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Article

Does Financial Inclusion Affect Non-Performing Loans and Liquidity Risk in the MENA Region? A Comparative Analysis Between GCC and Non-GCC Countries

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Abstract: Over the past decade, the debate on the microeconomic effects of financial inclusion has intensified, with a growing body of research exploring how access to financial services impacts banks' behaviors. Studying the effect of financial inclusion on bank risk is crucial because it helps understand how expanding access to financial services influences exposure to bank risks. This study explores the impact of financial inclusion on credit risk, measured by non-performing loans (NPLs), and liquidity risk measured by the loan-to-deposit (LTD) ratio in the Middle East and North Africa (MENA) region. The analysis is based on a sample of 74 banks observed between 2010 and 2021, and uses the System Generalized Method of Moments (SGMM). To conduct a comparative analysis, the whole sample is divided into two groups: the first includes GCC countries, while the second consists of non-Gulf Cooperation Council countries (NGCC). This sensitivity analysis was justified by several economic, financial, social, and regulatory differences between these two groups of countries. The findings reveal that across the MENA region and the two sub-regions, financial inclusion significantly reduces liquidity risk. However, it increases the level of NPLs in the Gulf Cooperation Council (GCC) countries. Furthermore, findings indicate that banks in the MENA region and the GCC countries benefit from an interaction between financial inclusion and liquidity since it significantly reduces the level of NPLs. Finally, the analysis shows that financial inclusion does not play a moderating role in the relationship between credit and liquidity risks in the NGCC countries.



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1. Introduction

Financial inclusion is recognized as a key driver of inclusive economic growth, attracting increasing interest from researchers and policymakers (Emara & El Said, 2021; Van et al., 2019). It has become a central focus of sustainable development policies due to its positive impact on national economies. By improving access to financial services, financial inclusion promotes the development of the financial sector and enables businesses to obtain financing at lower costs (M. M. Ahamed & Mallick, 2019). Many researchers and institutions have attempted to define financial inclusion, with some offering more precise definitions than others. According to the International Monetary Fund (IMF, 2015), financial inclusion is

defined as “the access to and use of formal financial services by households and businesses”. [Wang and Shihadeh \(2015\)](#) argue that financial inclusion can help reduce banking risks by facilitating access to financial services, particularly for vulnerable populations.

Banks are exposed to several financial risks, including liquidity risk, credit risk interest rate risk, exchange risk, and operational risk ([Cecchetti & Schoenholtz, 2011](#)). However, special attention was paid to credit risk and liquidity risk ([Bouslimi et al., 2024](#); [Hakimi et al., 2022a](#)). According to [Dermine \(1986\)](#), liquidity risk is seen as a cost that reduces gains, while defaulting on payments exacerbates liquidity risk by reducing cash inflows. Additionally, the literature suggests that credit and liquidity risks are positively correlated ([Hakimi et al., 2022a](#)). Liquidity is essential for banking operations ([Cornetta et al., 2011](#)), while lending remains a key source of profitability for banks ([Greuning & Bratanovic, 2004](#)).

The financial intermediation theory ([Diamond, 1984](#); [Leland & Pyle, 1977](#)) posits that financial institutions facilitate fund transfers between surplus clients and those in need of financing while reducing information asymmetries and transaction costs. Thus, they promote financial inclusion by leveraging their expertise and risk-sharing mechanisms ([Fama, 1980](#); [Levine, 1997](#)). Furthermore, the financial intermediation theory ([Bhattacharya & Thakor, 1993](#)) asserts that banks fulfill two primary functions: providing liquidity and managing risk transfers. While liquidity and credit risks are interdependent, most studies analyze them separately ([F.-W. Chen et al., 2018](#); [Hakimi & Zaghdoudi, 2017](#)), leaving gaps in understanding their impact on financial stability and financial inclusion.

Financial inclusion can help reduce bank risk by broadening the customer base, stabilizing funding sources, and improving credit diversification. When more individuals and businesses gain access to banking services, banks benefit from a larger and more stable deposit base, which enhances liquidity and reduces reliance on volatile wholesale funding. Inclusion also spreads credit exposure across a wider population, lowering the concentration of risk. Additionally, access to financial services encourages savings, improves financial literacy, and enables better monitoring of borrowers through formal credit histories, all of which contribute to more informed lending decisions and lower default rates.

Nevertheless, the effect of financial inclusion on credit and liquidity risks remains inconclusive and the empirical studies on this topic provide mixed results. On the one hand, financial inclusion can reduce credit risk by broadening access to financial services, improving borrowers’ credit profiles, and fostering economic stability ([Hakimi et al., 2023](#); [Shihadeh & Liu, 2019](#)). On the other hand, it can increase liquidity risk if financial institutions are not adequately equipped to manage a larger pool of customers with varying risk profiles ([Le et al., 2019](#); [Musau, 2022](#)). Moreover, while greater financial inclusion may promote economic growth, it can also lead to higher levels of lending to underserved, potentially higher-risk populations, complicating the overall risk landscape and increasing credit risk ([Ghasarma et al., 2019](#); [Musau et al., 2017](#)). Hence, the impact of financial inclusion on credit and liquidity risk remains context-dependent, requiring further investigation to fully understand its implications across different economies and financial systems. This study seeks to fill this gap by examining such relationships in the MENA region.

This paper aims to examine the impact of financial inclusion credit risk, measured by the NPL ratio and liquidity risk measured by the LTD ratio in the MENA countries. Additionally, we investigate the reciprocal relationship between credit risk and liquidity risk in the MENA region and the moderating role of financial inclusion. We analyze a sample of 74 banks from 10 MENA countries over the period 2010–2021, using the SGMM technique. To conduct a comparative analysis, the total sample is divided into two subgroups: the first focuses on GCC countries, while the second includes NGCC countries.

The MENA region presents a compelling case study for analyzing the impact of financial inclusion on credit and liquidity risk due to its unique blend of economic, financial, and social characteristics. Despite having relatively advanced banking systems in some countries, much of the region suffers from low levels of financial inclusion, with large segments of the population, especially women, youth, and rural communities, remaining unbanked or underbanked. This creates both risks and opportunities for financial institutions: as inclusion efforts expand, banks may gain more stable deposit bases, improving liquidity, but they may also face higher credit risk if newly included borrowers lack credit histories or financial literacy. Additionally, the region features diverse regulatory environments and includes both oil-rich GCC nations and more financially strained NGCC countries, allowing for comparative analysis. These contrasts make MENA an ideal setting to study how broadening financial access influences banks' risk exposure in varying economic and institutional contexts. As a consequence, a sensitivity analysis seems very useful by dividing the whole sample into GCC and NGCC countries.

GCC countries differ from NGCC countries economically by relying heavily on oil exports, leading to resource-driven economies with less diversified sectors. Financially, GCC markets are often less mature, with a higher level of state involvement and lower financial inclusion compared to more diversified NGCC economies. Socially, GCC nations have unique demographics, including high expatriate populations and strong cultural ties to conservative traditions. Regulatorily, GCC countries typically have evolving regulatory frameworks influenced by Islamic finance principles and centralized governance, while non-GCC countries often have more established, independent, and internationally aligned regulatory systems.

The empirical results indicate that financial inclusion reduces liquidity risk but does not play a moderating role between credit and liquidity risks for the whole sample. However, financial inclusion has a positive effect on liquidity risk in both sub-regions. The reciprocal relationship between credit and liquidity risk suggests that financial inclusion does not moderate this relationship in the whole sample and the NGCC countries. Nevertheless, the interaction between financial inclusion and liquidity risk has a negative and significant impact on NPLs for banks in the GCC region.

The MENA region could be an appropriate case study for several reasons. The banking sector plays a crucial role in economic development and growth. In several countries of this region, economic stability is highly dependent on the strength of the banking system. For instance, banking assets represent between 60% and over 100% of the gross domestic product (GDP) in MENA countries (Ghosh, 2017). However, this sector remains characterized by the dominance of public banks, high levels of NPLs, and high liquidity risk. These characteristics justify the need to analyze financial inclusion and banking risks, which are essential elements for ensuring the stability of the financial system and, by extension, the overall economy.

