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Research Paper

The factors affecting solvency and credit risks in mena banks

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ABSTRACT

This study examines the impact of bank-specific and macroeconomic variables on bank risk measures proxied by solvency risk (Z-score) and credit risk (NPLs). Fixed and random effects panel regression models are adopted the generalized method of moments (GMM) dynamic technique for 138 banks in 12 MENA countries (2005-2022). Which is further sub-divided into two groups, namely GCC and MPC for comparative analysis to reveal differences in terms of importance of risk determinants. The results indicate mainly that leverage raises both solvency and credit risks. An increase in income diversability reduces solvency risk and a larger bank size mitigates credit risk. Moreover, economic growth significantly reduces solvency risk but inflation erodes bank financial stability. Regarding the GCC, there is a positive relationship between size and solvency risk. Also, economic growth enhances credit quality while liquidity worsens this portfolio. Considering the MPC sample, leverage is the most important factor raising credit risk. Profitability has a positive effect on Z-score, thereby lowers solvency risk. These findings suggest that banks in the MENA region can enhance their stability by focusing on improving profitability and operational efficiency while managing leverage levels. Policymakers may also consider fostering economic growth to support banking sector stability.

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1. INTRODUCTION

Banks in the MENA region account for more than 80% of total financial system assets, and their role as financial intermediaries is essential to fostering a stable and sustainable economy. Banking operations inherently are exposed to various financial risks, mainly through facilitating credit allocation, and these evolving risks encompass solvency and credit risk factors that potentially threaten bank

performance. The z-score, introduced by [1], is a widely used measure of bank solvency risk, where higher values indicate lower risk of failure. This indicator captures a bank's ability to withstand financial shocks by measuring bank's capital to the variability of returns. Non-performing loans ratio (NPLs) reflects credit risk by emphasizing the proportion of loans that are unlikely to be repaid. Both risks influence both liquidity and profitability, and thus the broader stability of the banking sector.

The MENA region enjoys a diversifiable economic landscape, ranging from wealthy oil-rich economies to oil-importers relatively facing development challenges and political unrest. On one hand, banks in the Gulf Cooperation Council (GCC) countries are more sophisticated, stable, and less exposed to risk. On the other and, banks in the Mediterranean Partner Countries (MPCs) face lower profitability, liquidity issues, and higher levels of NPLs. Despite facing economic challenges, primarily the state-owned banks are dominating in providing required funds in the economy.

MENA's Economy

The region holdings of global energy reserves is remarkable (around 60% of the world's oil and 45% of its natural gas), but remains vulnerable to the disruptions of global commodity markets and other regional shocks. The MENA's economic growth rely mainly on its capability to successfully implement structural reforms implying a more diversified economy, productivity enhancement, and building a resilient banking sector against external shocks. Majority of MENA nations are characterized by low international capital market integration and thus were indirectly affected by the Global Financial Crisis (GFC) 2007-08. Noticeably, GDP growth rate dropped from 5.77% in 2008 to 0.64% in 2009 due to large declines in tourism, remittances, foreign direct investment (FDI), and oil prices, especially in the GCC. FDI fell from $88.7 billion in 2008 to $44.8 billion by 2011, and remained below $45 billion for the successive years. The region's recovery was prolonged further by fiscal pressures, reduced oil revenues, and oil price volatility after 2014, in which crude prices decreased from $100 per barrel to $30 by 2016. Sovereign debt levels also surged, as debt % of GDP increased from 48.6% in 2015 to 60.8% in 2018. For instance, this ratio exceeded 140% in Lebanon and rose from 55.4% to 80% in Bahrain.

Moreover, the COVID-19 pandemic exacerbated these pre-existing problems, reducing oil revenues and adversely affecting fiscal planning. In year 2020, economic growth contracted to 2.66%, inflation raised to 8%, and sovereign debt increased from 53.47% to 63.6% of GDP. These challenges were further aggravated by the Russia-Ukraine war, threatening financial stability and slowing down the economic recovery [2]. MENA's geopolitical and economic importance stem from being uniquely located at the crossroads of Asia, Africa, and Europe. Due to the region's ongoing financial vulnerability, it is essential to analyze the risk profiles of MENA banks. This study aims at contributing to the existing research body concerning financial risks in banking system, by analyzing the influence of both bank-specific and macroeconomic factors on solvency and credit risks for GCC and MPCs countries.

