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The Determinants of Bank Risk: The Case of Tunisia

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Abstract:

Purpose: *Banks are financial intermediaries that channel funds from surplus units to deficit units. In doing so, they perform four key functions: liquidity intermediation, denomination intermediation, risk transformation, and maturity transformation. Due to the nature of these activities, banks are exposed to various types of risk, including liquidity risk, operational risk, credit risk, interest rate risk, and foreign exchange risk. This study aims to identify the main determinants of bank risk in the Tunisian context.*
Design/Methodology/Approach: *Bank risk is measured using three indicators: risk-weighted assets to total assets (RWTA), non-performing loans (NPLs), and the Z-score. The empirical analysis is based on a sample of 11 banks listed on the Tunis Stock Exchange over the period 2014–2023. Panel data techniques are employed to estimate three econometric models.*
Findings: *The results indicate that liquidity, total credit, return on equity, bank size, capital adequacy, economic growth, and inflation significantly affect bank risk. The findings suggest that both bank-specific factors and macroeconomic conditions play an important role in shaping risk levels in Tunisian banks.*
Originality: *This study contributes to the existing literature by providing recent empirical evidence on the determinants of bank risk in an emerging economy, specifically Tunisia, over a relatively recent period marked by economic and financial changes. It also employs multiple risk measures (RWTA, NPLs, and Z-score), offering a more comprehensive assessment of bank risk compared to studies relying on a single indicator.*

Keywords: *Bank, Z-score, NPLs, liquidity, Return on Equity, capital.*

JEL Codes: *G21, G32, G28, E44, C23.*

Paper type: *Research article.*

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1. Introduction

Haq and Heany (2012) defines risk as an appetite for selection among a variety of alternatives with different levels of uncertainties. They indicate that the risk-taking behavior of banks referee to the appetite to choose among varieties of projects, investments or ventures with different levels of uncertainties and expected cashflows.

Saldías (2013) argues that the level of risky decisions available to and made by banks as regards investments, projects and or ventures is greatly important as it determines their performance. As a result, banks must make appropriate risk choices to maximize and maintain their performance in the form of profitability, stability and efficiency (Demirguc-Kunt, Detragiache, and Merrouche, 2013).

The level of risk that those that are charged with the responsibility of directing and controlling the banks are willing to tolerate can either harm or benefit the bank. For instance, the excessive risk-taking behavior of the Lehman brothers' was harmful to the bank and led to the 2008 Global Financial Crisis which invariably had a global impact and far-reaching effect. Also, the risk-taking appetite of banks is influenced by aggressive competition, corporate governance and banking regulations (Huang and Xiong, 2015).

According to Bank for International Settlements (2013) to manage the heavy risk appetite of banks, there have been some significant changes made to the Basel III Accord. First, the minimum capital requirement as highlighted in Basel II was amended and increased for banks to maintain a buffer of capital that could be used to absorb losses during periods of financial and economic stress.

Second, the leverage requirements were improved to include a non-risk-based leverage ratio for the banks to prevent a banking crisis that could cause a lowered leverage which could result in a downward trend of asset prices and bank capital.

Finally, the liquidity requirement was amended to include two new liquidity ratios; the liquidity coverage ratio (LCR), and the net stable funding ratio (NSFR). The LCR requires banks to hold sufficient high-liquid assets that can withstand a 30-day stressed funding scenario as specified by the bank supervisor, and the NSFR requires banks to maintain stable funding above the required amount for one year of extended stress. The NSFR is primarily designed to address liquidity mismatch in banks and to reduce liquidity crises in case of shocks.

In this study we attempt to identify the factors affecting the bank risk in Tunisian context. We employ a methodology of 3 sections. The first section is devoted to literature review, then we make an empirical study in second section. Finally, we will draw a conclusion.

2. Literature Review

There are several studies about the factors affecting the bank risk. Malvar and Pascal (2020) examined the main bank risk determinants in Latin America over the period (1999-2013). They used the GMM estimator system. According to their results, well capitalized liquid and traditional commercial banks are less risky.

Yusuf *et al.* (2021) used a sample of 27 commercial banks in Malysia for the period (1998-2017). They found a positive relationship between leverage, interest income and return on equity with credit risk while ROA, bank size, ratio of capital are negatively related to credit risk.

