Journal of Infrastructure, Policy and Development 2024, 8(12), 5395.
https://doi.org/10.24294/jipd.v8i12.5395

Article

Bank governance and risk-taking during times of crises: Evidence from Tunisian commercial banks

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CITATION

Kouki M, Mabrouk L, Sghaier N, et al. (2024). Bank governance and risk-taking during times of crises: Evidence from Tunisian commercial banks. Journal of Infrastructure, Policy and Development. 8(12): 5395.
https://doi.org/10.24294/jipd.v8i12.5395

ARTICLE INFO

Received: 22 March 2024
Accepted: 9 April 2024
Available online: 30 October 2024

Abstract: The objective of this paper is to assess the influence of various types of crises, including the Subprime, COVID-19, and political crises, on corporate governance attributes, regulations, and the association with bank risk. The consecutive occurrences of crises have significantly impacted the global economy, causing substantial disruptions across various facets of the international banking system. Our hypothesis posits that these crises not only influence governance characteristics and regulations but also impact their correlation with the risk and financial distress experienced by banks. Our study is conducted within the Tunisian context spanning from 2000 to 2021, utilizing a GMM regression on a dataset comprising 221 bank-year observations. Our findings indicate that crises have a discernible effect on the relationship between corporate governance and bank risk, as well as between regulation and bank risk. Our results are strong in a range of sensitivity checks, including the use of alternative proxies to measure the bank risks and corporate governance metrics.

Keywords: bank risk; corporate governance; various types of crises

1. Introduction

In scholarly literature, the notion of corporate governance is frequently employed and is primarily focused on examining the influence of business performance in shaping ideal governance structures. However, the conventional definition of corporate governance has primarily emphasized safeguarding shareholders' interests, often overlooking the protection of the interests of additional stakeholders. In reality, managerial decisions extend beyond their impact on investors, as there exists a group of stakeholders, including employees, depositors, and regulators, who hold a vested interest in the business (Fernandes et al., 2018). Shleifer and Vishny (1997) posit that corporate governance involves the mechanisms through which providers of corporate finance secure a return on their investment.

Corporate governance constitutes a set of mechanisms primarily designed to address agency problems and mitigate risks within firms. However, the characteristics of the banking sector, coupled with the complexity of its operations, pose heightened challenges for governance mechanisms. Factors such as information asymmetry and stakeholders' limitations in monitoring the decisions of bank managers become more pronounced. The management of banking operations is linked to the unique features of the banking industry, presenting difficulties for stakeholders in effectively overseeing their respective banks. This complexity may manifest in various forms, including challenges in assessing loan quality due to factors such as the absence of

critical credit rating standards, a deficiency of transparency in financial engineering, and the elaborate nature of financial statement validation. Additionally, modifying investment risk can also be a nuanced aspect of banks' complexity (Levine, 2004). Hence, the complexity inherent in the banking business exacerbates governance challenges for banks. Consequently, a board of directors is crucial not only for overseeing managerial efficiency but also for offering valuable guidance to effectively manage the bank (De Andres and Vallelado, 2008).

The association between governance instruments and risk management has been a focal point for governance researchers (Berger et al., 2014; Koirala et al., 2020; Safullah and Shamsuddin, 2019). Previous studies emphasize the significance of risk management purposes, risk governance, and risk identification in financial institutions (Ellul and Yerramilli, 2013; Stulz, 2008). Moreover, recognizing that risks cannot be fully mitigated through market discipline or supervisory oversight, there is a need to avoid excessive risk-taking (Addo et al., 2021). Ellul and Yerramilli (2013) developed a risk management index to evaluate the strength and autonomy of risk management functions within U.S. bank holding companies. Their findings reveal that banks with higher risk management indices exhibit reduced exposure to mortgage-backed securities, engage in fewer off-balance sheet derivatives, face lower downgrade risk, demonstrate higher creditworthiness, and achieve a higher Sharpe ratio during financial crises. Similarly, Aebi et al. (2012) demonstrate that the presence of a risk governance structure, and precisely a risk manager, positively impacts stock market returns. They also observe that traditional corporate governance mechanisms are not significantly correlated with stock market returns and financial performance.

We make several contributions to the existing literature. Firstly, despite the rapidly evolving finance literature on the subprime crisis, the Tunisian revolution, and the COVID-19 pandemic, there is a noticeable shortage of studies specifically exploring the impact of these three crises on bank stock prices. Our main goal is to examine how these crises effect the association between ownership structure, regulation, and bank risk. The paper is organized as follows: the next section reviews the relevant literature, followed by the third section, which outlines our data and methodology. Empirical tests and their debate are presented in the fourth section, with concluding remarks provided in the fifth section.