The structure of the paper is as follows: Section 2 illustrates the relevant empirical studies and demonstrates the research hypotheses. The methodology and model development is outlined in section 3. Section 4 interprets the results and discussion of main findings. Section 5 concludes the study and proposes avenues for future research.

2. RELATED WORK

Numerous studies have focused on identifying the influence of specific bank characteristics on bank risk. This section reviews empirical research that summarizes relevant analyses, highlighting the key determinants of banking solvency and credit risk.

2.1 Bank-Specific Variables

Size: The relationship between a bank's asset size and its stability is conflicting within the academic research. On one side of this debate, the evidence suggests that a larger size can mitigate bank's solvency risk and enjoy higher stability. In this case, advantages in economies of scale help financial institutions' capacity to increase revenues as well as maintaining higher level of capital buffers. These factors enable

banks to operate effectively and handle risks better to absorb potential losses [3], [4], [5], [6], [7], [8]. On the other side, some studies assert that larger banks may worsen solvency risk that undermines financial stability. Hence, larger banks tend to engage in excessive risk-taking practices, especially during credit boom periods which often exacerbate vulnerabilities [9], [10], [11], [12], [13].

Regarding credit risk, larger banks often have the advantage of asset diversification and a larger capital cushion, which helps mitigate risks associated with potential losses. Multiple studies show that, in this context, bank size negatively correlates with credit risk [5], [14], [15], [16], [17], [18]. However, other studies demonstrate that larger size positively affects credit risk which could be attributed to the "Too Big to Fail" (TBTF) policy. The implicit government support for these institutions can incentivize them to take on more risky loans, which can lower credit quality and increase the likelihood of loan defaults [19], [20], [8], [21].

Leverage: The results are mixed about the influence of bank leverage on financial stability. Generally, excessive leverage may be a primary source for financial fragility, [22] confirms that higher leverage ratio minimizes the level of Z-score reflecting an increased solvency risk. However, other studies present a contrary view, suggesting that highly leveraged banks may be linked to better financial stability [5], [23]. The financial soundness may not be immediately threatened particularly for those leveraged banks operating under stringent regulation and favorable market conditions. Instead, it can enhance financial stability temporarily by amplifying returns on investments. Leverage can drive up profitability, if the borrowed capital is wisely invested in high-return, low-risk opportunities. As long as the underlying risks are properly controlled, this eventually can improve the bank's financial health, higher Z-score, provided that the associated risks are properly managed.

While [16] argues that greater bank leverage deteriorates asset quality and increases credit risk exposure, [5] indicates that the impact of leverage on credit risk depends on specific factors. This involves the bank's internal risk management strategy and the macroeconomic environment. When banks are efficient and well-capitalized, higher leverage may be a sign of confidence in their own asset portfolio and proper credit assessment and monitoring process. This prudent lending approach can lead to a lower NPLs, particularly during stable economic periods and effective prudential regulations.

Liquidity: Several studies highlight that greater liquidity enhances bank's financial resilience through reducing the solvency risk [9], [10], [7]. Holding sufficient levels of liquid assets help banks to better meet short-term obligations, handle unexpected deposit withdrawals, and provide stable funding without engaging in fire sales, which could otherwise hamper financial stability. Nevertheless, [3] argues that excess liquidity positions may raise bank's solvency risk, which is attributed to inefficient capital allocation, thereby leading to opportunity costs and reduced profitability.

The findings of [24] reveal that maintaining higher liquid-assets positively affect bank credit quality, allowing them to better manage funding pressures and avoid costly asset fire sales, which in turn stabilize their earnings and reduce solvency risks. Conversely, other studies [25], [16] show that too much liquidity can even worsen the level of credit risk, as liquid assets usually yield lower returns than longer-term less liquid investments. This inefficient use of capital creates opportunity costs and drags down profitability, implying that overly conservative liquidity management could ultimately dampen a bank's financial performance.

Profitability: The evidence provided on the relationship between profitability and financial stability is mixed. Generally, greater profitability enhances financial stability since banks are more capable of accumulating capital buffers required to absorb potential losses during periods of distress [9], [12], [22], [23], [26]. Nevertheless, excessive profitability may encourage risk-taking behavior as banks seek higher returns, which may fuel leverage growth that ultimately can amplify financial instability [10], [27].