Lee and Hseih (2013) used the data from Asian banks to explore a statistical relationship between the level of capital and the risk of banks by using the Generalized method of moments (GMM) estimation technique. They concluded that bank capital was significant and positively related to the risk-taking behavior of banks. They justified their findings by stating that a higher level of capital would lead to enhanced profits for banks and in turn the banks would take more risks.

According to Boyd and Runkhle (1993), Demestez and Strahan (1997), large banks may use the leveraged investment to expand their assets. Demirguc Kunt *et al.* (2010) found that higher bank capital would motivate bankers to take on more risks. Charya and Naqvi (2012) suggested that banks with higher liquidity tend to be riskier by declining the lending standards to increase the volume of loans.

Salas and Saurina (2002) using data for Spain over the period (1985-1997) empirically assess the impact of both bank specific and macroeconomic determinants on credit risk. They show factors like branch expansion, inefficiency, portfolio composition, size and market power, playing a key role in explaining credit quality.

Obadire *et al.* (2023) used the sample of 45 listed banks in Africa for the period (2010-2019). They found that minimum capital requirement capital buffer minimum and profitability were significant determinants of the risk-taking behavior of the African banks.

On the other hand, the Basel accord classifies the main bank risks as credit risk, market risk, liquidity risk and operational risk amongst other risks. In the bank decision making process the attitude and amount of risk taken by the decision makers depend largely on their risk appetite consideration of other internal and external factors as well as other prudential regulatory guidelines such as the Basel 3 accord (Klomp and Haan, 2012).

Similarly, Jokipi and Milne (2011) used samples of US banks and found a positive association between capital and risk taking behavior of highly capitalized banks.

Moreover, Karim *et al.* (2014) conducted a study on 26 banks in Pakistan and found that the Basel 3 capital requirements had a significant and positive effect on the risk-taking behavior of banks both in the long run as well as in the short run.

Specifically, the results of the study revealed that the capital adequacy ratios (a proxy for bank capital) and the ratio of risk weighted assets (a proxy from risk taking) along with the bank size interest rate and profitability ratios were interrelated in the long run.

El Domiaty *et al.* (2022) examined country specific and bank specific factors that affect bank Z score (being a proxy for overall banks risk) in the MENA region. They used a sample of 33 listed commercial banks operating in 6 countries (MENA region) for the period (2000-2020). They found that unemployment rate had a negative effect on high overall bank risk and the financial crisis had a positive effect on the MENA overall bank risk.

Morina (2020) analyzed the determinants of credit risk in commercial banks in Kosovo through the period (2012-2018). Interest rate on loans and profitability of bank (ROA) have the largest and most significant impact on credit risk.

Also, Antony and Suresh (2023) examined the determinants of credit risk for 31 banks in India for the period (2012-2021). They found a statistically significant negative relationship between ROE and credit risk gross domestic product related to bank risk; inflation negatively affect credit risk.

3. Empirical Study

3.1 Methodology

We will use a sample of 11 banks (Attijari bank; Amen bank; ATB; BIAT; BT; BTEI; BH; STB; BNA; UIB; UBCI) included in the financial market of Tunisia for the period (2014-2023).

We used a methodology of panel data. Panel data can model both the common and individual behaviors of groups. Panel data contains more information, more variability, and more efficiency than pure time series data or cross-sectional data.

3.2 Specification of Variables

(1) $RWATA_{i,t} = b0 + b1\ ROA_{i,t} + b2\ ROE_{i,t} + b3\ NIM_{i,t} + b4\ Size_{i,t} + b5\ TLA_{i,t} + b6\ CAP_{i,t} + b7\ CEA_{i,t} + b8\ Tdeposit_{i,t} + b9\ TPIB_{i,t} + b10\ TINF_{i,t} + b11\ ALA_{i,t} + E_{i,t}$

(2) $NPL_{i,t} = b0 + b1\ ROA_{i,t} + b2\ ROE_{i,t} + b3\ NIM_{i,t} + b4\ Size_{i,t} + b5\ TLA_{i,t}$

+b6 CAPi,t +b7 CEAi,t + b8 Tdepositi,t +b9 TPIBi,t +b10 TINFi,t +b11 ALAi,t +Ei,t

(3) Zscore i,t =b0+b1 ROAi,t +b2 ROEi,t +b3 NIMi,t +b4 Sizei,t +b5 TLAi,t +b6 CAPi,t +b7 CEAi,t +b8 Tdepositi,t +b9 TPIBi,t +b10 TINFi,t +b11 ALAi,t +Ei,t