2. Literature review

2.1. Bank governance and risk taking

In the Asian context, recent studies by Hunjra et al. (2021) and Zheng and Das (2018) emphasize the substantial influence of corporate governance mechanisms on both bank performance and risk-taking. These findings suggest a positive market response to the presence of effective risk and corporate governance structures. Building on this background and drawing insights from previous research (Aebi et al., 2012; Aljughaiman and Salama, 2019), our focus revolves around assessing the relationship between bank risk-taking and the existence and attributes of the risk committee and risk manager at the board level. The importance of risk governance mechanisms is emphasized by the discussion above, highlighting their crucial role in managing diverse organizational risks effectively.

Numerous studies have showed a robust and positive correlation between ownership concentration and banking risk, as observed in works by Haw et al. (2010) and Laeven and Levine (2009). In contrast, Shehzad et al. (2010) revealed that credit risk tends to decrease when there is a higher degree of ownership concentration among majority shareholders. Another study by Iannotta, Nocera and Sironi (2007) involved a comparison of performance and risk across 181 large banks from 15 European countries. Their findings suggested that public banks exhibit lower credit quality and a higher risk of insolvency compared to private and cooperative banks.

2.2. Bank governance and risk-taking during crises

2.2.1. The financial crisis

The robustness and constancy of banks constitute fundamental elements for financial stability and are integral to overall economic well-being. Any weaknesses in the governance of banks, being central to the financial system, can potentially propagate issues throughout the entire banking sector and the broader economy. The significance of effective corporate governance in the banking sector is accentuated by the pivotal role of the banking sector in the economy, as highlighted in studies such as Fernandes et al. (2018). Additionally, Stulz (2015) asserts that well-structured governance policies for banks enable them to maintain an optimal level of risk, contributing to the enhancement of shareholder value by managers.

Prior to the global financial crisis of 2007–2008, there is a scarcity of studies that specifically concentrate on bank governance (Adams and Mehran, 2005; Caprio et al., 2007; Levine, 2004; Macey and O'Hara, 2003). However, in the aftermath of the 2007 crisis, a substantial body of research emerged to investigate bank governance (Abedifar et al., 2013; Aljughaiman, 2019; Brogi and Lagasio, 2021; Liu and Sun, 2021; Nsaibi and Rajhi, 2020; Pathan and Faff, 2013; Safiullah and Shamsuddin, 2018). This shift in focus was driven by the recognition that the 2007 financial crisis was, in part, attributed to governance failures, such as inadequate board oversight and damaged executive compensation practices that amplified excessive risk-taking (Erkens et al., 2012; Krikpatrick, 2009; Sharfman, 2009).

The global financial crisis emphasized, among various issues, the persistent weaknesses and inadequate understanding of bank governance mechanisms by both academics and policymakers, especially concerning their impact on bank risk-taking (Kirkpatrick, 2009). According to the Basel Committee on Banking Supervision (BCBS, 2015), the effectiveness of corporate governance is crucial to ensuring the proper functioning of the banking sector and the broader economy.

Weak corporate governance in banks is frequently cited as one of the contributing factors to the 2007 global financial crisis, if not the primary cause (Zedek and Tarazi, 2015). Additionally, the United States Financial Crisis Commission (2011) concluded in its final report that the primary reason behind the significant failures of many financial institutions during the 2007 crisis was attributed to shortcomings in corporate governance and risk management.

2.2.2. The political crisis

It is widely recognized that political ambiguity, social conflict, and revolutions has a detrimental impact on economic growth. Numerous studies also highlight the

negative effects of political uncertainty on the financial system. For instance, Chan and Wei (1996), in their examination of the Hang Seng Index in Hong Kong, observe that adverse political news is associated with negative returns. Jeribi et al. (2015) find that the Tunisian revolution influenced the volatility of major sectorial stock indices in the Tunisian Stock Exchange. Additionally, Soltani et al. (2017) assert that during periods of political instability in Tunisia, investor sentiment had a negative impact on market returns and volatility. Therefore, while the uprisings in Arab countries offer the potential to unlock economic growth by improving transparency and governance, they have also incurred significant financial costs (Chau et al., 2014). Despite some studies focusing on the stock market, there is a scarcity of research on the impact of the Arab Spring on the banking industry. To our knowledge, only one recent study by Ghosh (2016) has addressed this issue. The author concludes that the Arab Spring has reduced profitability and increased bank risk in MENA countries.

2.2.3. The Covid 19 pandemic crisis

In light of the global spread of the coronavirus, Elnahass et al. (2021) note that all economic players are grappling with an unprecedented crisis. Financial institutions, including banks, have experienced immediate exogenous shocks. Therefore, it becomes crucial to assess the impact of the COVID-19 pandemic on the stability of the global banking industry. The study by Elnahass et al. (2021) investigates the effects of COVID-19 on financial performance and stability, utilizing accounting-based, market-based, and risk-based indicators. The analysis covers 1090 banks from 116 countries, spanning from the first quarter of 2019 to the second quarter of 2020. The findings reveal a significant reduction in bank profitability, cost efficiency, financial stability, and stock market valuation during the COVID-19 crisis. However, the study notes a signal of recovery for bank stability in the second quarter of 2020.

