratio (LCR). The subsequent model is applied with a view to measuring the stability of our sample:

$$LCR_{i,t} = C + \delta_1 LCR_{i,t-1} + \alpha_1 FI_{i,t} + \alpha_2 ROA_{i,t} + \alpha_3 CAR_{i,t} + \alpha_4 SIZE_{i,t} + \beta_1 GDP_t + \beta_2 PS_t + \varepsilon_{i,t}$$

Where  $LCR_{i,t-1}$  is the first lagged dependent variable capturing the persistence in bank resilience to liquidity crises over time,  $\delta$ ,  $\alpha$  and  $\beta$  are coefficients for estimation, using the GMM-system.

S-GMM estimator developed by Arellano and Bover (1995) and Blundell and Bond (1998) is employed to address the biases inherent in static panel models, such as those arising from lagged dependent variables, endogeneity, and omitted variable bias.

### 3.2.1 Descriptive statistics

Over the 2010-2021 period, the LCR is distributed with a mean value of 1.411 which is well above the regulatory minimum of 1.00 (see table 3). In fact, it indicates that, on average, banks in the sample have 41.1% more HQLA than required. This suggests a strong short-term liquidity position, possibly reflecting conservative risk management or regulatory caution.

**Table 3.** Descriptive statistics

Variable	Mean	Std. Dev.	Min	Max	skewness	Kurtosis
LCR	1.411	0.909	0.462	5.573	2.400233	9.268947
FI	0	2.82	-5.41	3.713	-0.4364975	1.991109
ROA	0.012	0.013	-0.03	0.097	3.79584	28.02093
CAR	0.115	0.042	-0.062	0.22	-1.547589	8.882215
SIZE	15.687	0.473	14.7	16.77	-0.0441723	2.506127
GDP	1.242	3.514	-9	4.7	-1.991404	6.31107
PS	-0.759	0.288	-1.14	-0.064	1.129845	3.576829

**Source.** Authors' calculations using Stata 17

**Notes.** The mean corresponds to the average value of the variables; The standard deviation or variation corresponds to the distribution of data dispersed in relation to the mean value. Kurtosis reflects the shape of the distribution's tails. Skewness measures the direction and degree of asymmetry in the distribution of the data.

Hence, with a mean LCR value of 1.411, the banking institutions in the sample maintain a liquidity buffer well above the Basel III minimum requirement of 1.00. This indicates a satisfactory, and potentially conservative, approach to short-term liquidity risk management.

The skewness of all variables deviates from 0, suggesting that these variables do not follow a normal distribution. Additionally, the kurtosis of all variables differs from 3, further confirming that these variables are not normally distributed.

### 3.2.2. Correlation

The multicollinearity test aims at studying the correlation between independent variables. The bivariate multicollinearity occurs when two independent variables are closely correlated. Detecting this problem is based on the Pearson correlation matrix and variable influence factor. In fact, according to Kennedy (1985), when the correlation coefficient exceeds 0.8, he confirms the existence of this problem. For Fox (2005), the limit of VIF is 5.

**Table 4.** Pairwise correlation coefficients and the variance inflation factor (VIF) among variables

<b>Variables</b>	<b>(1)</b>	<b>(2)</b>	<b>(3)</b>	<b>(4)</b>	<b>(5)</b>	<b>(6)</b>	<b>VIF</b>
(1) FI	1.000						2.64
(2) ROA	0.150 (0.101)	1.000					1.19
(3) CAR	0.245* (0.007)	0.286* (0.002)	1.000				1.25
(4) SIZE	0.521* (0.000)	-0.169 (0.066)	-0.074 (0.425)	1.000			1.58
(5) GDP	-0.184* (0.045)	0.011 (0.904)	-0.103 (0.264)	-0.118 (0.198)	1.000		1.21
(6) PS	-0.586* (0.000)	-0.188* (0.040)	-0.011 (0.906)	-0.224* (0.014)	-0.194* (0.034)	1.000	1.9
<b>Notes.</b> *denotes the correlation coefficients with statistical significance at the 5% level.							<b>Mean VIF</b> 1.63

**Source.** Research findings

**Notes.** Pearson correlations between paired explanatory variables, these correlations relate to data extracted from 10 banks over the 2010-2021 period.