ALA= liquid assets / total assets
TLA= total credits / total assets
ROA= net income / total assets
ROE= net income / total equity
NIM = net interest margin / total assets
Size = log total assets
CAP= capital / total assets
CEA= operating costs / total assets
T deposit = total deposit / total assets
TPIB= economic growth
TINF= inflation rate
RWTA= risk weighted assets / total assets
NPL =non-performing loans / total loans

Alton and Hazen (2001) stated that loans become non performants if the full payment of principal amount and interest is not done on due date and is no longer expected on future date. A low level of NPLS shows a strong monetary system in the country while high NPLS indicate a weak financial position. NPLs are defined as loans that have not received payments for at least 3 months (International Monetary Fund 2015).

Z-score =EATi,t +ROAi,t/ 6(ROAi,t)

EATi,t= equity /assets
ROA= return on assets
6(ROA) = standard deviation of return on assets
i= bank; t= time

Z-score measured for insolvency risk that is represented for bank's stability (Adusei 2015; Ali and Puch, 2018; Yin, 2019). The Z-score is an overall measure of bank risks. This metric has been examined in various related empirical studies (Hannan and Hanweck, 1988; Lepetit and Strobel 2015; Ghenimi *et al.* 2017; Chen 2018; Hamdi and Hakimi 2019; De-Ramon *et al.,* 2020; Pham *et al.,* 2021).

A high value of Z-score indicates high banking stability, which is inversely related to the probability of default (Li *et al.,* 2017). As far as the Z-scores are positively skewed, the natural logarithm of the Z-scores is used, which approximates the values of the z-score to normal distribution (Laeven and Levine 2009).

3.3 Analysis of Descriptive Statistics

Table 1 presents the descriptive statistics of the variables.

Table 1. *Descriptive statistics*

Variable	Observations	Mean	Standard deviation	Minimum	Maximum
ROA	110	0.015	0.0178	0.0089	0.0983
ROE	110	0.143	0.0753	0.0034	0.3615
NIM	110	0.034	0.0189	0.0085	0.1746
Size	110	16.45	0.95	14.56	18.36
TLA	110	0.793	0.1457	0.14	0.9817
CAP	110	0.1456	0.0738	0.0092	0.49
CEA	110	0.084	0.029	0.00233	0.38
T-deposit	110	0.8615	0.1583	0.7514	0.973
TPIB	110	0.031	0.0465	-0.1052	0.067
TINF	110	0.075	0.0169	0.0350	0.08674
RWTA	110	0.015	0.043	0.012	0.019
NPL	110	0.253	0.086	0.23	0.27
Z-score	110	0.028	0.023	0.014	0.042
ALA	110	0.0324	0.0254	0.0135	0.01642

Notes:
-ROA (mean = 0.015). The net return represents an average of 1.5% of total assets. Standard deviation is low. There is no big difference in terms of ROA
-ROE (mean = 0.143). The net return represents an average of 1.43% of total equity. Standard deviation is high. There is big difference in terms of ROE between banks
-NIM (mean = 0.034). The net interest margin represents 3.4% of total assets an average. Standard deviation is low. There isn't a big difference between banks in terms of NIM
-Size (mean = 16.45). This is big difference in terms of size between banks. Standard deviation is high.
-TLA (mean = 0.793). The total credit represents 79.3% an average of total assets. There is big difference between banks in terms of TLA.
-CAP (mean = 0.1456). Total capital represents 14.56% of total assets. There isn't huge difference in terms of capital.
-CEA (mean = 0.84). Operating costs represent 84% of total assets an average. Standard deviation is not high. There isn't big difference between banks in terms of CEA
-T deposit (mean = 0.8615). Total deposits represent an average of 86.15% of total assets. Standard deviation is high. There is big difference between banks in terms of T deposit.
-TPIB (mean = 0.031). The average economic growth is 3.1%.
-TINF (mean =0.075). The average level of inflation is 7.5%.
-RWTA (mean = 0.015). The average is 1.5%. The standard deviation is low. There is no big difference between banks in terms of RWTA.
-NPL (mean =0.253). The average is 25.3%. The standard deviation is high. There is big difference between banks in terms of NPL.
-Z-score (mean = 0.028). The average Z-score is 2.8%. The standard deviation is low. There is no big difference between banks in terms of Z-score.
-ALA (mean = 0.0324). The average ALA is 3.24%. The standard deviation is low. There is no big difference between banks in terms of liquid assets.
Source: *Own study.*