Kunt et al. (2021) have conducted research on the impact of the COVID-19 pandemic on the banking industry, particularly examining whether the shock had varying effects on banks in comparison to other corporations. Their findings, consistent with Elnahass et al. (2021), indicate that the COVID-19 pandemic has adversely affected banks. Notably, the study reveals that the impact of the shock on banks has a more pronounced and enduring impact compared to non-bank corporations and other financial institutions. Furthermore, the research highlights that the returns on stocks of larger banks and public banks have experienced a more significant decline. Additionally, banks with lower liquidity also suffered a greater decline in returns, aligning with their greater vulnerability to shocks.

The impact of COVID-19 on banks can manifest in various ways. Globally, banks hold substantial borrowings denominated in US dollars, used for financing international trade, financial investments, and a diverse range of dollar-denominated assets (Aldasoro and Ehlers, 2018). Financial crises can tighten money markets that provide dollar loans, posing risks to the global banking system. Banks in emerging economies may experience more severe effects due to reduced inflows of such funds. In response to the coronavirus, central banks have taken measures such as extending existing swap lines and establishing new lines to reduce dollar funding costs (Bahaj and Reis, 2020). Banking regulatory measures, such as relaxing the treatment of non-performing loans and easing capital barriers, have been implemented to mitigate the

adverse effects of COVID-19 on financial system stability (Bitar and Tarazi, 2020). Danisman et al. (2021) revealed that equity markets in countries with stricter regulatory requirements on capital and liquidity tend to be more resilient to COVID-19. Due to the Basel III capital and liquidity reforms implemented after 2008, banks are better equipped to survive the severe impacts of COVID-19. However, the relaxation of non-performing loans and capital buffers during the pandemic could pose a risk to banks' solvency. The potential increase in non-performing loans and the risk of significant deposit withdrawals by firms and households (Goodell, 2020; Perotti, 2020) could significantly impact banks' performance. Elnahass et al. (2021) demonstrated that COVID-19 has adverse effects on the financial performance and stability of banks in 116 countries, with variations observed between Islamic and conventional banks. Danisman et al. (2021) found that banking systems with a higher presence of Islamic banks showed greater resilience.

Furthermore, COVID-19 has a negative impact on the operational performance of firms across all industries, with potential spillover effects on banks, amplifying their credit risk exposure. Acharya and Steffen (2020) noted that the rapid drawdown of credit lines, especially by riskier firms, could adversely affect bank balance sheets and reduce their capital adequacy ratios. This, in turn, could threaten their stability and impose constraints on future intermediation, potentially leading to spillover effects on the real economy.

While the balance sheets of all banks may suffer from the adverse consequences of COVID-19, some banks are likely to be less affected. For instance, Beltratti and Stulz (2012) identified significant variations in the stock returns of large banks during the 2008 global financial crisis. Their findings revealed that banks relying more on short-term finance pre-crisis exhibited worse performance, while banks with more capital and lower pre-crisis returns managed better during the crisis. Other studies investigated bank-specific factors contributing to better accounting performances during the global financial crisis. Berger and Bouwman (2013) found that higher capital improved the performance of medium and large US banks during crises. In line with Vazquez and Federico (2015), banks with less structural liquidity and more leverage before the 2008 financial crisis were more prone to failure afterward. Laeven et al. (2016) discovered that systemic risk during the 2008 crisis increased with bank size and was inversely related to bank capital. As evident, investors differentiate banks based on their pre-crisis financial characteristics, emphasizing the importance of a robust pre-COVID-19 balance sheet (Aldasoro et al., 2020). Motivated by these studies, our aim is to explore which bank-specific factors can provide resilience to banks during COVID-19.

3. Data and methodology

3.1. The sample

The Tunisian economy relies heavily on debt, with the banking sector serving as the primary source of funding for businesses. Loans constitute approximately 95% of the economy. Consequently, the economy's well-being is closely tied to the health of the banking sector, and its growth trajectory is heavily influenced by the sector's efficiency and its ability to allocate resources effectively. Our study focuses on a

sample of 10 deposit banks operating in the Tunisian financial market (Amen Bank, ATB, Attijari, BH, BT, BIAT, BNA, STAB, UBCI, UIB) spanning the period from 2000 to 2021. We specifically chose commercial banks due to their significant contribution to financing the Tunisian economy. This sample was selected because these banks collectively hold 89% of the sector's assets, 79% of its loans, and 88% of its deposits.

This study seeks to examine the influence of different types of crises including the subprime crisis, Tunisian revolution, and COVID-19 on the interplay between ownership structure, regulation, and bank risk. In pursuit of this objective, we focused on all publicly traded deposit banks.