Based on table 4, the correlation coefficients between variables do not exceed 0.6. Thus, the problem of bivariate multicollinearity is completely absent. Similarly, the results indicate that none of the values of the multivariate multicollinearity exceed the limits aforementioned.

## 4. Empirical results

### 4.1 Unit Root and cointegration tests

To begin, we test the stationarity of the variables in our analysis. Table 5 presents the results of unit root tests: fisher test (augmented dickey-fuller test) and Lagrange multiplier test (Hadri, 2000). We observe that the majority of variables failed both of tests in level, which makes them non-stationary. However, in first difference, all the series are stationary with both proposed tests. Therefore, we can consider the variables as integrated of order 1.

**Table 5.** Unit root and cointegration tests

Tests		Variables	LCR	FI	ROA	CAR	SIZE	GDP	PS
Unit root tests	At level	Fisher dickey fuller	1.07 (0.14)	-1.25 (0.89)	0.51 (0.3)	-0.85 (0.8)	-2.25 (0.98)	0.15 (0.43)	6.22* (0.000)
		Hadri LM	7.51* (0.000)	19.1* (0.000)	0.82 (0.2)	11.19* (0.000)	18.83* (0.000)	-1.39 (0.91)	5.39* (0.000)
	At first difference	Fisher dickey-fuller	7.78* (0.000)	13.62* (0.000)	7.6* (0.000)	2.65 (0.004)	5.89 (0.000)	8.49 (0.000)	8.1 (0.000)
		Hadri LM	-2 (0.97)	1.28 (0.09)	-1.87 (0.96)	-1.02 (0.84)	-1.19 (0.88)	-2.4 (0.99)	6.56* (0.000)
Cointegration tests	Kao ADF	t-statistic	-6.05						
		p-value	0.000						
	Pedroni ADF	t-statistic	5.29						
		p-value	0.000						

**Source.** Research findings

We conduct a test to determine whether a cointegrating relationship exists. Table 5 displays the outcomes of two cointegration tests: Kao ADF (1999) and Pedroni ADF (2004). Since the p-values for both tests are less than 5%, we reject the null hypothesis of no cointegration, suggesting that there is at least one cointegrating relationship between the chosen variables.

#### 4.2 Regression results

Referring to table 6, Hansen's test shows that the p-value is not statistically significant, with a value higher than 0.1. This means that the null hypothesis  $H_0$  of the validity of the identification restrictions (instrument validity) cannot be rejected. Thus, we come to the inference that the instruments used for these regressions are valid, implying the validity of the results. What is more, the p-value of AR (2) is not statistically significant. This connotes that we cannot reject the hypothesis stating that there is no second-order autocorrelation. That being the case, the empirical model has been properly identified. Consequently, we come to the conclusion that the model estimated satisfies the diagnostic tests.

It is worth noting that the coefficient of the lagged dependent variable is significant, proving the dynamic nature of the model specification (Daher et al., 2015). Hence, the dynamic nature of our model is approved. Table 6 below shows the empirical results of estimating our model, using the GMM-system.