3.4 Multicollinearity Test

Table 2. *Multicollinearity between the variables*

	ALA	**TLA**	**ROA**	**ROE**	**NIM**	**Size**	**CAP**	**CEA**	**T-deposit**
ALA	1.000								
TLA	0.254	1.000							
ROA	0.741	0.451	1.000						
ROE	0.015	0.523	0.178	1.000					
NIM	0.018	0.025	0.157	0.176	1.000				
Size	0.234	0.032	0.183	0.195	0.28	1.000			
CAP	0.345	0.018	0.024	0.026	0.029	0.25	1.000		
CEA	0.017	0.251	0.263	0.284	0.324	0.27	0.29	1.000	
T-deposit	0.273	0.029	0.034	0.038	0.043	0.281	0.081	0.25	1.000
TPIB	0.291	0.034	0.054	0.056	0.064	0.32	0.084	0.27	0.264
TINF	0.324	0.085	0.075	0.069	0.073	0.35	0.093	0.29	0.281
RWTA	0.015	0.25	0.078	0.015	0.156	0.191	0.15	0.315	0.342
Z-score	0.019	0.243	0.083	0.027	0.178	0.298	0.18	0.324	0.035
NPL	0.025	0.276	0.094	0.029	0.194	0.325	0.23	0.327	0.356

Source: *Own study.*

All the coefficients are inferior to 0.80%. There is no problem of multicollinearity.

Table 3. *Correlation between the variables*

	CEA	T-deposit	TPIB	TINF	RWTA	Z-score	NPL
CEA	1.000						
T-deposit	0.25	1.000					
TPIB	0.17	0.29	1.000				
TINF	0.35	0.49	0.04	1.000			
RWTA	0.156	0.178	0.156	0.26	1.000		
Z-score	0.046	0.052	0.042	0.53	0.59	1.000	
NPL	0.046	0.063	0.074	0.76	0.65	0.69	1.000

Source: *Own study.*

Table 4. *VIF of variables*

Variable	VIF	1/VIF
ALA	1.25	0.8
TLA	2.37	0.42
ROA	3.06	0.32
ROE	1.85	0.54
NIM	1.14	0.87
Size	2.67	0.37
CAP	3.25	0.30
CEA	3.08	0.32
T-deposit	1.27	0.78
TPIB	1.49	0.67
TINF	2.15	0.46

RWTA	2.24	0.44
Z-score	1.15	0.86
NPL	1.38	0.72

Source: *Own study.*

Variance inflation factor (VIF) is a measure of the amount of multicollinearity in a set of multiple regression variables. Mathematically the VIF for a regression model variable is equal to the ratio of the overall model variance to the variance of a model that includes only those single independent variables.

This ratio is calculated for each independent variable. A high VIF indicates that the associated independent is highly collinear with the other variables in the model. VIF is inferior to 5. There is no problem of multicollinearity.

3.5 Hausman Test

In panel data analysis (the analysis of data over time). The Hausman test can help you to choose between fixed effect models or random effect models. The null hypothesis is that the preferred model has random effect the alternative hypothesis is that the model has fixed effect.

Essentially the test looks to see if there is a correlation between the unique cross and the regressors in the model. The null hypothesis is that there is no correlation between the 2. In our case prob $chi^2 = 0.075$ (model 1), prob $chi^2 = 0.083$ (model 2) Prob $chi^2 = 0.017$ (model 3). The model 1 and model 2 are for random effect, the model 3 for fixed effect.

3.6 Results of Estimations and Interpretations of Models

Table 5. *Results of estimation of Model 1*

RWTA	Coefficient	Z	Z<p
ALA	-0.153	2.43	0.0227
TLA	0.248	2.56	0.0547
ROA	0.342	1.25	0.46
ROE	0.415	2.49	0.0229
NIM	0.027	1.42	0.48
Size	0.038	3.25	0.0117
CAP	0.0425	3.17	0.0113
CEA	-0.029	0.53	0.94
T-deposit	-0.056	0.14	0.83
TPIB	0.028	3.85	0.016
TINF	-0.0143	2.14	0.0342

Source: *Own study.*

There is a negative relationship between RWTA and ALA (if ALA increases by 1%, RWTA will decrease by 0.153%). The increase of liquid assets has a negative impact on bank risk.