This study differs from previous research and offers several contributions to the literature. First, to the best of the authors' knowledge, this is the first study to explore the relationship between financial inclusion, credit risk, and liquidity risk in the MENA region. Second, this region provides a relevant analytical framework, as its banking system is central in financing the economy. Strengthening financial inclusion is therefore an essential lever for ensuring the stability of this sector. Third, unlike previous studies that primarily focused on the impact of credit or liquidity risk on banking profitability, this study examines the effect of financial inclusion on the main critical risk in the MENA region. It also explores the interaction between credit and liquidity risk in the MENA region, while highlighting the moderating role of financial inclusion. Fourth, this study conducts a sensitivity analysis by dividing the MENA region into GCC and NGCC countries.

The remainder of this paper is structured as follows. Section 2 reviews the literature on the impact of financial inclusion on banking risks and the interaction between credit and liquidity risk. Section 3 outlines the sample and describes the empirical methodology. The empirical findings are discussed in Section 4, while Section 5 concludes and addresses policy recommendations.

2. Literature Review

2.1. The FI-Credit and Liquidity Risks Nexus

The impact of financial inclusion on banking risks remains a topic of debate among researchers. Theoretically, it was expected that financial inclusion would reduce bank risk by expanding the deposit base, enhancing funding stability, and diversifying credit exposure. It also improves borrower monitoring through formal credit histories and promotes more informed lending, leading to lower default and liquidity risks.

However, empirically, the results concerning the effect of financial inclusion on bank risks are inconclusive. For example, [Shihadeh and Liu \(2019\)](#), using a sample of 701 banks in 189 countries, found a negative and significant effect of financial inclusion on credit risk.

In contrast, [Ghasarma et al. \(2019\)](#), using a panel model on 34 banks in Indonesia, observed a positive and significant effect on credit risk. [Musau et al. \(2017\)](#), through a panel analysis of 43 banks in Kenya, confirmed a significant impact.

Regarding liquidity risk, [Le et al. \(2019\)](#), applying Feasible Generalized Least Squares (FGLS) to 31 Asian countries, showed that financial inclusion increases liquidity risk. In the same vein, [Musau \(2022\)](#), studying 42 commercial banks in Kenya, also revealed a positive effect. However, [Musau et al. \(2017\)](#), using a panel model on 43 Kenyan banks (2007–2015), found a negative and significant impact.

Other studies highlight contrasting effects depending on the context of studies. For example, [Ozili \(2021\)](#), applying an Ordinary Least Squares (OLS) regression to a sample of 79 countries, showed that financial inclusion increases risk in advanced and developed countries but reduces it in developing countries. [Siddik and Kabiraj \(2018\)](#), using a dynamic panel GMM model, emphasized its role in risk diversification. [Banna et al. \(2021\)](#), studying 534 banks in 24 OIC countries, confirmed a significant effect on banking risk. Finally, [Danisman and Tarazi \(2020\)](#), using a dynamic panel model and GMM, found a negative but insignificant effect on credit risk.

The effect of financial inclusion on credit risk in the MENA region was explored by [Hakimi et al. \(2023\)](#). By applying the Generalized Method of Moments in system (SGMM) to 38 banks in 10 MENA countries over the period 2004–2017, the authors found a negative impact on non-performing loans.

The regional scope of studies on financial inclusion, credit risk, and liquidity risk has been broader in regions like Sub-Saharan Africa ([Chinoda & Mingiri Kapingura, 2024](#)), South Asia ([Y. K. Chen et al., 2018](#)), and Latin America ([Motta & Gonzalez Farias, 2022](#)), where research often emphasizes financial access and development. In comparison, the MENA region has received less attention, making its regional scope underrepresented despite its distinct financial systems and low levels of inclusion, highlighting the need for more focused research in this context ([Hakimi et al., 2023](#)).

Based on the development above, we can formulate the following hypothesis:

H1: *Financial inclusion reduces the level of banking risks.*

2.2. Bank Characteristics and Banking Risks

This sub-section examines the impact of bank-specific factors like bank size, capital, and concentration on banking risks, particularly credit and liquidity risks.

Concerning bank size, several studies have analyzed the impact of bank size on banking risks. For instance, [Chaibi and Ftit \(2015\)](#) show that bank size is positively and significantly associated with NPLs in France and Germany. [Hakimi et al. \(2022a\)](#) indicate that bank size has a positive and significant impact on liquidity risk in MENA countries. However, in another study, [Hakimi et al. \(2023\)](#) reported that bank size has a negative and significant impact on NPLs in the MENA region. Other studies, such as those by [Ghneimi et al. \(2017\)](#) and [Boussaada et al. \(2022\)](#), reveal that bank size has a negative effect on liquidity risk.

It was recognized that capital plays a crucial role in risk management. Studies like those of [Makri et al. \(2014\)](#) show that bank capital has a negative effect on NPLs. However, [Hakimi et al. \(2023\)](#) find a positive and significant impact of bank capital on NPLs in the MENA region. For the same context, [Boussaada et al. \(2022\)](#) indicate a negative and significant effect between capital and liquidity risk for banks with low levels of liquidity, but this effect becomes insignificant for banks with high liquidity levels. [Radivojevic et al. \(2019\)](#) conclude that bank capital has an insignificant effect on NPLs in emerging Latin American economies.

Bank concentration could also influence banking risk in complex ways. Indeed, [Saif-Alyousfi et al. \(2020\)](#) find that concentration, measured by the Herfindahl–Hirschman Index (HHI), has a negative and significant effect on credit risk in GCC economies. [T. Beck et al. \(2003\)](#) show that concentration reduces banking risks in a sample of 69 countries. However, studies like those by [Jiang et al. \(2017\)](#) and [Kumar et al. \(2018\)](#) find that concentration has no significant impact on banking risks.

2.3. Macroeconomic Environment and Banking Risks

Gross domestic product (GDP) is often considered a key indicator of banking stability, directly influencing risk levels. Several studies have explored this relationship under different economic contexts and methodological approaches. [Radivojevic et al. \(2019\)](#), using the Generalized Method of Moments (GMM) on emerging Latin American countries, found that high GDP growth is associated with an increase in non-performing loans (NPLs). In contrast, [Chaibi and Ftit \(2015\)](#), through a GMM analysis of French and German banks, demonstrated an opposite effect, where higher economic growth significantly reduces NPLs. Similar results were obtained by [Makri et al. \(2014\)](#) and [Skarica \(2014\)](#), who showed that an improvement in GDP fosters loan repayment, thereby reducing bad debts. Regarding liquidity risk, findings are more mixed. [Udin et al. \(2021\)](#), studying 24 Asia-Pacific countries, found that the effect of GDP on liquidity risk varies depending on the income level of the countries. Likewise, [F. Ahamed \(2021\)](#) and [Amara and Mabrouki \(2019\)](#), analyzing banks in Bangladesh and Tunisia, respectively, highlighted a positive but sometimes insignificant impact of GDP on banking liquidity.

Inflation also plays a crucial role in financial stability, although its effects can be ambiguous. [Chaibi and Ftit \(2015\)](#) found a negative and significant relationship between inflation and NPLs, suggesting that moderate inflation could enhance borrowers' ability to repay their debts. A similar conclusion was reached by [Hakimi et al. \(2023\)](#), whose GMM analysis of banks in the MENA region (2004–2017) confirmed that inflation decreases the level of NPLs. However, its impact on banking liquidity remains debated. For instance, [Boussaada et al. \(2022\)](#), using a PSTR regression model on a sample of MENA banks, showed that inflation tends to increase liquidity risk for the most vulnerable banks, whereas this effect is less pronounced for well-capitalized institutions. Similarly, [Hakimi et al. \(2022a\)](#), through a Seemingly Unrelated Regression (SUR) analysis, found that inflation can mitigate liquidity risk by facilitating interest rate adjustments. Thus, while GDP growth

and inflation influence banking risk, their impact largely depends on the economic context and the level of development of the countries studied.