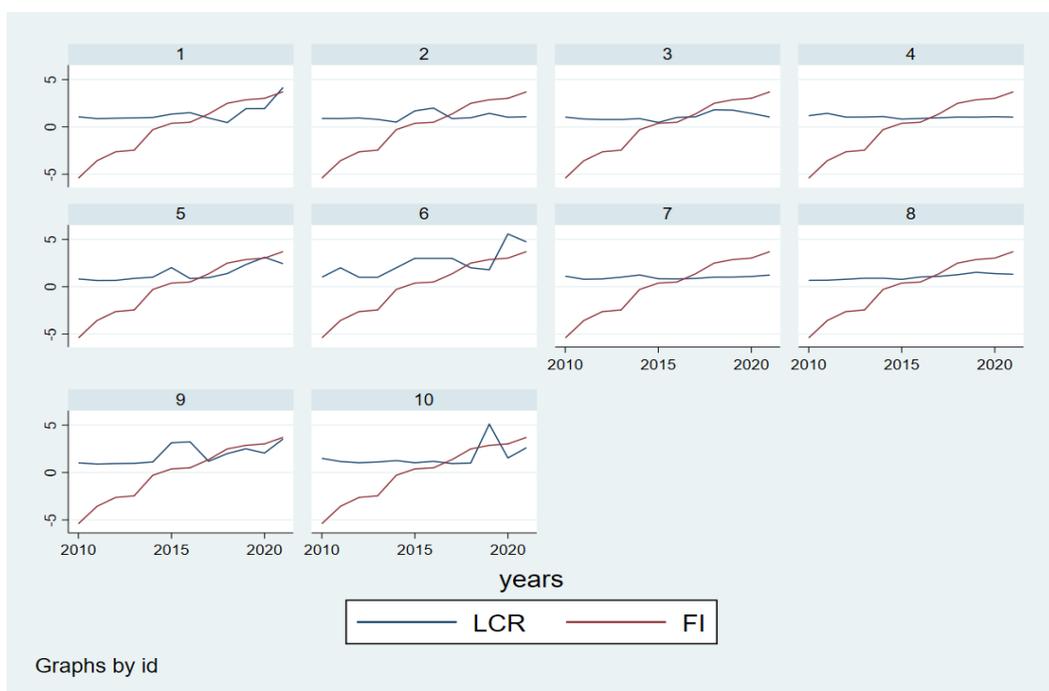
**Table 6.** S-GMM results

Variables	S-GMM
LCR <sub>t-1</sub>	0.44***(2.91)
FI	0.19***(2.68)
ROA	4.57*(1.73)
CAR	0.43(0.25)
SIZE	-1.14***(-2.71)
GDP	0.09(1.6)
PS	2.44*(1.77)
Constant	10.8**(2.31)
Diagnostic tests	
Wald chi2(7) (p-value)	0.000
AR(1)	0.028
AR(2)	0.133
Hansen test	0.421

**Source.** Research findings using Stata 17

**Notes.** LCR (Bank liquidity risk resilience) is the dependent variable; Values in parentheses indicate t-statistics; (\*), (\*\*) and (\*\*\*) indicate significance at the 10%, 5% and 1% thresholds, respectively.

Empirical results show a positive coefficient of FI with significance of 1%. That is to say, financial inclusion may contribute positively to the improvement of the Liquidity Coverage Ratio (LCR). In fact, financial inclusion, by expanding access to banking services and increasing the volume of stable retail deposits, indirectly enables banks to accumulate higher levels of high-quality liquid assets (HQLA). First, by attracting retail deposits, particularly from households, financial inclusion increases the volume of stable funding, which is less prone to sudden withdrawal compared to wholesale funding. Second, financial inclusion enables banks to diversify their sources of liquidity by expanding their customer base, thus decreasing reliance on more volatile or concentrated funding channels. Finally, as more individuals and small businesses are integrated into the formal financial system, aggregate savings are likely to rise. This enhanced mobilization of savings increases the volume of liquid assets available to banks, strengthening their short-term liquidity position and overall resilience in stress scenarios. Our results confirm our hypothesis, and align with several previous studies (Srivastava et al., 2025; Vo et al., 2021). We can clearly see the evolution of LCR in relation to the level of FI through the graph illustrated below (Figure 5).