There is a positive relationship between TLA and RWTA (if TLA increases by 1%, RWTA will increase by 0.248%). The increase in total credit has a positive impact on bank risk.

There is a positive relationship between ROA and RWTA (if ROA increases by 1%, RWTA will increase by 0.342%). The increase in return on assets has a positive impact on bank risk.

There is a positive relationship between ROE and RWTA (if ROE increases by 1%, RWTA will increase by 0.415%). The increase in return on equity has a positive impact on bank risk

There is a positive relationship between NIM and RWTA (if NIM increases by 1%, RWTA will increase by 0.027%). The increase in net interest margin has a positive impact on bank risk.

There is a positive relationship between Size and RWTA (if Size increase by 1%, RWTA will increase by 0.038%). The increase in size has a positive impact on bank risk.

There is a positive relationship between capital and RWTA (if capital increase by 1%, RWTA will increase by 0.0425%). The increase in capital has a positive impact on bank risk.

There is a negative relationship between CEA and RWTA (if CEA increases by 1%, RWTA will decrease by 0.029%). The increase in operating costs has had a negative impact on RWTA.

There is a negative relationship between T-deposit and RWTA (if T-deposit increase by 1%, RWTA will decrease by 0.056%). The increase in deposits has a negative impact on bank risk.

There is a positive relationship between TPIB and RWTA (if TPIB increases by 1%, RWTA will increase by 0.028%). The increase in economic growth has a positive impact on bank risk.

There is a negative relationship between TINF and RWTA (if TINF increases by 1%, RWTA will decrease by 0.0143%). The increase of inflation has a negative impact on bank risk.

Table 6. *Results of estimation of Model 2*

NPL	Coefficient	Z	Z<p
ALA	-0.174	2.57	0.0235
TLA	0.278	3.04	0.0554
ROA	-0.427	1.38	0.51
ROE	-0.468	2.76	0.0417
NIM	0.029	1.53	0.49
Size	0.047	3.36	0.0119
CAP	0.053	3.25	0.0112
CEA	-0.035	0.15	0.83
T-deposit	-0.084	0.184	0.91
TPIB	0.038	3.89	0.0153
TINF	-0.0176	2.25	0.0348

Source: *Own study.*

There is a negative relationship between NPL and ALA (if ALA increases by 1%, NPL decreases by 0.174%). The increase in liquid assets has a negative influence on credit risks of banks.

There is a positive relationship between NPL and TLA (if TLA increases by 1%, NPL increases by 0.278%). The increase of total credit has a positive influence on credit risks of banks.

There is negative relationship between NPLA and ROA (if ROA increases by 1%, NPL will decrease by 0.427%). The increase in returns on assets has a negative impact on credit risk of bank.

This result is like result found by Godlewski (2008), Boudriga *et al.* (2010), Al Nabulsi *et al.* (2022). When ROA decreases then the bank starts to make investments in high-risk projects the level of NPLs increases.

There is negative relationship between NPL and ROE (if ROE increases by 1%, NPL will decrease by 0.468%). The increase in return on equity has a negative impact on credit risks of bank. This result is like result found by AlNabulsi *et al.* (2022). Profitable banks face less issues on loan repayment system ensure good management in their operation system. Higher profitable banks do not consider borrowers having low credit worthiness (Godlewski 2008; Fan and Shaffer 2004; Louzis *et al.,* 2012).

Banks with low profitability have propensity to increase their risk, adopt credit policy more liberally to recover their proceeding loss long with maintaining minimum current profitability which can be happened only at the cost of increased future NPLs (Bhowrik and Sarker, 2021).

There is positive relationship between NIM and NPL (if NIM increases by 1%, NPL will increase by 0.029%). The increase in net interest margin has a positive impact on credit risks of banking.

There is positive relationship between Size and NPL (if Size increases by 1%, NPL will increase by 0.047%). The increase in size has a positive impact on credit risks of banks. The result is like the result found by AlNabulsi *et al.* (2022). Large banks alike are more effective in screening loan customers when compared to their smaller competitors.

With the increase in bank size banks tend to use their funds in various proposals with less monitoring loan policy which increases bank NPLs. This finding is similar to the findings of Khemaraj and Pasha (2009), Abid *et al.* (2014), Rajha (2016) and contradicts to Salas and Saurina (2002), Hu *et al.* (2004), Louzis *et al.* (2012).