2.4. The Reciprocal Relationship Between Liquidity Risk and Credit Risk: The Moderating Role of Financial Inclusion

Research has highlighted a complex relationship between liquidity risk, credit risk, and financial inclusion. [Musau et al. \(2018\)](#) indicate that the availability, accessibility, and usage of banking services significantly affect the credit risk of commercial banks in Kenya. This suggests that an increase in financial inclusion could lead to higher credit risk, as greater access to credit may result in an accumulation of risky loans. In contrast, [Hakimi et al. \(2023\)](#) offer a different perspective, arguing that financial inclusion can reduce credit risk by expanding access to financial services while promoting prudent liquidity management. Similarly, [Mekouar and Robert \(2019\)](#) further contribute to this discussion by highlighting the benefits of financial inclusion for banks, particularly in terms of potentially reducing both credit and liquidity risks. A diversified customer base can help stabilize cash flows and lower vulnerability to economic shocks. These findings underscore the importance of further research to better understand how financial inclusion influences both credit risk and liquidity risk in the banking sector. With reference to the development above, we can propose the following hypothesis:

H2: *Financial inclusion moderates the relationship between credit and liquidity risks.*

3. The Sample and Empirical Approach

3.1. The Sample

To analyze the impact of financial inclusion on banking risks and to examine the moderating role of financial inclusion (IFI) in the relationship between liquidity risk (LTD) and non-performing loans (NPLs), we used bank and country level data for the period 2010–2021. The initial sample included 124 banks from 10 MENA countries. However, several banks were excluded. As a result, the final sample consisted of 74 banks. These banks were excluded from the sample to ensure data consistency, comparability, and analytical reliability. Common reasons include missing or incomplete financial data, especially related to NPLs and LTD ratios, and outlier status due to size or risk profile. Excluding such banks helps maintain a homogeneous and relevant sample, improving the validity of the results.

Due to economic, financial, and regulatory differences, this total sample was subdivided into banks belonging to the GCC region (42 banks) and those in the NGCC region (32 banks). In this study, there are three main data sources. Data relating to bank specifics were obtained from the annual reports of each bank and the Refinitiv Eikon database. Data on financial inclusion were collected from the Global Financial Development Database, and macroeconomic variables were sourced from the World Development Indicators (WDI) database. Table 1 presents the distribution of the sample.

To assess the impact of financial inclusion on banking risks, this study uses the NPL ratio as the dependent variable, indicating credit risk. In parallel, the analysis of liquidity risk is conducted using the loan-to-deposit ratio (LTD). In both cases, financial inclusion (IFI) is the main explanatory variable, allowing us to examine its influence on these two types of risks.

The literature on financial inclusion offers three main measures. According to [Sarma \(2008\)](#), [M. M. Ahamed and Mallick \(2019\)](#), and [Hakimi et al. \(2022b\)](#), the first measure is the financial inclusion index. The second measure concerns the access dimension of financial services, as described by [Hakimi et al. \(2022b\)](#) and [Rasheed et al. \(2016\)](#). Finally, the third

measure focuses on the usage dimension of financial services, according to the works of [Hakimi et al. \(2022b\)](#) and [Sarma \(2008\)](#). Following [Sarma \(2008\)](#), in our analysis, financial inclusion (IFI) is measured using an index.

Table 1. Sample Composition by Country.

MENA	N	GCC	N	NGCC	N
Jordan	5	United Arab Emirates (UAE)	9	Egypt	7
Kuwait	9	Saudi Arabia	8	Morocco	5
Oman	7	Qatar	9	Tunisia	10
Lebanon	5	Kuwait	9	Lebanon	5
Qatar	9	Oman	7	Jordan	5
Saudi Arabia	8				
United Arab Emirates (UAE)	9				
Egypt	7				
Morocco	5				
Tunisia	10				
Total	74	Total	42	Total	32

In model (1), several control variables were included to refine our analysis. The first category includes bank-specific variables, among which the loan-to-deposit (LTD) ratio is used to measure liquidity risk. We also included bank size (SIZE), as large financial institutions generally exhibit greater efficiency in assessing and managing credit risk, which may influence the variability of non-performing loans (NPLs) ([Hakimi et al., 2022c](#)). Additionally, the capital adequacy ratio (CAP) was included, as well-capitalized banks tend to show higher profitability and lower risk levels ([Hakimi et al., 2022c](#)). The second category concerns sector-specific variables, including bank concentration (CONC). To complete our analysis, we also considered GDP growth (GDPG) and the inflation rate (INF) to control the macroeconomic environment in which banks operate. It has been observed that during periods of economic growth and low inflation rates, the likelihood of loan repayment increases, which can contribute to a reduction in NPLs ([Hakimi et al., 2022c](#); [Klein, 2013](#)).

In Model (2), we examine how financial inclusion influences liquidity risk by using the liquidity ratio (LTD) as the dependent variable. In this model, the non-performing loan (NPL) ratio is then used as the explanatory variable. The control variables remain the same in both models to ensure consistency in the analysis.

The definitions of all variables are provided in Table 2.

Table 2. Definition and Measurement of Variables.

Variables	Definitions	Measurements
Dependent Variables (NPLs/LTD)		
NPLs	Non-performing loans	Non-performing loans as a percentage of gross loans (%)
LTD	Liquidity risk	Loan-to-deposit ratio (%)
Financial Inclusion		
IFI	Financial Inclusion	A financial inclusion index (see Section 3.2)
IFI × LTD	Interactional variable	Interaction between financial inclusion and credit risk
IFI × NPLs	Interactional variable	Interaction between financial inclusion and liquidity risk

Table 2. *Cont.*

Variables	Definitions	Measurements
Bank specifics		
SIZE	Bank size	Natural logarithm of total assets
CAP	Capital adequacy ratio	Bank capital as a percentage of total assets (%)
Industry specifics		
conc	Banking concentration	Banking concentration (%)
Macroeconomic Environment		
GDPG	GDP growth rate	Annual GDP growth rate (%)
INF	Inflation rate	Consumer index price (%)

3.2. Financial Inclusion Measurements (Dependent Variable)

In this study, we built a financial inclusion index (IFI) based on four indicators. The first indicator, Automated Teller Machines (ATM) per 100,000 adults, measures access to financial services through automated teller machines, as highlighted by [Rasheed et al. \(2016\)](#) and [Adeola and Evans \(2017\)](#). The second indicator, bank branches per 100,000 adults (BRAN), evaluates the level of banking service coverage through the number of bank branches, as suggested by [Sarma \(2008\)](#), [Gimet and Lagoarde-Segot \(2012\)](#), and [Rasheed et al. \(2016\)](#). The third indicator, Bank Deposits as a Percentage of GDP (DEPO), represents the usage of financial services through bank deposits, based on the work of [Adeola and Evans \(2017\)](#), and [Sarma \(2008, 2012\)](#). The fourth indicator, Domestic Credit to the Private Sector as a Percentage of GDP (DCPS), measures the usage of financial services through credit to the private sector, as described by [Sarma \(2008, 2012\)](#). The first two indicators (ATM and BRAN) capture the degree of access and coverage of financial services, while the latter two (DEPO and DCPS) serve as proxies for the usage dimension. These four indicators were combined to construct the IFI, offering a comprehensive measure of financial inclusion.

Although the importance of financial inclusion is widely recognized, no formal consensus exists on its measurement ([Tram et al., 2023](#)). However, the literature generally agrees on two key dimensions: access and usage. Financial inclusion is defined as a process that ensures easy access, availability, and utilization of formal financial services across all sectors of the economy ([Sarma, 2016](#)). In this study, we constructed an IFI based on four indicators. Table 3 summarizes the indicators used for the construction of the IFI:

Table 3. Indicators of the Financial Inclusion Index (IFI).