Robust profitability helps reduce a bank's credit risk that could be emanating from tighter leverage constraint and improved capital-generation capacity. In case of tighter governance, profitable banks' strategies are less speculative in behaviour, while investing in risk management reflected in lower NPLs [19], [25], [15], [28], [12], [17], [16], [18]. Other empirical results oppositely argue that profitability raises

credit losses, which probably occur when higher profitability encourages banks to raise interest margins, thereby losing creditworthy and safer borrowers while attracting riskier ones who accept higher rates. Moreover, relying on higher leverage and risky investment decisions to pursue greater profitability may cause spillovers and deteriorated future loan portfolios. This strategy can lead to a deterioration in credit quality [16], [22], [21]. Furtherly, a study by [29] explains that a bank's credit policy is influenced not only by profitability goals but also by the effectiveness of its credit risk management practices.

Diver's Ability: Non-interest income (NII) captures the level of income diversification for banks, alternative sources from other activities such as asset management, fee-based services, and trading. Income diversification can dampen earnings volatility and enhance a bank's financial resilience, as several studies support that more income diversity reduces the likelihood of bankruptcy and strengthens bank's stability [22], [26], [8], [13]. Contrarly, some research warns that NII may lead to a greater solvency risk, especially when banks depend heavily on non-traditional activities without adequate risk controls. These activities (e.g. trading or insurance) are inherently more volatile than traditional interest income, which may furtherly threaten institution's financial stability [30], [11].

Although some studies find an adverse link between NII and credit risk, referring that more diversifiable banks tend to be safer generally coincide with better asset quality and lower NPLs [31], [28], [8] other research suggests that excessive reliance on diversification can raise income volatility and amplify credit risk. This may occur in case of inadequate internal governance and relaxed lending standards heightening the probability of loan defaults [32], [20]. Consequently, asset diversification can drive profitability and help banks to withstand financial turmoil, but its benefits are sensitive to appropriate risk management techniques.

2.2 Macroeconomic Factors

Economic Growth: Economic expansion can induce banking resilience usually via higher returns and providing better capital cushion, which enable banks to expand and maintain their financial stability, captured by a higher level of Z-score [5], [7], [22], [8]. Nonetheless, some studies pointed out that economic growth weakens banking financial stability, as banks often seek greater profit via engaging in riskier lending during booms. These short-term practices to boost bank profits come at the expense of long-term financial stability [11], [10]. Economic growth is generally linked to lower non-performing loans (NPLs), with many studies showing an inverse relationship between GDP growth and NPLs during economic booms [19], [5], [20], [14], [12], [24]. However, some results signal that economic growth dampens credit quality [17], [28], [8]. This could be attributed to a combination of relaxed lending criteria and more credit expansion that build up riskier loan portfolio with probable future defaults.

Inflation: The impact of inflation on the banking sector might be ambiguous. On one hand, some results affirm that an inflation surge is considered to threaten banks' financial stability [11], [10], [8]. Inflation can destabilize the financial institutions by reducing the currency's purchasing power and raising the opportunity cost of holding currency, and thus it adversely affects exchange rates. Additionally, high inflation can disrupt banks' decisions in terms of capital allocation which furtherly could harm the value of banks' equity holdings and lead to financial instability. On the other hand, some studies show that inflation can have a positive effect on bank stability when banks accurately anticipate price trends and adjust their interest rates accordingly. This strategy may enable them to widen the gap between revenues and costs. Basically, when interest rate margins are effectively managed, profitability and stability are enhanced [9], [6], [7], [27], [12].

A positive associationship between inflation and NPLs, credit risk, is supported by numerous studies [14], [28], [12], [8], [24], [21]. Higher Inflation often threaten asset portfolio quality because it weakens the borrowers' debt repayment capacities. However, some other studies suggest that rising inflation can reduce default risk derived by eroded real value of outstanding loans making repayment easier [15], [17]. In other words, the lowered repayment burden could improve borrowers' ability to meet their obligations and thereby lower the rate of loan defaults. Numerous studies emphasize the importance of

analyzing the factors influencing solvency and credit risks which is crucial for enhancing asset quality management and financial stability. While existing research explores the relationship among bank performance, macroeconomic conditions and bank risk, a significant gap remains concerning the MENA region context. This is due to the region's unique features, involving different levels of economic development and regulatory regimes, which necessitates further examination of the driving factors of solvency risk (Z-score) and credit risk (non-performing loan (NPL) ratios) in the MENA region. The empirical literature specific to the MENA region is relatively limited. Some existing studies focus on the main sources of bank stability and solvency risk (Z-score) [9], [4], [27] and others explore the drivers of NPLs [15], [28]. A few authors, such as [5] and [8], investigate both banking risk measures. Given this, it is crucial to specifically address the factors influencing banking solvency and credit risks in the MENA region. This paper aims to bridge this gap by empirically examining how both bank-specific factors and macroeconomic indicators affect financial risks in MENA countries.