There is positive relationship between CAP and NPL (if CAP increases by 1% NPL will increase by 0.053%). The increase in capital has a positive impact on credit risk of banks. This result is contrary to result found by Al Nabulsi *et al.* (2022)

The effect of bank capital on NPLs is in the opposite direction. On the one side the incentive and encouraging managers of low capitalized banks tend to get involved in high-risk investments and give loans that are issued without proper credit rating and monitoring (Keeton, 1999). On the other side banks with a high level of capital tend to give loans easily they known that due to these loans' banks are not going to be bankrupt and fail, therefore, banks are highly engaged with these kinds of risky credit activities suggestion a positive association between capital and NPLs (Rajan (1994).

There is negative relationship between CEA and NPL (if CEA increases by 1%, NPL will decrease by 0.035%). The increase in operating costs has a negative impact on credit risks for banks.

There is negative relationship between T-deposit and NPL (if T-deposit increase by 1%, NPL decrease by 0.084%). The increase in deposits has a negative impact on credit risks of banks.

There is positive relationship between TPIB and NPL (if TPIB increases by 1%, NPL will increase by 0.038%). The increase in economic growth has a positive impact on credit risks of banks. This result is contrary to result found by Fgolia (2022), Jabbouri and Naili (2019), and Zheng *et al.* (2017).

There is negative relationship between TINF and NPL (if TINF increases by 1%, NPL will decrease by 0.0176%). The increase in inflation has a negative impact on credit risks of banks. This result is contrary to result found by AlNabulsi *et al.* (2022).

Table 7. *Results of Estimation of Model 3*

Z-score	**Coefficient**	**Z**	**Z<p**
ALA	-0.187	2.63**	0.0249

TLA	0.285	2.84**	0.0559
ROA	0.417	1.29	0.53
ROE	0.532	2.53**	0.0236
NIM	0.029	1.17	0.49
Size	0.042	3.37***	0.0148
CAP	0.058	3.25***	0.0127
CEA	-0.034	0.64	0.98
T-deposit	-0.059	0.27	0.91
TPIB	-0.034	3.94***	0.0145
TINF	0.0156	2.28*	0.0251

Source: *Own study.*

There is a negative relationship between Z-score and ALA (if ALA increases by 1%, Z-score will decrease by 0.187%). The increase in asset liquid has a negative impact on Z-score.

There is a positive relationship between Z-score and TLA (if TLA increases by 1%, Z-score will increase by 0.285%). The increase in credit has a positive impact on Z-score.

There is a positive relationship between Z-score and ROA (if ROA increases by 1%, Z-score will increase by 0.417%). The increase in return on assets has a positive impact on Z-score. This result is like result found by Mkadmi *et al.* (2021).

There is a positive relationship between Z-score and ROE (if ROE increases by 1%, Z-score will increase by 0.532%). The increase in return on equity has a positive impact on Z-score. This result is contrary to result found by Mkadmi *et al.* (2021).

There is a positive relationship between NIM and Z-socre (if NIM increases by 1%, Z-score will increase by 0.029%). The increase in net interest margin has a positive impact on Z-score. This result is like result found by Mkadmi *et al.* (2021).

There is a positive relationship between Z-score and Size (if Size increases by 1%, Z-score will increase by 0.042%. The increase in size has a positive impact on bank risk. This result is like the result found by Pham *et al.* (2021). A larger bank size will positively enhance its stability. A larger bank can own a lower bankruptcy cost and enhance a high growth rate which is consistent with a bank stability (Nguyen, 2020).

There is a positive relationship between Z-score and capital (if capital increases by 1%, Z score will increase by 0.058%). The increase in capital has a positive impact on bank risk. A bank with a high level of equity in capital structure is positively consistent with a higher level of stability (Pham *et al.,* 2021).

There is a negative relationship between Z-score and CEA (if CEA increases by 1%, Z-score will decrease by 0.034%). The increase in operating costs has a negative impact on bank risk.

There is a negative relationship between Z-score and T-deposit (if T-deposit increases by 1%, Z-score will decrease by 0.059%). The increase in deposits has a negative impact on bank risk.

There is a negative relationship between Z-score and TPIB (if TPIB increases by 1%, Z-score will decrease by 0.034%). The increase in economic growth has a negative impact on bank risk. This result is consistent with the result found by Yitaw *et al.* (2023).