The governance requirement in Tunisia: Corporate governance addresses issues surrounding power distribution within a company, defining the roles and responsibilities of each party, procedures for appointing and removing executives, compensation and incentives, strategic decisions, and the rights and obligations of shareholders and other stakeholders. The 2005 law on Financial Transaction Security in Tunisia primarily focuses on enhancing executive accountability, strengthening internal controls, and mitigating conflicts of interest. This legislation, heavily influenced by the Sarbanes-Oxley Act in the United States, introduces numerous reforms. The enhancement of governance standards in credit institutions was underscored in Circular No. 2011-06 issued by the Governor of the Central Bank of Tunisia (BCT) on 20 May 2011. This circular initially outlines the roles and responsibilities of the boards of directors of credit institutions. The board is responsible for formulating the institution's development strategy and intervention policies, ensuring effective oversight of the management body by assessing decisions made in managing the institution's activities regarding its profitability and financial soundness, and implementing a governance framework. In terms of governance, the board must establish a governance code and set an example of good governance principles through its own practices.

The international financial crisis 2007–2008 and Tunisian banks: The global financial crisis that originated from the subprime mortgage market in the United States in 2007–2008 had far-reaching implications, creating a ripple effect across the interconnected global economy. While Tunisia did not face the direct brunt of the crisis, it was not completely shielded from its consequences, experiencing indirect effects on various economic aspects. It's important to highlight that Tunisia maintained a relatively conservative banking sector during this period, characterized by well-regulated financial institutions. The country also implemented economic reforms to strengthen the flexibility of its financial system. While the direct impact on Tunisian banks may have been limited, the broader economic consequences of the global financial crisis inevitably influenced the country's economic performance during that timeframe. We deduce some key considerations regarding the impact of the subprime crisis on Tunisian banks: (i) Global economic slowdown: The crisis triggered a worldwide economic slowdown, influencing international trade and investment. Tunisia, as an integral part of the global economy, encountered reduced demand for its exports and encountered challenges in attracting foreign investments; (ii) Financial market volatility: The crisis induced volatility in global financial markets, potentially affecting Tunisian banks' access to international capital markets and causing

fluctuations in the value of their financial assets; (iii) Foreign exchange reserves: Tunisia's central bank manages foreign exchange reserves, and fluctuations in global financial markets can influence the value of these reserves. Changes in exchange rates may have implications for the country's monetary policy and financial stability.

The Tunisian bank sector after Jasmin Revolution: The term "Jasmine Revolution" refers to the series of protests and demonstrations that occurred in Tunisia, leading to the ousting of President Zine El Abidine Ben Ali in January 2011. The revolution was a significant event in the Arab Spring uprisings. As for the impact on Tunisian banks, the revolution had both immediate and long-term effects on the country's economy, including its financial sector: (i) Immediate economic disruptions: The period of the revolution saw disruptions to normal economic activities. Protests, strikes, and political instability could have led to challenges in banking operations and financial transactions; (ii) Investor confidence: Political unrest and uncertainty can negatively impact investor confidence. Foreign and domestic investors may adopt a cautious approach, affecting capital flows and investment in various sectors, including banking; (iii) Economic reforms: In the aftermath of the revolution, Tunisia underwent a process of political and economic reforms. Efforts were made to address issues such as corruption and improve governance. These reforms aimed to create a more stable and transparent economic environment, which would have implications for the banking sector; (IV) Stabilization and recovery: Over time, Tunisia worked towards stabilizing its economy and promoting recovery. The banking sector played a role in supporting economic initiatives and facilitating financial stability; (V) Government policies: The post-revolution period involved the formulation of new government policies to address economic challenges. These policies, including those related to fiscal and monetary matters, could have influenced the banking sector. It's important to note that the banking sector is intricately linked to the overall economic and political landscape. The Jasmine Revolution and its aftermath influenced Tunisia's trajectory, and the banking sector played a part in the broader efforts to rebuild and stabilize the country.

The effect of COVID-19 pandemic and Tunisian financial system: In the initial phases of the pandemic, various countries, including Tunisia, implemented measures to support their economies and financial systems. These measures typically involved financial assistance, liquidity support, and regulatory adjustments aimed at assisting businesses and individuals in navigating the economic challenges posed by the pandemic. The COVID-19 pandemic has accompanied in a unique form of economic shock, unprecedented in its abrupt cessation of costs within the modern economy. This has translated into escalating pressures on the Tunisian banking system, with the imminent risk of more pronounced defaults. Forecasts indicate an impending financial shock on par with the magnitude of the 2008 crisis. It becomes imperative to scrutinize the impact of COVID-19, a distinct crisis amplifying instability in the financial system, specifically on Non-Performing Loans (NPLs). This crisis is characterized by diminishing demand, reducing fund transfers, a surge in unemployment, declining consumption, fluctuations in interest rates, and the depreciation of currencies. Both the financial and real economies bear direct consequences, resulting in heightened risk exposure that banks are compelled to navigate.

We have concentrated our research on these three types of economic, social, and health crises due to their significance for the Tunisian economy. We have excluded the recent Ukraine war crisis due to the limited time available for its study.