Dimension	Indicator	Adjustment	Weight
Access	ATMs per 100,000 adults	Standardized value	0.25
Access	Bank branches per 100,000 adults	Standardized value	0.25
Usage	Bank deposits as a percentage of GDP	Standardized value	0.25
Usage	Domestic credit to the private sector as a percentage of GDP	Standardized value	0.25

Once the financial inclusion indicators were selected, the second step was to calculate each indicator's standardized mean. This required determining each indicator's minimum and maximum values to ensure equal variance across all indicators. The literature identifies two main standardization methods: statistical standardization and empirical standardization.

Statistical standardization converts indicators to a common scale with a mean of zero and a standard deviation of one, preventing distortions due to differences in means. The statistical standardization formula is:

$$In_{i,t} = \frac{I_{i,t} - \mu_{i,t}}{\sigma_{i,t}}$$

$In_{i,t}$ is the standardized value of indicator I at time t , and time $\mu_{i,t}$, and $\sigma_{i,t}$ represent the mean and standard deviation of the indicator, respectively. This process normalizes indicator values between 0 and 1.

We opted for empirical standardization in this study. The empirical normalization formula is as follows:

$$In_{i,t} = \frac{I_{i,t} - \min(I_i)}{\max(I_i) - \min(I_i)}$$

where $In_{i,t}$ represents the standardized value of indicator I at time t , and $\min(I_i)$ and $\max(I_i)$ are the minimum and maximum values of the indicator, respectively.

3.3. Empirical Strategy

The empirical methodology adopted in this research relies on the SGMM model. One of the major challenges in corporate and banking finance is endogeneity, which is addressed through the SGMM approach. Additionally, biases related to omitted variables and measurement errors are recurring issues in ordinary least squares (OLS) regression models as well as in fixed and random effects (FE and RE) models. To overcome these challenges, we applied the SGMM method proposed by [Blundell and Bond \(1998\)](#). Consequently, the results generated by this SGMM approach are generally considered more robust and reliable ([Zhou, 2014](#); [Teixeira & Queirós, 2016](#); [Danisman & Tarazi, 2020](#); [Hakimi et al., 2023](#)).

The empirical approach followed in this study is carried out in four steps. The first step consists of analyzing the impact of financial inclusion on credit risk. The equation to be estimated in this step is formulated as follows (Equation (1)).

$$NPLs_{i,t} = \beta_0 + \beta_1 NPLs_{i,t-1} + \beta_2 IFI_{i,t} + \beta_3 CAP_{i,t} + \beta_4 SIZE_{i,t} + \beta_5 LTD_{i,t} + \beta_6 CONC_{i,t} + \beta_7 GDPG_{i,t} + \beta_8 INF_{i,t} + \epsilon_{i,t} \quad (1)$$

In the second step, we examine the impact of financial inclusion on liquidity risk. The corresponding econometric equation is presented as follows (Equation (2)).

$$LTD_{i,t} = \beta_0 + \beta_1 LTD_{i,t-1} + \beta_2 IFI_{i,t} + \beta_3 CAP_{i,t} + \beta_4 SIZE_{i,t} + \beta_5 NPLs_{i,t} + \beta_6 CONC_{i,t} + \beta_7 GDPG_{i,t} + \beta_8 INF_{i,t} + \epsilon_{i,t} \quad (2)$$

In the third step, we examine whether financial inclusion plays a moderating role in the relationship between liquidity risk and credit risk. To this end, we include an interaction variable in the econometric model, representing the interaction between financial inclusion and liquidity risk. The econometric model to be tested is presented in Equation (3).

$$NPLs_{i,t} = \beta_0 + \beta_1 NPLs_{i,t-1} + \beta_2 IFI_{i,t} + \beta_3 (IFI \times LTD)_{i,t} + \beta_4 CAP_{i,t} + \beta_5 SIZE_{i,t} + \beta_6 LTD_{i,t} + \beta_7 CONC_{i,t} + \beta_8 GDPG_{i,t} + \beta_9 INF_{i,t} + \epsilon_{i,t} \quad (3)$$

In the fourth step, we analyze whether financial inclusion moderates the relationship between credit risk and liquidity risk. To this end, we incorporate an interaction variable into the econometric model, reflecting the interaction between financial inclusion and credit risk. The econometric model to be tested is expressed in Equation (4).

$$LTD_{i,t} = \beta_0 + \beta_1 LTD_{i,t-1} + \beta_2 IFI_{i,t} + \beta_3 (IFI \times NPLs)_{i,t} + \beta_4 CAP_{i,t} + \beta_5 SIZE_{i,t} + \beta_6 NPLs_{i,t} + \beta_7 CONC_{i,t} + \beta_8 GDPG_{i,t} + \beta_9 INF_{i,t} + \epsilon_{i,t} \quad (4)$$

4. Empirical Analysis

4.1. Summary Statistics and Correlation Matrix

The following table provides an overview of the descriptive statistics for industry and bank-specific characteristics, as well as financial inclusion and banking risk indicators.

Additionally, the correlation matrix shows the linear relationships between the variables, offering insights into the strength and nature of the links between them.

According to the descriptive statistics displayed in Table 4, non-performing loans (NPLs) have an average of 7.2% and a standard deviation of 7.2, with a minimum value of 0.04% and a maximum value of 67.9%. Financial inclusion (IFI) registers an average of 0.549 and a standard deviation of 0.141, with values ranging from 0.224 to 0.768. The capital adequacy ratio (CAP) has an average of 16.9% and a standard deviation of 9.1, with values ranging from 3.5% as a minimum to 20.4% as a maximum value.

Table 4. Descriptive Statistics.

Variable	Mean	Std. Dev.	Min	Max
NPLs	7.2	7.2	0.04	67.9
IFI	0.549	0.141	0.224	0.768
CAP	16.9	9.1	3.5	20.4
SIZE	23.469	1.206	20.942	26.428
LTD	83.7	28.9	1.4	222.8
CONC	83.959	12.779	61.026	100.00
GDPG	2.462	4.078	-21.400	19.592
INF	4.222	10.796	-3.749	154.756

Bank size (SIZE) has an average of 23.469 and a standard deviation of 1.206, with values ranging from 20.942 to 26.428. The liquidity ratio (LTD) has an average of 83.7%, with maximum and minimum values ranging from 1.4% to 222.8%. Banking concentration (CONC) has an average of 83.959, with values ranging from 61.026 to 100.00. As macroeconomic variables, GDP growth (GDPG) has an average of 2.462%, while inflation (INF) records an average value of 4.222%. These descriptive statistics reveal significant variations in the data, helping to understand the underlying economic and banking dynamics across the different countries studied.

Table 5 shows that the correlation between the independent variables is generally weak. The highest levels are found between financial inclusion (IFI) and bank size (SIZE) at 39.53%, financial inclusion (IFI) and banking concentration (CONC) at 38.50%, and financial inclusion (IFI) and liquidity ratio (LTD) at 36.60%. However, these variables reflect key aspects of financial inclusion and bank specifics, which were tested separately in the models. Therefore, we confirm that there is no significant issue with multicollinearity.

Table 5. Correlation Matrix.

	Npls	Ifi	Cap	Taille	Ltd	Conc	Pib	Inf
Npls	1.0000							
Ifi	-0.1995 *	1.0000						
	0.0000							
Cap	-0.3511 *	0.0565	1.0000					
	0.0000	0.1246						
Taille	-0.4003 *	0.3953 *	0.4359 *	1.0000				
	0.0000	0.0000	0.0000	0.0000				
Ltd	-0.0569	0.3660 *	-0.1467 *	0.0423	1.0000			
	0.1374	0.0000	0.0001	0.3098				
Conc	-0.2418 *	0.3850 *	0.2305 *	0.0996 *	0.1724 *	1.0000		
	0.0000	0.0000	0.0000	0.0244	0.0000			
Pib	-0.0994 *	-0.0016	0.0841 *	-0.1144 *	-0.0220	-0.0530	1.0000	
	0.0091	0.9616	0.0216	0.0048	0.5311	0.1448		
Inf	0.2057 *	-0.3631 *	-0.0698	-0.1366 *	-0.2846 *	-0.0576	-0.2142 *	1.0000
	0.0000	0.0000	0.0564	0.0007	0.0000	0.1131	0.0000	

* indicates the 5% significance level.