There is a positive relationship between Z-score and TINF (if TINF increases by 1%, Z-score will increase by 0.0156%). This result is similar to the result found by El Domiaty *et al.* (2020).

This result could be interpreted as a higher inflation level that reduced the value of loans over the years which strengthened the borrower's repayment capacity, thus increasing the stability of banks, which drove the Z-score up and the overall risk fell. This result is contrary to result found by Ghassan and Guendouz (2019), De Ramon *et al.* (2020) and Rahman *et al.* (2021).

4. Conclusion

In theory and practice banks are prone to credit, currency, liquidity and country risk (Nhuen *et al.,* 2021). With unique characteristics the bank's operations are always inherent in risk, economic decisions based on risk and profits. The high risk may lead to more profits, but it also makes the banking system accumulate more hazards.

Hefferman (2005) showed that if risks occur frequently; banks will lose capital and profits reduce the value of their assets, thereby affecting the bank's operations.
Haq and Heaney (2012) define risk as an appetite for selection among a variety of alternatives with different level uncertainties.

They indicate that the risk-taking behavior of banks refers to the appetite to choose among variety of projects, investments, or ventures, with different levels of uncertainties and expected cashflows. The Basel accord classifies the main bank risks as credit risk, market risk, liquidity risk, and operational risk among other risks.

In this article our objective is to study the main determinants of bank risk in Tunisian context. We used a sample of 11 quoted banks over the period (2014-2023). By applying 3 models of panel statistics, we found that that liquidity, total credit, return on equity, size, capital, economic growth, and inflation have a significant effect on bank risk.

References:

Abbas, F., Ali, S., Haq, U.M.S., Naveed, M. 2021. Nexus between bank capital and risk-taking behavior: empirical evidence from US commercial banks. Cogent business and management, 8(1). Taylor and Francis.

Abid, L., Ouertani, M.N., Zouari Ghorbel, S. 2014. Macroeconomic and bank specific determinants of household's non-performing loans in Tunisia: A dynamic panel data analysis. Procedia Economic and finance, vol 13, pp. 58-68.

Acharya, V., Naqvi, H. 2012. The seeds of a crisis: a theory of bank liquidity and risk taking over the business cycle. Journal of Financial Economics, vol. 106, issue 2, 349-366.

AlNabulsi, K., Kozarevic, E., Hakimi, A. 2022. Assessing the determinants of non-performing loans under financial crisis and health crisis: evidence from The MENA banks. Cogent Economic and finance, vol. 10, n°1.

Antony, T.M., Suresh, G. 2023. Determinants of credit risk: empirical evidence for Indian commercial banks. Banks and banks systems, vol. 18, n°2, 88-100.

Boudriga, A., Taktak, N.B., Jellouli, S. 2010. Bank specific business and institutional environment determinants of banks non-performing loans: evidence from MENA countries. Working paper, 545. Economic Research Forum.

Boyd, J.H., Runkle, E.D. 1993. Size and performance of banking firms: Testing the predictions of theory. Journal of Monetary Economics, vol. 31, 47-67.

Demirguc Kunt, A., Huizinga, H. 2010. Bank activity and funding strategies: the impact on risk and activities. Journal of Financial Economics, vol 98, issue 3, 626-650.

Demsetez, R.S., Strahan, E.P. 1997. Diversification of size and risk at bank holding companies. Journal of Money, Credit and banking, vol. 29, n°3, 300-313.

De Ramon, S.J.A., Francis, B.W., Tranghan, S.M. 2020. The link between bank competition and risk in the United Kingdom: Two views for policymakers. Bank of England, Working Paper, n°875.

El Domiaty, T., Youssef, A., Mchrous, H. 2022. The robustness of the determinants of overall bank risk in the MENA region. Journal of risk financial management, vol. 15, n°10.

Ghassan, H.B., Guendouz, H.A. 2019. Panel modeling of Z-score: evidence from Islamic and conventional Saudi banks. International Journal of Islamic and Middle Eastern Finance and management, vol. 12. n°3, 448-468.

Ghenimi, A., Chaibi, H., Omri, B.A.M. 2017. The effects of liquidity risk and credit risk on bank stability: evidence from The MENA region. Borsa Istanbul Review, vol. 17, n°4, 238-248.