**Figure 5.** Evolution of Banks' Liquidity Coverage Ratio with Financial Inclusion

**Source.** Generated by Stata 17

The analysis of the LCR in relation to financial inclusion (FI) shows that banks 1, 5, 6, 9, and 10 experience a slight increase in LCR as FI rises. In contrast, banks 2, 3, 4, 7, and 8 have a relatively stable LCR despite the growth in FI. Overall, these results suggest that higher financial inclusion does not harm the LCR and may even coincide with a moderate improvement in Tunisian banks.

With regard to bank profitability, our results prove a positive impact of ROA on LCR. Indeed, bank profit can stabilize or reduce cash outflows, can be used to accumulate or maintain high levels of HQLA. Moreover, more profitable banks face fewer unexpected liquidity shocks than their peers. This outcome is congruent with some previous studies conducted under the same context (Mahdi & Abbes, 2018; Effendi & Disman, 2017).

The coefficient associated to capital ratio is non-significant, proving that there is no impact of capital on Liquidity risk resilience (Effendi & Disman, 2017; Abdul-Rahman et al., 2018). Although capital ratios and the Liquidity Coverage Ratio (LCR) are both integral components of the Basel III regulatory framework, changes in capital ratios do not necessarily have a direct impact on the LCR. Indeed, LCR is designed to ensure short-term liquidity. Yet, capital ratios are designed to absorb losses and ensure solvency. That is to say, it is not necessarily liquid. For example, retained earnings or investments in subsidiaries may boost capital but cannot be quickly sold to meet liquidity needs. Hence, strong capitalization does not imply strong liquidity.

Regarding bank size, total assets display a negative and significant coefficient. This implies that large banks often have riskier asset structures (Vodovà, 2011), which can undermine their liquidity positions and reduce their ability to respond to short-term liquidity shocks effectively. In fact, they tend to engage in more complex financial activities, including investment

banking, derivatives trading, and international operations. These activities are often less liquid and more volatile, which reduces the overall liquidity profile of the institution. As a result, larger banks may hold a lower proportion of High-Quality Liquid Assets (HQLA) relative to their total exposures, thereby negatively affecting the LCR. Hence, although larger banks benefit from economies of scale, their increased complexity, reliance on wholesale funding, and lower proportion of stable deposits often undermine their short-term liquidity resilience.

Respecting economic growth, although macroeconomic conditions may indirectly influence bank behaviour, our findings indicate that GDP growth does not directly affect the Liquidity Coverage Ratio (LCR). This outcome is in accordance with some previous study focusing on measure of liquidity level and liquidity risk (Abdul-Rahman et al., 2018 ; Mahdi & Abbes, 2018 ; Tran et al., 2019; Hassan et al., 2019). Thus, the LCR remains a regulatory construct determined by a bank's internal liquidity profile and strategic decisions, independent of national economic output.

Eventually, political stability enhances bank resilience by reducing uncertainty, strengthening investor confidence, and supporting the accumulation of stable funding (Bermpei et al., 2018). A stable political environment fosters depositor confidence, supports market access, and reduces systemic liquidity shocks, thereby enhancing a bank's ability to maintain adequate levels of High-Quality Liquid Assets (HQLA) and manage cash outflows effectively.

## **5. Conclusion and futures research suggestions**

### **5.1 Conclusion**

Financial inclusion is a constantly evolving concept that differs across nations and can be studied from various perspectives, including those of financial institutions, authorities, and decision-makers. To reach this objective, we analyzed a sample of commercial banks from 2010 to 2021 and applied the system-generalized method of moments (S-GMM) as our empirical approach. The findings of this study suggest that enhanced financial inclusion significantly boosts resilience against bank liquidity issues. Regarding bank-specific factors, we observed that resilience to liquidity risk is more responsive to an increase in bank size and a decline in profitability.

### **5.2. Implications**

The results of our research carry several implications. To begin with, they offer guidelines for academic researchers on financial inclusion within the banking sector. Indeed, they consist of examining the impact of investment in financial inclusion on resilience to liquidity risk, an area that has received relatively less attention compared to the extensive literature linking financial inclusion to bank liquidity, stability, and risk. Add to that, the value is attributed to the study of banking sector in developing countries such as Tunisia, since the Tunisian context has not been explored in previous studies.