4.2. Discussion of the Empirical Findings

The sample is divided into two subgroups: the first one is devoted to banks in GCC countries and the other one for banks in NGCC countries. The analysis of the empirical results involves several steps. We begin by evaluating the overall results for the whole sample, as presented in the following table. Next, we delve into the analysis of results specific to the GCC countries, before interpreting the results for the NGCC countries.

The results of the model estimations (1 and 2) by the SGMM do not allow us to reject the hypothesis regarding the validity of the lagged variables in levels and differences as instruments, as indicated by the Sargan test (the *p*-value is greater than 5%), or the hypothesis regarding the absence of second-order autocorrelation, as suggested by the Arellano and Bond test (the *p*-value of AR(2) is greater than 5%). Moreover, we find that the coefficient estimator of the lagged endogenous variable (X_{it-1}) always remains significant at $\alpha\%$ level for all regressions, which leads us to assert that Equations (1) and (2) better capture the dynamic specification.

The results presented in Table 6 indicate that the lagged dependent variable NPLs (-1) has a positive and significant coefficient. This suggests that the previous year's credit risk positively and significantly impacts the current year's credit risk, as measured by non-performing loans.

Table 6. The Impact of Financial Inclusion on Credit Risk and liquidity risk in the MENA Region.

Credit Risk (NPLs)			Liquidity Risk (LTD)		
NPLs	Coef.	Z	LTD	Coef.	Z
NPLs (-1)	0.763	95.01 ***	LTD (-1)	0.643	47.880 ***
IFI	0.036	8.34 ***	IFI	-0.117	-4.940 ***
CAP	-0.238	-26.94 ***	CAP	0.488	9.000 ***
SIZE	-0.007	-3.55 ***	SIZE	-0.145	-23.090 ***
LTD	-0.032	-19.21 ***	LTD	0.030	1.200
CONC	-0.001	-9.60 ***	CONC	0.0001	0.470
GDPG	-0.002	-22.04 ***	GDPG	-0.002	-6.940 ***
INF	0.001	9.93 ***	INF	-0.002	-9.380 ***
_cons	0.288	6.41 ***	_cons	3.694	25.490 ***
AR(1)	-1.761		AR(1)	-1.226	
Prob	0.078		Prob	0.220	
AR(2)	-0.750		AR(2)	-1.127	
Prob	0.452		Prob	0.259	
Sargan Test	52.301		Sargan Test	44.028	
Prob	0.829		Prob	0.966	
Obs	636		Obs	636	

Note: NPLs = Non-Performing Loans, IFI = Financial Inclusion, CAP = Capital Adequacy Ratio, SIZE = Bank Size, LTD = Liquidity Risk, CONC = Banking Concentration, GDPG = Annual GDP Growth Rate (%), INF = Inflation Rate. *** indicates the significance level at 1%.

The financial inclusion variable (IFI) has a positive and significant effect on credit risk. This suggests that an increase in financial inclusion is associated with a rise in NPLs. These results indicate that higher financial inclusion could worsen the quality of banks' loan portfolios. In this context, banks, seeking to expand their market share, may grant loans to high-risk borrowers or those without sufficient collateral, leading to an increase in NPLs. Borrowers who manage their finances poorly or face challenging economic conditions may struggle to repay their loans, complicating banks' situations. This phenomenon could also reflect a race to increase the loan volume, where banks, by maximizing profitability, neglect careful risk management. These findings lead to the rejection of Hypothesis H1.

This research supports the conclusions of [Ghasarma et al. \(2019\)](#) while contradicting those of [Hakimi et al. \(2023\)](#), [Danisman and Tarazi \(2020\)](#), and [Ayadi and De Groot \(2014\)](#).

Bank capital is found to be negatively associated with the NPL ratio, meaning that better-capitalized banks have lower NPL levels. High capital allows banks to absorb losses, reduce defaults, and implement stricter risk management. It also helps diversify loan portfolios and strengthens depositor and investor confidence, reducing funding costs. These factors contribute to a reduction in NPLs. These findings align with the work of [Makri et al. \(2014\)](#) but contrast with the conclusions of [Aggarwal and Jacques \(2001\)](#) and [Ghasarma et al. \(2019\)](#).

Concerning bank size, empirical findings indicate that it is negatively associated with NPLs. Large banks have lower NPL levels. A 1% increase in size reduces the NPL ratio by 0.007%. These large banks can manage credit risk better, adopt more prudent behaviors, and are less sensitive to banking shocks due to their resources to absorb losses and maintain high provisions. These results confirm the findings of [Hu et al. \(2004\)](#) and [Hakimi et al. \(2022c\)](#).

Liquidity risk has a negative and significant impact on the NPL ratio. Although credit risk and liquidity risk are interconnected, our study shows that liquidity risk significantly reduces the NPL ratio. An increase in liquidity indicates an adequate level, while a decrease signals liquidity issues. Therefore, banks with sufficient liquidity record lower NPL levels, aligning with the work of [Boussaada et al. \(2022\)](#).

The results indicate that a highly concentrated banking sector tends to show lower NPL levels. The coefficient associated with bank concentration is negative and statistically significant at the 1% level. A banking sector dominated by a small number of large banks can manage NPLs better. This situation enables more effective regulation and better risk management. Additionally, concentration facilitates closer monitoring, allowing for swift intervention in case of default risk. These findings are consistent with those of [Berti et al. \(2017\)](#) and [Hakimi and Khemiri \(2024\)](#).

The results show that GDP growth has a significant negative relationship with NPLs. Sustained economic growth improves borrowers' ability to repay loans, thus reducing NPLs. These results confirm previous studies, including [Arham et al. \(2020\)](#) and [R. Beck et al. \(2015\)](#).

The positive coefficient associated with inflation shows that higher inflation levels lead to an increase in NPLs. This is explained by the reduction in borrowers' purchasing power, higher interest rates, and worsening economic conditions, increasing the risk of defaults. Inflation may also affect businesses' profitability, leading to financial difficulties and an increase in NPLs, particularly for business loans, as confirmed by [Boussaada et al. \(2022\)](#).

Concerning the result of the effect of financial inclusion on liquidity risk, findings indicate that the coefficient LTD (−1) indicates a significant and positive impact between liquidity risk in the previous period and the current period. This means that high levels of liquidity observed in the past are likely to be reproduced in the present, encouraging banks to consider their liquidity history when managing risks.

The coefficient of the financial inclusion index (IFI) shows an inverse relationship between financial inclusion and liquidity risk, suggesting that an increase in financial inclusion is associated with a reduction in liquidity risk. This result is statistically significant, reinforcing confidence in the impact of financial inclusion on liquidity risk. By improving access to financial services, such as opening new bank accounts and gaining access to credit, banks can increase customer deposits and diversify their funding sources, helping them better manage liquidity shocks. Therefore, promoting financial inclusion is essential for enhancing the stability of the banking system and mitigating liquidity risks. These findings support Hypothesis H1 and are consistent with the work of [Musau et al. \(2017\)](#), while diverging from that of [Le et al. \(2019\)](#).

The banking capital ratio (CAP) is positively and significantly correlated with liquidity risk. Although this relationship may seem counterintuitive, as we would expect better-capitalized banks to be less exposed to this risk, in a context of intense competition, insufficient prudential regulation, and ineffective governance, banks may take excessive risks by granting loans without adequate guarantees. This can lead to an increase in non-performing loans, where a high level of credit risk translates into an increase in liquidity risk. This result is consistent with the conclusions of [Boussaada et al. \(2022\)](#).