3.2. Research design

We segmented our study period into four distinct phases, delineated by key events. The terms from 2000 to 2006 represent the pre-subprime period, 2000-2009 signify the subprime period, 2006–2019 encapsulate the revolution period, and the comprehensive span from 2000 to 2021 encompasses the pandemic period of COVID-19. The years 2000 to 2006 serve as the baseline, pre-subprime crisis period. To investigate the interplay between bank governance and bank risk during crisis periods, we systematically incorporated the respective crisis years into the pre-subprime period (2000–2006). Our primary focus is on discerning significant changes in regression outcomes during the subprime, revolution, and COVID-19 periods relative to the pre-subprime era. The assessment of bank risk is conducted through three proxies, while various governance mechanisms with potential impacts on bank risk are considered. The subsequent section provides the definitions of the variables utilized in our regression model and presents the model itself.

3.2.1. Definition and measurement of variables

The dependent variable: we use three measures of bank risk, namely, The Z-score stability index, the volatility of return on equities and the volatility of return on assets.

The Z-score stability index is derived from the works of Roy (1952), Hannan and Hanwick (1988), Boyd et al. (1993), and De Nicolo and Kwast (2001), who gauge bank risk by assessing the Z-score of each bank alongside the volatility of stock returns. When appraising bank stability and soundness, the Z-score stability index emerges as a predominant method, alongside measures like capital adequacy and the non-performing loans (NPLs) indicator (Haq and Heaney, 2012; Lepetit and Strobel, 2015). The Z-score serves as a proxy for bank stability, offering a metric for bank solvency. It combines various accounting measures, encompassing profitability, leverage, and volatility. In particular, the authors demonstrate that when insolvency is defined as a condition in which losses surpass equity (E < Losses)—where E represents equity, NI denotes net income, TA signifies total assets, *ROA* stands for return on assets (calculated as NI/TA), and K is the funding ratio (calculated as E/TA)—the probability of failure can be presented as Prob (ROA < K). Consequently, the formulation of the Z-score is as follows:

$$Z - \text{score} = \frac{\text{ROA} + K}{\text{SD(ROA)}} \tag{1}$$

In this context, where SD represents standard deviation, this ratio serves as an inverse measure of the likelihood of bankruptcy, as proposed by Roy (1952), Hannan and Hanwick (1988), Boyd et al. (1993), and De Nicolo and Kwast (2001). Consequently, higher Z-score levels signify greater stability for the bank.

The volatility of return on equities: The second measure of bank risk is in line with the approach of Saunders et al. (1990) and Esty (1998), who employed volatility

in Return on Equities (SD ROE). The return on equity is calculated by dividing income by equities. Return volatility is determined as the standard deviation of equity returns.

$$\mathrm{SDROE} = \mathrm{SD}\left(\frac{\mathrm{NI}}{E}\right) \tag{2}$$

where NI represents the net income and *E* denotes the equities.

The volatility of return on assets: The third dimension evaluating bank risk encompasses the volatility of Return on Assets (SDROA), denoting the standard deviation observed in the return on assets. The return on assets is delineated as the quotient of net income divided by total assets.

$$\mathrm{SDROA} = \mathrm{SD}\left(\frac{\mathrm{NI}}{\mathrm{TA}}\right) \tag{3}$$

where NI and TA represents respectively the net income and the total assets.

The Independent variables: We select explanatory variables their intrinsic relevance in delineating the risk exposure of banks, given their pivotal functions in financial intermediation. The main explanatory variable is Bank governance is measured by fourth set of variables which are the ownership structure, the board of directors, and the bank regulation.

Ownership structure: This variable is assessed through three components: management ownership (MOW), involvement of institutional investors (INST), and capital concentration (MAJ).

Manager ownership (MOW): The augmentation of managers' stock ownership within a company aims to synchronize their incentives for risk-taking with those of stockholders. However, this alignment is contingent on their ownership stake constituting a reasonable portion of their non-human wealth, preventing an excessive preoccupation or aversion to the company's non-systematic risk. Our contention revolves around the notion that equity ownership serves as a moderating influence on the risk-taking behavior of bank managers. This is because manager-owners, having fewer avenues for wealth diversification compared to external shareholders, are inclined towards projects with lower risk profiles (Jin, 2001; Zhou, 2001).

Institutional investors (INST): Institutional investors play a practical role in overseeing a company's governance, closely monitoring its strategies for adaptability, exercising considerable voting power, and inducing a substantial impact on risk-taking. Some research suggests that when institutional investors and venture capital firms are in the mix, family managers may feel compelled to take on greater risk to enhance performance, as illustrated by George et al. (2005). In contrast, Setiyono and Tarazi (2014) present an alternate viewpoint, contending that the presence of institutional investors as secondary blockholders tends to have the reverse effect, diminishing risk-taking while simultaneously enhancing performance.