3. METHODOLOGY

The entire sample includes 2484 observations, including 138 banks for the same countries during 2005-2022. The risk measures adopted are solvency-risk (Z-score) and credit-risk (NPLs ratio). Moreover, the full datasets are divided into 2 sub-samples, one for GCC region and the second for MPC. The selected countries are the same for both main samples which are: GCC group includes Qatar, Saudi Arabia, Emirates, Kuwait, Bahrain and Oman and the MPC, involving Egypt, Jordan, Lebanon, Tunisia, Algeria, and Morocco. The bank-specific ratios obtained from the Orbis BankFocus database by Bureau van Dijk, and macroeconomic variables are collected from the World Bank. Stata statistical software is used to run multiple panel regressions through the following expression:

$$Y_{it} = \theta + \beta X_{it} + \alpha M_{it} + u_{it}$$

Where subscripts i and t denote the cross-sectional (bank) and time dimension (year) of the panel, respectively. Y_{it} is the vector of bank indicators, X_{it} and M_{it} are the vectors of bank-specific variables and country-level variables. β and α are the vector of coefficients to be estimated, and u_{it} is the error term. Bank characteristics and macroeconomic variables are illustrated in Figure 1.

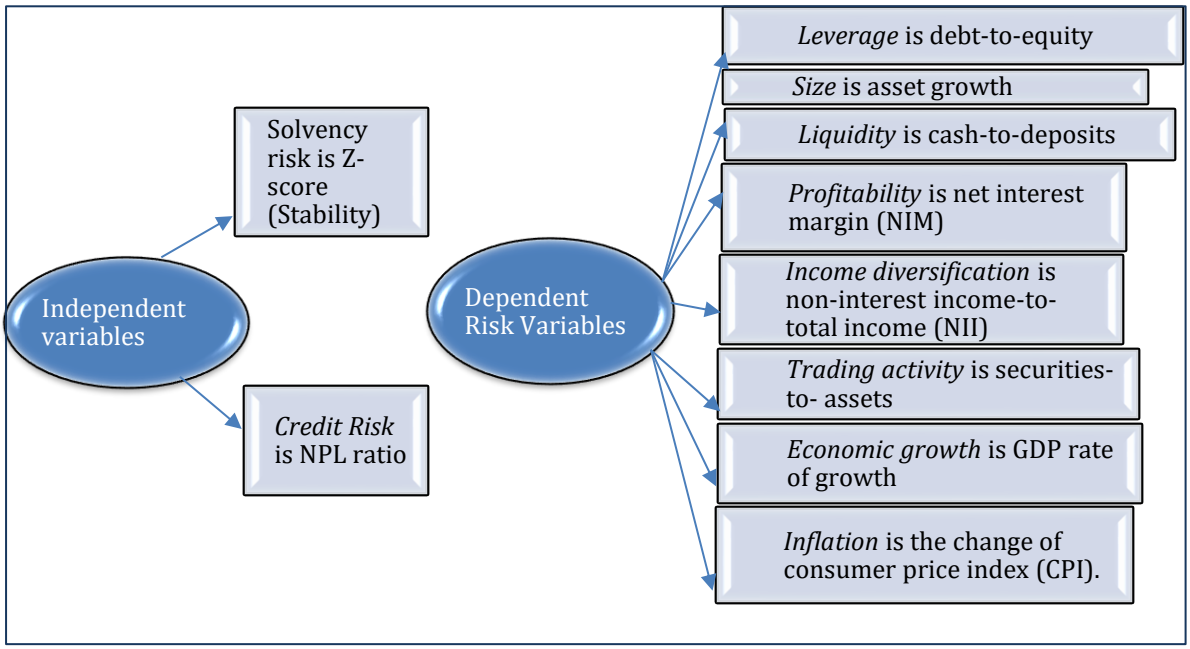

Figure 1. Conceptual Framework Shows the Dependent Risk Variables and Explanatory Variables (Bank-Specific and Macroeconomic)

4. RESULTS AND DISCUSSION

4.1 Descriptive Statistics

The summary statistics of the dataset between 3 samples are separated as indicated in Table 1. Through the period 2005-2022, this research uses 138 bank-year observations (panel A) and divided into two subsamples to compare between two groups of countries GCC (B) and MPC (C). On average, the behaviour of stability measured by z-score appears similar across the 3 samples and the MPC group reveals the largest value of 81.09. It also has highest leverage value of around 30 and its mean value is larger compared to B, also MPC' banks have a relatively lower credit quality. Both Size and Diversability have the highest standard deviations in sample B as 16.38 and 16.58, respectively.