Bank size is inversely correlated with liquidity risk, meaning that larger banks have a more robust liquidity profile. Their easier access to financial markets, increased diversification of funding sources, and a larger and more stable deposit base allow them to better manage liquidity needs and handle liquidity crises with more resilience. This result highlights the importance of bank size in liquidity risk management, in line with the work of [Ghneimi et al. \(2017\)](#) and [Boussaada et al. \(2022\)](#). Non-performing loans do not have a significant impact on liquidity risk, and market concentration does not show a significant relationship with this risk.

Findings also indicate that increased economic growth is linked to a significant reduction in liquidity risk. Indeed, an expanding economy improves bank liquidity as businesses and individuals deposit more and withdraw less, thereby strengthening deposit stability and liquidity availability. These results are consistent with studies by [Udin et al. \(2021\)](#) and [Naoaj \(2023\)](#). Inflation significantly reduces banks' liquidity risk. During periods of inflation, banks increase interest rates on deposits to attract funds, while borrowers accelerate the repayment of their debts, thus improving bank liquidity. These results align with studies by [Hakimi et al. \(2022a\)](#) and [Boussaada et al. \(2022\)](#).

After studying the effect of financial inclusion on credit risk and liquidity risk in the MENA region, we analyze the reciprocal relationship between these two types of risk. The results of this analysis are detailed in Table 7. Diagnostic tests, including the Sargan test and AR(1) and AR(2) tests by Arellano and Bond, did not reject the null hypothesis of correct specification, with p -values greater than 5% for each. We inform that column (1) corresponds to the estimation of model (3) and column (2) corresponds to the estimation of the model (4).

The results presented in Table 7 highlight the moderating effect of financial inclusion in the relationship between liquidity risk and non-performing loans. It was observed that greater financial inclusion, combined with effective liquidity risk management ($IFI \times LTD$), leads to a significant reduction in non-performing loans in the MENA region. When more individuals and businesses gain access to the formal financial system, they are more likely to repay their loans, which results in a decrease in non-performing loans. Furthermore, financial inclusion enables banks to diversify their loan portfolios by extending credit to previously underserved groups, which helps better distribute risks and enhances the stability of the banking system. Therefore, a more inclusive financial environment encourages greater diversification of banking activities, contributing to the reduction of non-performing loans. These results underscore the importance of financial inclusion in the reciprocal relationship between credit risk and liquidity risk, highlighting its essential role in promoting banking stability in the MENA region.

These findings lead to partially accepting the Hypothesis H2 when the dependent variable is NPLs. The results are consistent with the conclusions of [Altunbas et al. \(2001\)](#) and [Hakimi et al. \(2022c\)](#). Furthermore, the analysis of bank characteristics, business sectors, and macroeconomic conditions did not reveal any significant changes compared to the results presented in Table 6.

Regarding the interaction between financial inclusion and non-performing loans ($IFI \times NPLs$) this interaction is not significant. This means that financial inclusion does not

significantly moderate the effect of non-performing loans on liquidity risk in the MENA context. Hence, this result leads to the rejection of our Hypothesis H2. As for the impact of banking characteristics and macroeconomic conditions, the results did not show any significant variation compared to those presented in Table 6.

Table 7. The moderating role of financial inclusion in the reciprocal relationship between credit risk and liquidity risk.

Credit Risk (NPLs)			Liquidity Risk (LTD)		
NPLs	Coef.	Z	LTD	Coef.	Z
NPLs (−1)	0.759	77.330 ***	LTD (−1)	0.642	47.650 ***
IFI	0.054	7.040 ***	IFI	−0.118	−4.910 ***
LTD	−0.018	−2.570 ***	NPLs	0.052	0.620
IFI × LTD	−0.021	−2.490 **	IFI × NPLs	−0.046	−0.240
CAP	−0.235	−32.640 ***	CAP	0.479	7.950 ***
SIZE	−0.008	−3.770 ***	SIZE	−0.144	−22.160 ***
CONC	−0.001	−9.930 ***	CONC	0.001	0.480
GDPG	−0.002	−21.320 ***	GDPG	−0.002	−6.930 ***
INF	0.001	9.730 ***	INF	−0.002	−9.050 ***
_cons	0.302	6.390 ***	_cons	3.677	24.480 ***
AR(1)	−1.7559			−1.2276	
Prob	0.0791			0.2196	
AR(2)	−0.75222			−1.1281	
Prob	0.4519			0.2593	
Test de Sargan	50.5444			43.68021	
Prob	0.8712			0.9697	
Obs	636			636	

Note: NPLs = Non-Performing Loans. IFI = Financial Inclusion. LTD = Liquidity Risk. IFI × LTD and IFI × NPLs = Interactional Variables. CAP = Capital Adequacy Ratio. SIZE = Bank Size. CONC = Bank Concentration. GDPG = Annual GDP Growth Rate (%). INF = Inflation Rate. *** and ** indicate the significance thresholds at 1% and 5%, respectively.

5. The Sensitivity Analysis: GCC vs. NGCC Countries

In this section, we will expand our study to the GCC and NGCC regions. This extension will allow us to analyze the dynamics of financial inclusion in diverse contexts and better understand its impact on banking risks in these regions. The results of the model estimation (1 and 2) using the SGMM do not allow us to reject the hypothesis regarding the validity of the lagged variables in levels and differences as instruments, as indicated by the Sargan test (the *p*-value is greater than 5%), or the hypothesis regarding the absence of second-order autocorrelation, as suggested by the Arellano and Bond test (the *p*-value of AR(2) is greater than 5%). Moreover, we find that the coefficient estimator of the lagged endogenous variable (X_{it-1}) always remains significant at the $\alpha\%$ level for all regressions, which leads us to assert that Equations (1) and (2) better captures the dynamic specification.

The results presented in Table 8 show that the lagged dependent variable (NPLs (−1)) has a positive and significant effect in both the GCC and NGCC regions. This means that the previous year's credit risk has a positive and significant impact on the current year's credit risk, as measured by the NPLs ratio.

Table 8. The impact of financial inclusion on credit risk in the GCC and NGCC regions.

GCC			NGCC	
NPLs	Coef.	z	Coef.	z
NPLs (−1)	0.759	16.840 ***	0.820	12.250 ***
IFI	0.024	3.360 ***	0.056	0.100
CAP	−0.500	−20.070 ***	−0.186	−0.570
SIZE	0.004	0.720	0.041	1.080
LTD	−0.007	−1.980 **	−0.124	−0.610
CONC	−0.00015	−1.270	−0.00019	−0.240
GDPG	−0.002	−20.410 ***	−0.000037	−0.030
INF	0.001	6.680 ***	0.0014	2.420 **
_cons	0.020	0.160	−0.813	−1.060
AR(1)	−2.215		0.096	
Prob	0.026		0.923	
AR(2)	−0.640		−0.483	
Prob	0.521		0.628	
Sargan Test	37.347		3.103	
Prob	0.995		1.000	
Obs	357		272	

Note: NPLs = Non-Performing Loans, IFI = Financial Inclusion, CAP = Capital Adequacy Ratio, SIZE = Bank Size, LTD = Liquidity Risk, CONC = Banking Concentration, GDPG = Annual GDP Growth Rate (%), INF = Inflation Rate. ***, ** indicate the significance levels at 1% and 5%, respectively.