### **5.3. Limitations and futures research suggestions**

Our study has certain limitations. Firstly, it is difficult to make generalization from our results because of our limited sample size. It deals only with some Tunisian banks. Secondly, it examines only some bank variables. So, future researchers can look into other factors such as credit risk, capital, leverage, inflation and unemployment rate. Eventually, as a direction for future research, the study could be extended to other developing countries to broaden its scope and enable cross-country comparisons.

**REFERENCES**

- Abdul-Rahman, A., Sulaiman, A. A., & Said, N. L. H. M. (2018). Does financing structure affects bank liquidity risk?. *Pacific-Basin Finance Journal*, 52, 26-39. <https://doi.org/10.1016/j.pacfin.2017.04.004>
- Acharya, V., & Naqvi, H. (2012). The seeds of a crisis: A theory of bank liquidity and risk taking over the business cycle. *Journal of financial economics*, 106(2), 349-366. <https://doi.org/10.1016/j.jfineco.2012.05.014>
- Ahamed, M. M., & Mallick, S. K. (2019). Is financial inclusion good for bank stability? International evidence. *Journal of Economic Behavior & Organization*, 157, 403-427. <https://doi.org/10.1016/j.jebo.2017.07.027>
- Akram, H., & Hushmat, A. (2024). Bank liquidity creation, loan concentration and liquidity risk: a comparative analysis of dual banking system. *Journal of Islamic Accounting and Business Research*. <https://doi.org/10.1108/JIABR-07-2023-0228>
- Al-Chahadah, A. R., Refae, G. A. E., & Qasim, A. (2020). The impact of financial inclusion on bank performance: the case of Jordan. *International Journal of Economics and Business Research*, 20(4), 483-496. <https://doi.org/10.1504/IJEBR.2020.111096>
- Almaskati, N. (2022). The determinants of bank profitability and risk: A random forest approach. *Cogent Economics & Finance*, 10(1), 2021479. <https://doi.org/10.1080/23322039.2021.2021479>
- Alzoubi, T. (2017). Determinants of liquidity risk in Islamic banks. *Banks & bank systems*, 12(3), 142-148. [https://dx.doi.org/10.21511/bbs.12\(3\).2017.10](https://dx.doi.org/10.21511/bbs.12(3).2017.10)
- Arellano, M., & Bover, O. (1995). Another Look at the Instrumental Variable Estimation of Error-Components Models. *Journal of Econometrics*, 68(1), 29-51. [https://doi.org/10.1016/0304-4076\(94\)01642-D](https://doi.org/10.1016/0304-4076(94)01642-D)
- Bae, K. H., & Goyal, V. K. (2009). Creditor rights, enforcement, and bank loans. *The Journal of Finance*, 64(2), 823-860. <https://doi.org/10.1111/j.1540-6261.2009.01450.x>
- Barongo, R. I., & Mbelwa, J. T. (2024). Using machine learning for detecting liquidity risk in banks. *Machine Learning with Applications*, 15, 100511. <https://doi.org/10.1016/j.mlwa.2023.100511>
- Bartel, A.P. (1994) Productivity Gains from the Implementation of Employee Training Program, *Industrial Relations*, Vol. 33, pp. 411-422. <https://doi.org/10.1111/j.1468232X.1994.tb00349.x>
- Bermpei, T., Kalyvas, A., & Nguyen, T. C. (2018). Does institutional quality condition the effect of bank regulations and supervision on bank stability? Evidence from emerging and developing economies. *International Review of Financial Analysis*, 59, 255-275. <https://doi.org/10.1016/j.irfa.2018.06.002>
- Blundell, R., & Bond, S. (1998). Initial Conditions and Moment Restrictions in Dynamic Panel Data Models. *Journal of Econometrics*, 87(1), 115-143. [https://doi.org/10.1016/S0304-4076\(98\)00009-8](https://doi.org/10.1016/S0304-4076(98)00009-8)
- Bonner, C., Lelyveld, I. V., & Zymek, R. (2015). Banks' liquidity buffers and the role of liquidity regulation. *Journal of Financial Services Research*, 48(3), 215-234. <https://doi.org/10.1007/s10693-014-0207-5>
- Daher, H., Masih, M., & Ibrahim, M. (2015). The unique risk exposures of Islamic banks' capital buffers: A dynamic panel data analysis. *Journal of International Financial Markets, Institutions and Money*, 36, 36-52. <https://doi.org/10.1016/j.intfin.2015.02.012>
- Dahir, A. M., Mahat, F. B., & Ali, N. A. B. (2018). Funding liquidity risk and bank risk-taking