Ownership concentration (MAJ): Existing empirical literature emphasizes the significance of ownership concentration in influencing risk-taking behavior. Nevertheless, the specific impact of ownership concentration on risk-taking remains inconclusive in the available empirical evidence. Laeven and Levine (2009), for instance, conducted an empirical study to explore the relationship between risk-taking in banks, ownership structure, and national bank regulations. Their findings suggest

that banks with more influential owners tend to exhibit higher levels of risk-taking. This is attributed to the substantial influence exercised by powerful owners, who, funded by significant cash flows, can persuade bank managers to intensify their risk-taking activities. The underlying logic is that engaging in such risk-taking behavior may result in higher returns.

The board of directors: The board is characterized by three variables: board size (BSIZE), duality (DUAL) and independent board directors (BIND):

Board size (Bsize): The dimensions of a corporate board represent a crucial factor influencing the decision-making dynamics, ultimately shaping the board's effectiveness and, consequently, the quality of monitoring and risk-taking within the organization. Extensive research, spanning disciplines like economics and social psychology, has investigated into the dynamics of group decision-making. A consistent insight from these studies indicates that larger groups typically necessitate increased effort and deliberation to reach a consensus.

CEO duality (DUAL): This variable signifies the circumstance in which the CEO simultaneously serves as the Chairman of the board. In the framework of agency theory, it postulates that risk-averse bank managers may opt for safer projects, even if these projects lead to a decrease in value, while simultaneously rejecting riskier projects that could potentially enhance value. The underlying rationale is that powerful CEOs, acting in their self-interest, are expected to make decisions that align with their personal benefit. Assuming risk aversion, these CEOs are not expected to engage in actions considered as risky. Empirical support for this perspective is provided by Kim and Buchanan (2008), demonstrating that firms under CEO duality leadership exhibit significantly reduced levels of risk. DUAL is measured by a dummy variable (one if duality, zero if not).

Independent directors (BIND): Within the corporate governance studies, the role of independent directors on a company's board is extensively emphasized (Byrd and Hickman, 1992; Brickley et al., 1987; Weisbach, 1988). The inclusion of independent directors serves to align the interests of equity-holders and firm managers (D'Onza and Rigolini, 2017), leveraging essential skills across various domains like finance, law, management, sales, and marketing. Independent directors play a pivotal role in overseeing and addressing potential agency conflicts that might emerge between a firm's management and its shareholders. In this capacity, the independence of the board serves as a regulatory mechanism to control and mitigate excessive risk-taking. BIND is quantified by the proportion of independent directors on the board.

Banking regulations: The regulatory capital (REG) is formulated in the framework of international solvency ratios set by the Basel Committee for credit institutions and financial entities involved in extensive international activities. The objective of these regulations is to enhance the stability of the banking system and mitigate bank risk. The solvency ratio, representing the proportion of a bank's capital to its total credit risks, is designed to establish a baseline of equity corresponding to its risk exposure. Adherence to this regulatory framework necessitates a solvency ratio exceeding 8%, highlighting a dedication to prudent standards.

Control variables: To comprehensively elucidate bank risk beyond ownership structure, we incorporate five variables encapsulating various facets of bank characteristics:

Bank size (SIZE): This variable, expressed as the natural logarithm of total assets, captures the potential impact on bank risk stemming from economies of scale. Larger banks typically benefit from easy access to capital markets and undertake more extensive portfolio diversification.

Age of the bank (AGE): An influential factor in determining insolvency risk, bank age signifies accumulated experience that aids in judicious investment project selection. Categorized through a dummy variable: 1 for banks with an age less than 20 years, 2 for ages between 20 and 40 years, 3 for ages between 40 and 60 years, and 4 for banks exceeding 60 years in age.

Age of the bank (AGE): An influential variable in assessing insolvency risk, bank age reflects accumulated experience that contributes to prudent investment project selection. Represented by a dummy variable: 1 for banks with an age less than 20 years, 2 for ages between 20 and 40 years, 3 for ages between 40 and 60 years, and 4 for banks exceeding 60 years in age.

Liquidity ratio (LIQUID): This metric, representing realizable assets to current liabilities, aligns with regulatory requirements mandating a ratio surpassing 100%. Banks with higher liquidity ratios are better positioned to navigate lower-risk scenarios.

Quality of assets (LLOSS): This parameter, reflecting provisions for loss relative to total assets, offers insights into asset quality. Provisions for bad debts serve as a crucial metric for evaluating the resilience of the bank's asset portfolio.

Activity level (LOANS): Capturing the ratio of loans to total assets, this metric provides a gauge of the bank's activity. Elevated values suggest more extensive lending operations, which can have implications for risk exposure.

Net banking income (NBI): Representing the difference between banking operating income and expenses, this metric, excluding interest on doubtful debts but encompassing provisions for the depreciation of investment securities, gauges the unique contribution of banks to national wealth growth. The natural logarithm of NBI (LOG(NBI)) is employed to assess net banking income.