Table 1. Summary Statistics

	Mean			Std. Dev.			Min			Max		
Variable	**A**	**B**	**C**	**A**	**B**	**C**	**A**	**B**	**C**	**A**	**B**	**C**
Z-score	21.06	21.44	20.83	12.76	12.81	12.73	0.64	2.00	0.64	81.09	75.92	81.09
Leverage	8.56	6.16	10.01	4.58	2.70	4.87	0.10	0.13	0.10	30.97	24.03	30.97
Liquidity	14.04	12.02	15.26	13.67	11.47	14.71	0.34	1.01	0.34	92.01	92.01	88.56
Size	11.70	11.14	12.04	15.11	16.38	14.29	-44.48	-44.48	-32.99	78.51	78.19	78.51
Profitability	3.38	3.07	3.57	1.56	1.36	1.64	-3.86	-3.86	-2.30	12.42	9.53	12.42
Diversability	31.31	31.81	31.00	15.69	16.58	15.12	-2.66	1.36	-2.66	141.21	129.82	141.21
Trading activity	20.17	15.42	23.03	13.12	9.85	14.00	0.00	0.00	0.00	63.73	57.05	63.73
Credit quality	8.31	6.24	9.56	9.00	9.43	8.50	0.02	0.05	0.02	74.79	59.78	74.79
Eco Growth	3.04	3.64	2.67	4.50	4.35	4.55	-21.40	-8.86	-21.40	26.17	26.17	10.23
Inflation	4.78	2.66	6.06	4.97	2.96	5.48	-4.86	-4.86	-3.75	29.51	15.05	29.51
Obs	2484	936	1548	2484	936	1548	2484	936	1548	2484	936	1548

4.2 Estimation Results

Before applying FE or RE models, Pooled OLS regression is firstly estimated to check diagnostics of the model residuals. Generally, the results are similar of the preliminary POLS estimations for the dependent variables and the relevant diagnostic checks. Where, Skewness and Kurtosis test shows that residuals are non-normally distributed. As per the correlation matrices, variance inflation factor (vif) indicates no multicollinearity issues. Finally, Breusch-Pagan test for serial correlation indicates the presence of hetroskedasticity, in which p-value>0.05 refers to rejecting the null hypothesis of constant variance of error term). Nevertheless, FE an RE estimations can appropriately deal with hetroskedasticity through using robust standard errors.

Solvency-Risk (or Stability): Z-Score

The estimation outcomes for the 3 panels, as in Table 2, demonstrate that Leverage has strong significant adverse impact on bank's Stability level, hence lower leverage ratio improves bank's stability. However, significant only for panels A and B, greater Liquidity is associated with higher level of stability. Only in case of GCC banks, Size has a significant negative effect on stability for the main model FE and the GMM, but it is insignificant for the primary models RE and FE in panels A and C, respectively. Larger Profitability tends to be significantly associated with better stability level as indicated in panels A and C. Both Diversability and Economic growth tend to have a significant positive relationship for all panels. Similarly, more Trading activity contributes to better stability position that is significant only for the sub-sample of GCC banks. The coefficients of Credit quality in the primary regression models are insignificant for the 3 samples, only GMM estimators are significantly positive for A and B. For the samples A and B, the estimations indicate that higher Inflation worsens stability level of a bank.