- 354 *Financial Inclusion as a Determinant of Short-Term Liquidity Risk in Tunisia's Banking Sector* in BRICS countries: An application of system GMM approach. *International Journal of Emerging Markets*, 13(1), 231-248. <https://doi.org/10.1108/IJoEM-03-2017-0086>
- Diamond, D. W., & Rajan, R. G. (2000). A theory of bank capital. *the Journal of Finance*, 55(6), 2431-2465. <https://doi.org/10.1111/0022-1082.00296>
- Distinguin, I., Roulet, C., & Tarazi, A. (2013). Bank regulatory capital and liquidity: Evidence from US and European publicly traded banks. *Journal of Banking & Finance*, 37(9), 3295-3317. <https://doi.org/10.1016/j.jbankfin.2013.04.027>
- Effendi, K. A., & Disman, D. (2017). Liquidity risk: Comparison between Islamic and conventional banking. *European Research Studies Journal*, 20(2), 308–318. <https://doi.org/10.35808/ersj/643>.
- Fox, J. (2005). Linear models, problems. *Encyclopedia of social measurement*, 2, 515-522.
- Fungáčová, Z., & Weill, L. (2015). Understanding financial inclusion in China. *China Economic Review*, 34, 196-206. <https://doi.org/10.1016/j.chieco.2014.12.004>
- Gharbi, I., & Kammoun, A. (2022). Relationship between digital banking and financial inclusion: Evidence from Tunisia. *International Journal of Business Studies*, 6(3), 168-177.
- Ghenimi, A., Chaibi, H., & Omri, M. A. B. (2017). The effects of liquidity risk and credit risk on bank stability: Evidence from the MENA region. *Borsa Istanbul Review*, 17(4), 238-248. <https://doi.org/10.1016/j.bir.2017.05.002>
- Ghenimi, A., Chaibi, H., & Omri, M. A. B. (2021). Liquidity risk determinants: Islamic vs conventional banks. *International Journal of Law and Management*, 63(1), 65-95. <https://doi.org/10.1108/IJLMA-03-2018-0060>
- GSMA. (2019). *The Mobile Economy: Sub-Saharan Africa*. GSMA Publications.
- Hassan, M. K., Khan, A., & Paltrinieri, A. (2019). Liquidity risk, credit risk and stability in Islamic and conventional banks. *Research in International Business and Finance*, 48, 17-3. <https://doi.org/10.1016/j.ribaf.2018.10.006>
- House, M., Sablik, T., & Walter, J. R. (2016). Understanding the new liquidity coverage ratio requirements. *Richmond Fed Economic Brief*, (Jan).
- Imbierowicz, B., & Rauch, C. (2014). The relationship between liquidity risk and credit risk in banks. *Journal of Banking & Finance*, 40, 242-256. <https://doi.org/10.1016/j.jbankfin.2013.11.030>
- Jahan, S., De, J., Jamaludin, F., Sodsriwiboon, P., & Sullivan, C. (2019). *The Financial Inclusion Landscape in the Asia-Pacific Region: A Dozen Key Findings*.
- Jungo, J., Madaleno, M., & Botelho, A. (2024). The role of financial inclusion and institutional factors on banking stability in developing countries. *International Journal of Development Issues*, 23(3), 361-377. <https://doi.org/10.1108/IJDI-09-2023-0233>
- Kaufmann, D., Kraay, A. and Mastruzzi, M. (2010), *The Worldwide Governance Indicators: Methodology and Analytical Issues*. The World Bank, <sup>[1]</sup><sub>SEP</sub>Development Research Group, Macroeconomics and Growth Team: Policy Research Working Paper, No: 5430. <https://doi.org/10.1017/S1876404511200046>
- Kennedy, P. (1985). *A Guide to Econometrics*, MA: MIT Press, Cambridge
- Khan, M. S., Scheule, H., & Wu, E. (2017). Funding liquidity and bank risk taking. *Journal of banking & finance*, 82, 203-216. <https://doi.org/10.1016/j.jbankfin.2016.09.005>
- Khémiri, W., Chafai, A., Attia, E. F., Tobar, R., & Farid Fouad, H. (2024). Trade-off between financial inclusion and Islamic bank stability in five GCC countries: the moderating effect of CSR. *Cogent Business & Management*, 11(1), 2300524. <https://doi.org/10.1080/23311975.2023.2300524>