In the GCC region, the coefficient of the financial inclusion index (IFI), estimated at 0.024, shows that financial inclusion is slightly linked to an increase in credit risk. By promoting inclusion, different segments of the population gain access to the formal financial system, offering them credit opportunities that were previously inaccessible. While this helps spread the risk across a larger customer base, it can also increase the concentration of credit risk among certain borrowers. Financial inclusion may encourage risky behavior among some borrowers and lead to irresponsible borrowing, thus increasing the risk of default. Although greater accessibility to financial services diversifies credit, it can also raise the overall credit risk without proper risk management. These results lead to the rejection of Hypothesis H1. Our results corroborate the work of [Ghasarma et al. \(2019\)](#) and are not consistent with those of [Hakimi et al. \(2023\)](#), [Danisman and Tarazi \(2020\)](#), or [Ayadi and De Groen \(2014\)](#). In contrast, in the NGCC region, financial inclusion does not have any significant effect on credit risk. These results also lead to the rejection of Hypothesis H1.

Regarding banking capitalization (CAP) in the GCC region, the results indicate that an increase in capitalization significantly reduces credit risk. This result, which is significant at the 1% level, suggests that better-capitalized banks are more capable of managing their credit risks, likely due to their better ability to absorb potential losses and maintain the trust of investors and depositors. This result aligns with the work of [Makri et al. \(2014\)](#) and contrasts with the conclusions of [Aggarwal and Jacques \(2001\)](#) and [Ghasarma et al. \(2019\)](#). In contrast, in the NGCC region, the banking capitalization coefficient (CAP) is not significant. Regarding bank size (SIZE), in both the GCC and the NGCC regions, it does not have a significant effect on credit risk.

For the liquidity ratio (LTD), there is a notable difference between the two regions. In the GCC region, better liquidity significantly reduces credit risk. This result is significant at the 5% level, suggesting that more liquid banks are better able to meet financial obligations and reduce credit risk. This finding is consistent with the work of [Boussaada et al. \(2022\)](#). In contrast, in the NGCC region, the liquidity ratio (LTD) coefficient is not significant.

Moreover, market concentration (CONC) does not show a significant effect on credit risk in either region.

GDP growth in the GCC region shows a negative and significant relationship with the NPL ratio. This negative effect is expected, as sustained economic growth facilitates loan repayment due to regular payments, thereby increasing the chances of repayment and contributing to a reduction in NPLs. Furthermore, NPL levels tend to decrease during periods of economic prosperity, which aligns with the results of studies by [Arham et al. \(2020\)](#) and [R. Beck et al. \(2015\)](#). In contrast, in the NGCC region, the effect of GDP growth is not significant.

Inflation significantly increases credit risk in both the GCC and NGCC regions. A positive coefficient associated with inflation reveals that rising inflation levels are linked to an increase in NPLs. Several factors explain this relationship, including the reduction in borrowers' purchasing power, higher interest rates, and a deterioration in economic conditions. Inflation can also affect the profitability of businesses, thus contributing to financial difficulties and an increase in NPLs, particularly for business loans. These conclusions align with those of [Boussaada et al. \(2022\)](#).

The results presented in Table 9 examine the effect of financial inclusion on liquidity risk in the GCC and NGCC regions. Diagnostic tests, including the Sargan test and serial correlation tests, do not reject the null hypothesis regarding the validity of the over-identified identification restrictions and the absence of correlation. The *p*-values obtained for the Sargan test and the AR(2) test by Arellano and Bond are above 5%, indicating the robustness of the model and the relevance of the instruments used.

Table 9. The impact of financial inclusion on liquidity risk in the GCC and NGCC regions.

	GCC		NGCC	
LTD	Coef.	z	Coef.	z
LTD (−1)	0.675	63.680 ***	0.331	1.830 **
IFI	−0.037	−1.660 *	−0.987	−4.050 ***
CAP	0.369	3.580 ***	0.383	0.910
SIZE	−0.065	−6.490 ***	−0.203	−3.580 ***
NPLs	0.046	0.700	0.398	1.160
CONC	−0.001	−3.060 ***	−0.001	−2.350 **
GDPG	−0.002	−5.100 ***	0.005	2.880 ***
INF	−0.001	−3.580 ***	−0.004	−2.360 **
_cons	1.855	8.010 ***	4.637	3.680 ***
AR(1)	−1.222		−0.438	
Prob	0.221		0.661	
AR(2)	−1.172		0.1754	
Prob	0.240		0.860	
Sargan Test	33.507		3.127	
Prob	0.999		1.000	
Obs	357		272	

Note: NPLs = Non-Performing Loans, IFI = Financial Inclusion, CAP = Capital Adequacy Ratio, SIZE = Bank Size, LTD = Liquidity Risk, CONC = Banking Concentration, GDPG = Annual GDP Growth Rate (%), INF = Inflation Rate. ***, **, and * indicate the significance levels at 1%, 5%, and 10%, respectively.

In the GCC region, the coefficient of the dependent lagged variable indicates a positive and significant influence of past liquidity risk on current liquidity risk. In the NGCC region, the influence remains positive and significant but is less pronounced than in the GCC region. This suggests that the impact of past liquidity risk is stronger in the GCC region.

The analysis of financial inclusion (IFI) reveals significant differences between the GCC and NGCC regions regarding their impact on liquidity risk. In GCC countries, financial inclusion has a negative effect on liquidity risk, significant at the 10% level, suggesting

that its influence is relatively weak due to factors such as a less developed economic and financial structure and low adoption of financial services. In contrast, in NGCC countries, financial inclusion has a significantly negative effect at the 1% level, indicating a much more substantial role in reducing liquidity risk. This difference can be attributed to a greater diversity of financial institutions, better regulation, and policies that promote financial inclusion, facilitating access to financial services for a broader population. Additionally, greater financial awareness and education in some NGCC countries contribute to this impact. These findings support Hypothesis H1 and align with the work of [Musau et al. \(2017\)](#) while diverging from that of [Le et al. \(2019\)](#).

The positive and significant relationship between bank capital (CAP) and liquidity risk in the GCC region may seem counterintuitive. While higher capital levels are generally associated with greater financial resilience, in the Middle Eastern context, they may encourage banks to adopt riskier behavior, leading to increased liquidity risk. This result is consistent with the findings of [Boussaada et al. \(2022\)](#). In contrast, for NGCC countries, this relationship is not significant.

In both the GCC and NGCC regions, large banks exhibit an inverse relationship with liquidity risk, indicating a stronger liquidity profile. Their easier access to financial markets, diversified funding sources, and broader deposit base allow them to better manage liquidity needs and withstand crises with resilience. This finding highlights the importance of bank size in liquidity risk management and aligns with the work of [Ghneimi et al. \(2017\)](#) and [Boussaada et al. \(2022\)](#).

Banking sector concentration (CONC) shows a negative and significant relationship in both regions. In the GCC, greater concentration is associated with reduced liquidity risk. In NGCC countries, banking sector concentration also exhibits a negative relationship, although the association is slightly less significant. These results suggest that increased concentration in the banking sector may contribute to more effective liquidity management in both regions. This finding is consistent with the conclusions of [T. Beck et al. \(2003\)](#) and diverges from the work of [Laryea et al. \(2016\)](#).

GDP growth has opposite effects on liquidity risk in the GCC and NGCC regions. In GCC countries, higher economic growth reduces liquidity risk, likely by enhancing financial stability and increasing bank deposits, which is in line with the findings of [Naoaj \(2023\)](#) and [F. Ahmed \(2021\)](#). Conversely, in NGCC countries, higher economic growth increases liquidity risk, possibly due to rapid credit expansion and increased liquidity demand from banks. This observation is consistent with the work of [Udin et al. \(2021\)](#). In both the GCC and NGCC regions, inflation reduces banks' liquidity risk. This can be explained by improved borrower repayment capacity, increased bank deposits, and the nominal appreciation of bank assets, which enhances financial stability and reduces the need for banks to maintain high liquidity levels. Our result aligns with the findings of [Hakimi et al. \(2022a\)](#).

Table 10 provides an in-depth analysis of the reciprocal relationship between credit risk and liquidity risk in the GCC and NGCC regions. This study particularly focuses on the moderating role of financial inclusion in this complex dynamic. By examining the joint and separate effects of the two types of risks, as well as the influence of banking and macroeconomic variables, the analysis aims to shed light on the interactions between these risks within the financial systems of both regions.