3.2.2. Empirical model

The empirical model of our paper is to test the impact the bank governance as represented by the ownership structure, the Board characteristics and the Regulation on the Bank Risk. Specifically, we consider the following model:

$$\text{BRISK}_{it} = \alpha_0 + \alpha_{1i}\sum_{i=1}^{N} \textit{O}\text{wnership}_{it} + \alpha_{2i}\sum_{i=1}^{N} \text{Board}_{it} + \alpha_{3i}\sum_{i=1}^{N} \text{Regulation}_{it} + \alpha_{3i}\sum_{i=1}^{N} CV_{it} + \mu_{it} \quad (4)$$

with: *BRISK*: bank risk estimated using three proxies: *Z*-score, SDROE and SDROA, ΣOwnership represents the set of governance variables related to the ownership structure, ΣBoard includes variables related to the board of directors, Regulation is the variable of banking regulations and ΣCV represents the set of control variables.

4. Results and discussion

4.1. Descriptive statistics

Table 1 reports the descriptive statistics. The mean value of the *Z*-score is around 17.6. The volatility of the return on equity (SDROE) is 30%. The return on assets

volatility (SDROA) is equal to 1.3%. The percentage of shares held by managers (MOW) is 37.6% with a maximum value of 64.6%, suggesting that Tunisian banks have a relatively concentrated ownership structure.

Table 1. Descriptive statistics.

	Mean	**SD**	**Min**	**Max**
Z-score	17.638	13.579	−1.702	47.851
SDROE	0.304	0.573	0.018	1.982
SDROA	0.013	0.014	0.002	0.051
MOW	0.376	0.166	0.095	0.646
INST	0.493	0.197	0.083	0.85
MAJ	0.532	0.151	0.9	0.84
BSIZE	11.286	1.548	7	14
BIND	0.322	0.138	0.1	0.64
REG	0.112	0.039	−0.014	0.221
SIZE	15.236	0.690	13.810	16.643
LIQUID	1.289	0.702	0.661	5.109
LLOSS	0.075	0.036	0.020	0.200
LOANS	0.732	0.084	0.481	0.905
NBI	12.091	0.705	10.547	13.754
AGE	4.55% (1)	34.09% (2)	49.09% (3)	12.27% (4)
DUAL	49.77% (0)		50.23% (1)	

Note: SD is standard deviation. Min is minimum and Max is maximum.

Table 1 presents descriptive statistics for the variables in focus. Here's a summary of the findings: The average *Z*-score, a measure of bank risk, stands at 17.6 over the observed period. Return on Equity Volatility (SDROE) exhibits a volatility of 30%, indicating the extent of fluctuations in this financial metric. Return on Assets Volatility (SDROA) shows a modest volatility of 1.3%, suggesting relative stability in this aspect. Manager Ownership (MOW) The average percentage of shares held by managers is 37.6%, with a maximum value reaching 64.6%. This points to a notably concentrated ownership structure, with a significant portion of shares in the hands of managers.

Continuing the overview of descriptive statistics: Participation of Institutional Investors (INST): Institutional investors, on average, hold 49.3% of shares, with a maximum reaching 85%. This signifies a substantial influence wielded by institutional investors in board decisions. Concentration of Capital (CONC) averages at 53.2%, with a maximum value of 84%, indicating that a majority of banks have ownership concentrated among a select group of shareholders. Board Characteristics, the board size ranges from 7 to 17, with an average of 11. The percentage of independent directors is recorded at 35.8%, reflecting a significant contribution to enhancing board independence. Bank Regulation Ratio (REG): The mean value of the regulatory capital ratio is approximately 11.2%, surpassing the government-mandated minimum of 8%. This suggests compliance with Basel Committee regulations. The average liquidity ratio is well above the regulatory threshold, with a mean value of 128.9% and a

maximum of 510.9%, ensuring banks meet regulatory requirements. Loss provision (LLOSS) and loans constitute, on average, 8.5% and 73.2% of total assets, respectively. The Net Banking Income (NBI) variable has a mean value of 12.091.

Descriptive statistics show also that most Tunisian banks of our sample have a manager who holds the presidency of the board, which is relatively significant. In addition, the average age of the banks is considered between 40 and 60 years old (value 3 with 49.9%), which indicates that most of Tunisian banks are old.

4.2. Empirical findings and discussion

Our study employs three regression models to examine the interplay between bank governance, regulation, and risk among Tunisian banks, with a focus on the persistence of this relationship during distinct crises—the subprime crisis, the revolution, and the COVID-19 pandemic. Understand how governance structures, board characteristics, and regulatory frameworks contribute to or mitigate risk in Tunisian banks, with a nuanced examination during pivotal crisis periods. The crisis-specific dummies facilitate a granular analysis of risk patterns across the subprime crisis, revolution, and the ongoing pandemic.