- Li, B., Xiong, W., Chen, L., & Wang, Y. (2017). The impact of the liquidity coverage ratio on money creation: A stock-flow based dynamic approach. *Economic Modelling*, 67, 193-202. <https://doi.org/10.1016/j.econmod.2016.12.016>
- Mahdi, I. B. S., & Abbes, M. B. (2018). Relationship between capital, risk and liquidity: a comparative study between Islamic and conventional banks in MENA region. *Research in International Business and Finance*, 45, 588-596. <https://doi.org/10.1016/j.ribaf.2017.07.113>
- Mohammad, S., Asutay, M., Dixon, R., & Platonova, E. (2020). Liquidity risk exposure and its determinants in the banking sector: A comparative analysis between Islamic, conventional and hybrid banks. *Journal of International Financial Markets, Institutions and Money*, 66, 101196. <https://doi.org/10.1016/j.intfin.2020.101196>
- Owen, A. L., & Pereira, J. M. (2018). Bank concentration, competition, and financial inclusion. *Review of development finance*, 8(1), 1-17. <https://doi.org/10.1016/j.rdf.2018.05.001>
- Phan, D. H. B., Tran, V. T., & Iyke, B. N. (2022). Geopolitical risk and bank stability. *Finance Research Letters*, 46, 102453. <https://doi.org/10.1016/j.frl.2021.102453>
- Repullo, R. (2004). Capital requirements, market power, and risk-taking in banking. *Journal of financial Intermediation*, 13(2), 156-182. <https://doi.org/10.1016/j.jfi.2003.08.005>
- Riahi, Y. M. (2019). How to explain the liquidity risk by the dynamics of discretionary loan loss provisions and non-performing loans? The impact of the global crisis. *Managerial Finance*, 45(2), 244-262. <https://doi.org/10.1108/MF-12-2017-0520>
- Roman, A., & Sargu, A. C. (2015). The impact of bank-specific factors on the commercial banks liquidity: Empirical evidence from CEE countries. *Procedia Economics and Finance*, 20, 571-579. [https://doi.org/10.1016/S2212-5671\(15\)00110-0](https://doi.org/10.1016/S2212-5671(15)00110-0)
- Shabir, M., Jiang, P., Bakhsh, S., & Zhao, Z. (2021). Economic policy uncertainty and bank stability: Threshold effect of institutional quality and competition. *Pacific-Basin Finance Journal*, 68, 101610. <https://doi.org/10.1016/j.pacfin.2021.101610>
- Shabir, M., Jiang, P., Wang, W., & Işık, Ö. (2023). COVID-19 pandemic impact on banking sector: A cross-country analysis. *Journal of Multinational Financial Management*, 67, 100784. <https://doi.org/10.1016/j.mulfin.2023.100784>
- Shleifer, A., & Vishny, R. W. (2010). Unstable banking. *Journal of financial economics*, 97(3), 306-318. <https://doi.org/10.1016/j.jfineco.2009.10.007>
- Soewignyo, F., & Soewignyo, T. I. (2015). Workforce Factors and Banking Performance. *Journal of US-China Public Administration*, 12(11), 823-832. <https://doi.org/10.17265/1548-6591/2015.11.001>
- Srivastava, N., Mohanty, P. K., & Kesari, N. (2025). Financial inclusion and bank stability: Evidence from the Indian banking system. *Economics Letters*, 250, 112303. <https://doi.org/10.1016/j.econlet.2025.112303>
- Thathsarani, U. S., Wei, J., & Samaraweera, G. R. S. R. C. (2021). Financial inclusion's role in economic growth and human capital in South Asia: An econometric approach. *Sustainability*, 13(8), 4303. <https://doi.org/10.3390/su13084303>
- Tran, T. T., Nguyen, Y. T., & Long, T. (2019). The determinants of liquidity risk of commercial banks in Vietnam. *Banks and Bank Systems*, 14(1), 94. [http://dx.doi.org/10.21511/bbs.14\(1\).2019.09](http://dx.doi.org/10.21511/bbs.14(1).2019.09)
- Tran, S., Nguyen, D., & Nguyen, L. (2022). Concentration, capital, and bank stability in emerging and developing countries. *Borsa Istanbul Review*, 22(6), 1251-1259.