Table 10. The reciprocal relationship between credit risk and liquidity risk in the GCC and NGCC regions: the moderating role of financial inclusion.

GCC						NGCC					
NPLs			LTD			NPLs			LTD		
NPLs	Coef.	z	LTD	Coef.	z	NPLs	Coef.	z	LTD	Coef.	z
NPLs (−1)	0.714	22.820 ***	LTD(−1)	0.663	56.480 ***	NPLs (−1)	0.451	12.130 ***	LTD(−1)	0.372	1.870 **
IFI	0.106	5.550 ***	IFI	−0.080	−1.980 **	IFI	−0.860	1.050	IFI	0.044	−4.04 ***
LTD	0.048	−3.260 ***	NPLs	−1.504	0.750	LTD	0.043	−0.130	NPLs	−0.141	1.230
IFI × LTD	−0.095	−4.440 ***	IFI × NPLs	2.379	1.540	IFI × LTD	−0.181	−0.160	IFI × NPLs	0.382	0.320
CAP	−0.487	−21.49 ***	CAP	0.245	3.020 ***	CAP	−1.590	−0.680	CAP	0.347	0.640
SIZE	0.001	0.340	SIZE	−0.051	−5.380 ***	SIZE	0.080	1.070	SIZE	−0.188	−2.230 **
CONC	−0.0003	−1.070	CONC	−0.002	−5.350 ***	CONC	−0.001	−0.790	CONC	−0.0004	−2.520 **
GDPG	−0.002	−31.04 ***	GDPG	−0.002	−5.960 ***	GDPG	−0.001	−1.210	GDPG	0.002	2.270 ***
INF	0.0007	4.600 ***	INF	−0.00003	−3.110 ***	INF	0.001	1.770 *	INF	−0.004	−2.220 **
_cons	0.048	0.630	_cons	1.684	6.42 ***	_cons	−1.066	−1.210	_cons	4.516	2.78 ***
AR(1)	−2.111		AR(1)	−1.219		AR(1)	0.413		AR(1)	1.418	
Prob	0.034		Prob	0.222		Prob	0.679		Prob	0.154	
AR(2)	−0.511		AR(2)	−1.193		AR(2)	−0.811		AR(2)	3.177	
Prob	0.609		Prob	0.232		Prob	0.417		Prob	0.221	
Sargan Test	38.222		Sargan Test	32.827		Sargan Test	2.439		Sargan Test	2.636	
Prob	0.994		Prob	0.999		Prob	1.000		Prob	1.000	
Obs	357		Obs	357		Obs	272		Obs	272	

Note: NPLs = Non-Performing Loans. IFI = Financial Inclusion. LTD = Liquidity Risk. IFI × LTD and IFI × NPLs = Interactional Variables. CAP = Capital Adequacy Ratio. SIZE = Bank Size. CONC = Bank Concentration. GDPG = Annual GDP Growth Rate (%). INF = Inflation Rate. ***, **, and * indicate the significance levels at 1%, 5%, and 10%, respectively.

The results of the model estimation (3 and 4) by the SGMM do not allow us to reject the hypothesis regarding the validity of the lagged variables in levels and differences as instruments, as indicated by the Sargan test (the *p*-value is greater than 5%,) or the hypothesis regarding the absence of second-order autocorrelation, as indicated by the Arellano and Bond test (the *p*-value of AR(2) is greater than 5%). Moreover, we find that the coefficient estimator of the lagged endogenous variable (X_{it-1}) always remains significant at $\alpha\%$ level for all regressions, which leads us to assert that Equations (3) and (4) better capture the dynamic specification.

In the GCC region, the interaction between financial inclusion and liquidity risk ($IFI \times LTD$) has a negative and significant impact on non-performing loans. This suggests that greater financial inclusion enables more individuals and businesses to access appropriate financial services, which enhances their ability to repay loans. Additionally, financial inclusion promotes the diversification of banking activities, leading to better management of credit-related risks. As a result, IFI mitigates the effect of liquidity risk on credit risk and strengthens the resilience of the banking system. These findings are consistent with previous research by [Altunbas et al. \(2001\)](#) and [Hakimi et al. \(2022c\)](#). Consequently, Hypothesis H2 is accepted only for the GCC region.

In contrast, the interaction term ($IFI \times NPLs$) is not significant in the GCC region, leading to the rejection of Hypothesis H2. Furthermore, the analysis of bank specifics, industry sectors, and macroeconomic conditions did not reveal any significant changes compared to the results presented in Table 7. The analysis of the moderating role of financial inclusion in the relationship between credit risk and liquidity risk ($IFI \times LTD$) and ($IFI \times NPLs$) in NGCC countries shows non-significant results. As a result, Hypothesis H2 is also rejected for the NGCC region.

6. Conclusions

This paper aimed to analyze the impact of financial inclusion on banking risks, particularly credit risk and liquidity risk, as well as the moderating role of financial inclusion in the reciprocal relationship between these two risks in the MENA region. Using a sample of 74 banks from 10 countries in the region, covering the period from 2010 to 2021, we applied the system generalized method of moments (SGMM) estimator to validate our hypotheses while highlighting the moderating role of financial inclusion.

The empirical results indicate that financial inclusion has no significant effect on credit risk in the MENA region. However, the impact of financial inclusion on liquidity risk suggests that higher levels of financial inclusion can effectively reduce liquidity risk in the banking sector. Regarding the reciprocal relationship between credit risk and liquidity risk, we also found that financial inclusion does not play a moderating role in the MENA region.

In the sensitivity analysis, the results of the impact of financial inclusion on credit risk in the GCC and NGCC regions also support no significant effect, which posits that greater financial inclusion does not affect credit risk. Conversely, financial inclusion has a negative effect on liquidity risk in both sub-regions. Furthermore, the analysis of the reciprocal relationship between credit risk and liquidity risk shows that financial inclusion does not moderate this relationship in either region. However, the impact of the interaction between financial inclusion and liquidity risk ($IFI \times LTD$) on NPLs is negative and significant for banks in the GCC region. These results highlight the complex dynamics between financial inclusion and banking risks in the region. Financial inclusion appears to have a positive potential for managing liquidity risk, but its lack of influence on credit risk suggests that other factors, such as financial institutional quality and macroeconomic conditions, may play a more decisive role.

The results of this paper could have significant practical implications for policymakers and bank managers. First, to mitigate liquidity risk, MENA countries and the two sub-regions (GCC and NGCC countries) should promote better accessibility and broader use of financial services. Strengthening financial inclusion appears to be a key lever for more effective banking risk management, particularly in terms of credit and liquidity risks. To this end, countries in the region are encouraged to promote financial technologies (FinTech), accelerate digitalization, and foster innovation to facilitate access to financial services. Additionally, implementing a tailored strategy would help remove barriers to financial inclusion and maximize its benefits for both individuals and businesses. Second, lending activities require special attention to improve the quality of loan portfolios and limit the proportion of NPLs in the region. Similarly, liquidity risk management should be optimized by ensuring an adequate level of liquidity, thereby reducing banks' vulnerability to financial crises. In addition, governments in the region should undertake measures to stabilize the macroeconomic environment, a crucial factor in ensuring better control over banking risks. Third, the findings of this study raise economic policy concerns and contribute to the debate on expanding financial inclusion in developing countries. To maximize its positive outcomes, institutional quality and financial intermediation should be given central importance. A robust institutional framework, characterized by effective governance, low corruption, and greater political stability, could play a moderating role in the relationship between financial inclusion and banking risk management, particularly by mitigating tensions related to credit and liquidity risks.

This study has certain limitations that should be noted. First, while the sample is representative of the MENA region, its relatively small size may affect the generalizability of the results. Additionally, the relationship between financial inclusion and banking risks requires further analysis to establish a robust causal link. Moreover, the impact of financial inclusion on banking risks may follow a nonlinear dynamic, which warrants further exploration in future research.

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