Table 2. Z-Score Estimation Results

	Panel A		Panel B		Panel C	
	RE	**GMM**	**RE**	**GMM**	**RE**	**GMM**
Leverage	-1.110***	-0.508***	-1.711***	-0.728***	-0.987***	-0.503***
	(0.121)	(0.0158)	(0.486)	(0.075)	(0.110)	(0.0193)
Liquidity	0.0804*	0.0187***	0.143*	0.052***	0.0246	-0.00362
	(0.0480)	(0.00267)	(0.0746)	(0.015)	(0.0365)	(0.00313)
Size	0.0129	-0.0354***	-0.0401**	-0.05***	-0.000281	-0.0239***
	(0.0111)	(0.00190)	(0.0195)	(0.009)	(0.0107)	(0.00232)
Profitability	0.584**	0.459***	0.108	0.213	0.824***	0.555***
	(0.298)	(0.0447)	(0.294)	(0.169)	(0.313)	(0.0965)
Diversability	0.0828**	0.0471***	0.0222	0.022	0.109*	0.0593***
	(0.0420)	(0.00211)	(0.0214)	(0.014)	(0.0577)	(0.00431)
Trading activity	0.0369	0.0117***	0.0854*	0.039**	0.00996	0.00231
	(0.0266)	(0.00385)	(0.0478)	(0.019)	(0.0227)	(0.00620)
Credit quality	0.0931	0.0202***	0.157	0.052**	0.0285	0.00641
	(0.0641)	(0.00310)	(0.144)	(0.023)	(0.0218)	(0.00513)
Eco. Growth	0.108***	0.0711***	0.145*	0.097***	0.0656**	0.0536***
	(0.0395)	(0.00577)	(0.0860)	(0.028)	(0.0263)	(0.00611)
Inflation	-0.0546**	-0.0157***	-0.00518	-0.031	-0.0609**	-0.00856
	(0.0271)	(0.00338)	(0.0700)	(0.039)	(0.0274)	(0.00605)
L.Zscore	0.532***		0.610***		0.490***	
	(0.0139)		(0.025)		(0.0273)	
Constant	23.13***	10.37***	25.97***	10.29***	23.72***	11.54***
	(2.738)	(0.371)	(4.996)	(1.19)	(3.376)	(0.865)
No. of obs.	2,484	2,208	936	832	1,548	1,376
No. of banks	138	138	52	52	86	86
R-squared	0.39		0.41		0.42	

Notes: The dependent variable is solvency-risk (stability) risk proxied by Z-score. The explanatory variables include bank-level variables: leverage (TL-to-TE), liquidity (cash-to-deposits and short-term funding), size (growth rate of TA), profitability (net interest margin NIM), and income diversification (non-interest income-to-total income NII), credit quality (NPLs-to-gross loans) and trading activity (total trading securities-to-TA), as well as macroeconomic variables: economic growth (growth rate of GDP) and Inflation (change of consumer price index CPI). The regressions consider Bank random effects are considered in panels A and B, while bank fixed effects in panel C. Also, the table depicts the conducted GMM dynamic

models using first lag of dependent variable (L. Z-score). Robust standard errors are indicated in parentheses. Statistical significance according to p-value: *** p<0.01, **p<0.05, * p<0.1.

Credit-Risk: NPL

The effect of bank-level and macroeconomic explanatory variables on Credit risk is shown in Table 3. The results show a positive relationship between less Credit quality and Leverage ratio, which is highly significant for both panels A and C. Similarly, higher Liquidity is positively associated with NPL ratio (i.e. lower Credit quality) and it is statistically significant mainly for panels A and B. The findings suggest better Credit quality (lower NPL ratio) will occur as Size becomes larger and this significant for the 3 panels. However, Profitability is statistically insignificant for all samples. Moreover, the main FE-RE panel estimation results of Diversability, Trading activity and Inflation are insignificant for the 3 samples. Only highly significant for GCC banks, the results show that Economic growth is negatively associated with Credit quality indicating a lower NPL ratio or better Credit quality.