<https://doi.org/10.1016/j.bir.2022.08.012>

- Ünvan, Y. A., & Yakubu, I. N. (2020). Do bank-specific factors drive bank deposits in Ghana?. *Journal of Computational and Applied Mathematics*, 376, 112827. <https://doi.org/10.1016/j.cam.2020.112827>
- Vodova, P. (2011). Liquidity of Czech commercial banks and its determinants. *International Journal of mathematical models and methods in applied sciences*, 5(6), 1060-1067.
- Vo, D. H., Nguyen, N. T., & Van, L. T. H. (2021). Financial inclusion and stability in the Asian region using bank-level data. *Borsa Istanbul Review*, 21(1), 36-43. <https://doi.org/10.1016/j.bir.2020.06.003>
- Wang, R., & Luo, H. R. (2022). How does financial inclusion affect bank stability in emerging economies?. *Emerging Markets Review*, 51, 100876. <https://doi.org/10.1016/j.ememar.2021.100876>
- Wang, X., & Wang, X. (2022). Digital financial inclusion and household risk sharing: Evidence from China's digital finance revolution. *China Economic Quarterly International*, 2(4), 334-348. <https://doi.org/10.1016/j.ceqi.2022.11.006>
- Wu, J., Li, H., Zheng, D., & Liu, X. (2021). Economic uncertainty or financial uncertainty? An empirical analysis of bank risk-taking in Asian emerging markets. *Finance Research Letters*, 39, 101542. <https://doi.org/10.1016/j.frl.2020.101542>
- Xie, J. (2025). Banking evolution in the digital age: How digital financial inclusion induces systematic financial risk?. *Finance Research Letters*, 80, 107351. <https://doi.org/10.1016/j.frl.2025.107351>
- Yakubu, I. N., & Musah, A. (2024). The nexus between financial inclusion and bank profitability: A dynamic panel approach. *Journal of Sustainable Finance & Investment*, 14(2), 430-443. <https://doi.org/10.1080/20430795.2022.2105792>
- Yang, D., & Choi, H. (2007). Are remittances insurance? Evidence from rainfall shocks in the Philippines. *The World Bank Economic Review*, 21(2), 219-248. <https://doi.org/10.1093/wber/lhm003>
- Yang, F., & Masron, T. A. (2024). Role of financial inclusion and digital transformation on bank credit risk. *Journal of International Financial Markets, Institutions and Money*, 91, 101934. <https://doi.org/10.1016/j.intfin.2023.101934>

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