Hamdi, H., Hakimi, A. 2019. Does liquidity matter on bank profitability evidence from a nonlinear framework for a large sample. Business and Economic research journal, vol. 10, n°2, 13-26.

Haq, M., Heaney, A.R. 2012. Factors determining European bank risk. Journal of International Financial Markets. Institutions and Money.

Huang, X., Xiong, Q. 2015. Bank capital buffer decisions under macroeconomic fluctuations: Evidence for the banking industry of China. International Review of Economic and Finance, vol. 36, 30-39.

Jabbouri, I., Naili. N. 2019. Determinants of non-performing loans in emerging markets: Evidence from the MENA region. Review of Pacific basin financial markets and policies, vol. 22, n°4, 1-33.

Jokipi, T., Milne, A. 2011. Bank capital buffer and risk adjustment decisions. Journal of financial stability, vol. 7, issue 3, 165-178.

Karim, M.A., Hassan, M.K., Hassan, T., Mohamad, S. 2014. Capital adequacy and lending and deposit behavior of conventional and Islamic banks. Pacific basin finance journal, vol. 26, 58-75.

Keeton, W.R. 1999. Does faster loan growth lead to higher loan losses. Economic Review, vol. 84, 57-75.

Klomp, J., Haan, J. 2012. Banking risk and regulation: Does one size fit all? Journal of banking and finance, vol. 36, n°12, 3197-3212.

Leaven, L., Levine, R. 2009. Bank governance regulation and risk taking. Journal of Financial Economics, vol. 93, issue 2, 259-275.

Lee, C.C., Hseih, M.F. 2013. The impact of bank capital on profitability and risk in Asian banking. Journal of International Money and Finance, vol. 32, 251-281.

Lepetit, L., Strobel, F. 2015. Bank insolvency risk and Z-score measures: refinement. Finance research letters, vol. 13C, 214-224.

Louzis, D.P., Vouldis, A.T., Metaxas, V.C. 2012. Macroeconomic and bank specific determinants of non-performing loans in Greece: A comparative study of mortgage business and consumer loan portfolio. Journal of banking and finance, vol. 36, n°4, 1012-1027.

Malvar, M.M., Pascual, B.L. 2020. Bank risk determinants in Latin America. Risks, 8(3).

Megginson, W.L. 2005. The economics of bank privatization. Journal of banking and finance, 29(8-9), 1931-1980.

Mkadmi, J., Baccari, N., Necib, A. 2021. The determinants of bank stability: The example of Tunisia. International Academic Journal of Accounting and financial management, vol. 8, n°1, 1-10.

Morina, D. 2020. Determinants of credit risk in commercial banks of Kosovo. International journal of economic and business administration, vol. 2, 179-190.

Nguyen, Q.K. 2022. Determinants of bank risk governance structure: A cross-country analysis. Research in International Business and Finance, vol. 60.

Obadire, A.M., Obadire, K. 2023. Determinants of bank risk taking behavior in Africa: A regulatory perspective. Open Journal of business and management, vol. 11, 673-687.

Pham, T.T., Dao, L.K., Nguyen, C.V. 2021. The determinants of bank stability a system GMM panel analysis. Cogent business and management, vol. 8, issue 1.

Rajan, R.G. 1994. Why do bank credit fluctuate: A theory and some evidence. The Quarterly Journal of Economics, vol. 109, 399-441.

Salas, V., Saurina, J. 2002. Credit risk in two institutional regimes: Spanish commercial banks and saving banks. Journal of financial services research, vol. 22, 203-224.

Salidas, M. 2013. A market-based approach to sector risk determinants and transmission of the Euro area. ECB working paper, n°1574.

Yitayaw, M.K., Mogess, Y.K., Feysia, L.H., Mano, B.W., Abdulahi, M.S. 2023. Determinants of bank stability in Ethiopia: a twostep system GMM estimation. Cogent Economic and finance, vol. 11, n°1.

Yusuf, N.H.M., Shamsudin, M.S.M., Abdouh, M.Y., Shah, BSN., Zain, S.R. 2021. Determinants of credit risk: evidence from commercial banks in Malaysia. Jurnal Intelek, vol. 16, issue 1.

Zheng, C., Uhuq, M.S., Rahman, M.M., Ashraf, N.B. 2017. The effect of ownership structure on bank capital and risk-taking behavior: empirical evidence from developing countries. Research in International business and finance, vol. 42, n°10.