Table 3. NPL Estimation Results

	Panel A		**Panel B**		**Panel C**	
	FE	**GMM**	**FE**	**GMM**	**RE**	**GMM**
Z-score	0.156*	0.0101	0.188	0.0283	0.0376	-0.00634
	(0.0929)	(0.00725)	(0.131)	(0.0291)	(0.0369)	(0.0360)
Leverage	0.308***	0.123***	0.0710	0.0553	0.244***	0.110**
	(0.109)	(0.0237)	(0.204)	(0.122)	(0.0841)	(0.0539)
Liquidity	0.0772*	0.0394***	0.155*	0.0252***	0.0193	0.0355**
	(0.0461)	(0.00235)	(0.0893)	(0.00814)	(0.0271)	(0.0163)
Size	-0.0660***	-0.0424***	-0.0740***	-0.0475***	-0.0548***	-0.0381***
	(0.0119)	(0.000871)	(0.0149)	(0.00292)	(0.0165)	(0.00970)
Profitability	-0.188	-0.00798	-0.380	-0.0513	-0.0597	0.0870
	(0.279)	(0.0488)	(0.344)	(0.151)	(0.290)	(0.154)
Diversability	-0.0107	0.00594***	-0.0394	-0.0159***	0.0107	0.0187
	(0.0262)	(0.00179)	(0.0414)	(0.00482)	(0.0247)	(0.0133)
Trading activity	0.0118	-0.0150***	0.151**	0.0112	-0.0454	-0.0329*
	(0.0408)	(0.00218)	(0.0697)	(0.0217)	(0.0423)	(0.0174)
Eco. Growth	-0.0709	-0.0687***	-0.114**	-0.0935***	-0.0418	-0.0551*
	(0.0438)	(0.00310)	(0.0481)	(0.00981)	(0.0598)	(0.0285)
Inflation	0.0402	0.00868***	0.0387	0.0597***	0.0667	0.00250
	(0.0492)	(0.00328)	(0.0701)	(0.0151)	(0.0524)	(0.0273)
L.NPL	0.669***		0.697***			0.681***
	(0.00853)		(0.0186)			(0.0208)
Constant	2.819	1.700***	1.129	1.691***	7.330***	1.934***
	(2.992)	(0.387)	(3.746)	(1.399)	(2.600)	(1.374)
No. of obs.	2,484	2,208	936	832	1,548	1,376
No. of banks	138	138	52	52	86	86
R-squared	0.07		0.24		0.05	

Notes: The dependent variable is credit-risk proxied by NPLs-to-gross loans.

5. CONCLUSION

The study presents empirical findings from panel estimations, identifying key bank-specific and macroeconomic factors that influence solvency and credit risk. Key determinants of solvency risk include leverage, liquidity, profitability, diversification, and economic growth. Specifically, lower leverage and inflation levels contribute to a lower solvency risk, while increased liquidity, profitability, diversification,

and economic growth positively affect it. In contrast, credit risk is found to be inversely related to bank size but positively linked to leverage and liquidity. In the context of the GCC**,** solvency risk is positively correlated with leverage and bank size, whereas liquidity, trading activity, and economic growth exert a negative influence. For credit risk, an increase in bank size and economic growth leads to improved credit quality, while greater liquidity is associated with higher credit risk. In the MPC, findings indicate that only leverage worsens solvency risk, while profitability, diversification, and economic growth mitigate it. Similar to samples A and B, larger bank size reduces credit risk, but higher leverage worsens it.

The study's findings align with existing literature, supporting the notion that higher leverage increases both solvency and credit risk, thereby compromising bank stability and increasing the NPLs. Additionally, better liquidity**,** profitability**,** diversification, and economic growth reduce solvency risk, although the relationship between liquidity and credit risk is positive, particularly in the GCC. The study also affirms the "Too Big to Fail" (TBTF) hypothesis for the GCC, where larger banks face higher solvency risks, yet exhibit lower credit risk. Macroeconomic factors further corroborate established research, with inflation increasing solvency risk and economic growth decreasing both solvency and credit risks.

Research Implications and Further Research directions

This study examines the key sources of banking risk and the role of regulation in enhancing financial stability. The findings indicate that stricter supervision effectively mitigates banking risks, while excessive leverage drives credit expansion at the cost of higher credit risk, underscoring the importance of leverage ratio requirements. Income diversification is shown to reduce solvency risk, and MENA banks—particularly in GCC countries with strong capitalization (average Tier 1 ratio of 16.5%)—demonstrate greater resilience, with larger banks exhibiting lower bankruptcy and credit risks. Basel III further strengthens stability by imposing higher capital buffers, countercyclical measures, and stricter liquidity standards (LCR and NSFR). However, the MENA region faces heightened risks from macroeconomic instability, including inflation, rising interest rates, and spillover effects from global crises such as the COVID-19 pandemic and the Russia-Ukraine conflict. Additionally, climate-related financial risks are emerging as a critical concern. The study emphasizes the need for robust Basel III implementation to safeguard the banking sector against these compounding challenges while maintaining financial stability in a volatile economic landscape.

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Author Contributions Statement

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
Lamya M. Gadou	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

Conflict of Interest Statement

Author state no conflict of interest.

Informed Consent

Not Applicable

Ethical Approval

Not Applicable

Data Availability

The data that support the findings of this study are available on request from the corresponding author, LG.

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