Table 2 shows the empirical results of banks risk measured by *Z*-score. We apply model *I* at four different periods of time. The first period is the pre-subprime period, where model *I*(*a*) is located. In the second period, we incorporate the subprime period into the pre-subprime period, where model *I*(*b*) is located. In models *I*(*c*) we included the revolution period. In models *I*(*d*), we add pandemic period of COVID-19. The empirical results consistently highlight a positive and significant relationship between ownership concentration (MAJ) and Z-Score, signifying that a concentrated ownership structure enhances bank risk and solvency across various periods, including crisis periods such as the subprime crisis, the revolution, and the COVID-19 pandemic. This suggests the enduring importance of ownership concentration in strengthening bank stability and solvency.

Table 2. Regression analysis: ZSCORE and governance factors.

Crisis	**Pre-subprime (2000–2006)**	**Including subprime period (2000–2009)**	**Including revolution period (2000–2019)**	**Including pandemic period (2000–2021)**
Model	**Model *I* (*a*)**	**Model *I* (*b*)**	**Model *I* (*c*)**	**Model *I* (*d*)**
Variables	**Coeff**	**Coeff**	**Coeff**	**Coeff**
MOW	0.0036	−0.000	0.0010	−0.001
INST	−0.0207[b]	−0.0098	0.0013	0.0036
MAJ	0.0414[a]	0.0417[b]	0.0173[b]	0.0179[b]
BSIZE	0.0062[a]	0.0043[a]	0.0023[a]	0.0024[a]
DUAL	0.0079[c]	0.0063[b]	0.0071[a]	0.0077[a]
BIND	−0.0272[a]	−0.0110	0.0035	0.0009
REG	0.1122[b]	0.1697[a]	0.1212[a]	0.1156[a]
SIZE	−0.0044	−0.0027	−0.0055	−0.0058[b]
AGE	0.0039[a]	0.0005	0.0001	0.0003
LIQUID	−0.0211[b]	−0.0086[b]	−0.0034[b]	−0.0013
LLOSS	−0.0679[c]	−0.0668[b]	0.0170	0.0213

Table 2. (*Continued*).

Crisis	**Pre-subprime (2000–2006)**	**Including subprime period (2000–2009)**	**Including revolution period (2000–2019)**	**Including pandemic period (2000–2021)**
Model	**Model *I* (*a*)**	**Model *I* (*b*)**	**Model *I* (*c*)**	**Model *I* (*d*)**
Variables	**Coeff**	**Coeff**	**Coeff**	**Coeff**
LOANS	−0.0211	−0.0126	−0.0328[b]	−0.0355[b]
NBI	−0.0066	−0.0025	0.0040	0.0046[c]
Cons	0.1082[b]	0.0305	0.0252	0.0205
R-square	0.4893	0.3958	0.2545	0.2710

a, b, c a indicate respectively the significant level *p* values at 1%, 5%, 10%.

The presented table indicates a significant and positive impact of board size (BSIZE) on the *Z*-score. This suggests that an increased number of members in the board contributes to the stability of banks, guiding them to make optimal and efficient decisions that minimize risk. This finding aligns with Blanchard and Dionne's (2004) model, which proposes that a larger number of directors correlates with the adoption of sophisticated risk-hedging instruments.

The dual roles of decision-making and control, as represented by CEO duality (DUAL), seem to have a risk-reducing effect on banks. This suggests that when CEOs simultaneously hold decision-making and control functions within the board, it leads to a lower level of risk. This outcome can be attributed to CEOs aligning their interests with the overall stability of Tunisian banks, avoiding ventures that might pose risks to the bank. Therefore, despite the impact of crises, as evidenced in models *I*(*b*), *I*(*c*), *I*(*d*), board size continues to play a crucial role in keeping stability and mitigating risk during uncertain periods. The board of directors, particularly its size, reflects rational responses to changes in the external environment and the bank's past financial performance.

The regression results reveal a noteworthy positive association between the regulatory ratio (REG) and Z-score, suggesting a negative impact on bank risk. This relationship holds steady even during periods of crises. Nevertheless, the findings indicate that certain governance mechanisms contribute to an increased level of bank risk, specifically the independence of the board (BIND) and institutional ownership (INST).

The positive correlation between board independence and bank risk can be attributed to the presence of capital concentration. The concentration of capital reduces the authority of independent directors to counter decisions that pose a risk to the bank. Institutional investors exert a positive and significant influence on bank risk. According to the OECD's 2013 report, institutional investors, such as insurance companies, pension funds, and mutual funds, have become increasingly prominent players in financial markets. They have expanded their allocation to alternative risky assets and elevated their risk exposure over the years.

Upon integrating the subprime period (model *I*(*b*)), the revolution period (model *I*(*c*)), and the pandemic period (model *I*(*d*)) into the pre-subprime period, the findings suggest that during times of crisis, INST and BIND no longer exert a substantial effect on bank risk and stability, contrasting with the previous period. This implies that the independence of the board and institutional investors may not be effective in helping

firms mitigate the adverse effects of crises. Notably, the positive impact of liquidity (LIQUID) and loss (LLOSS) on bank risk is highlighted during these periods of uncertainty.

Table 3 indicates that the concentration of capital (MAJ) had a positive but statistically insignificant impact on the volatility of return on equity (SDROE) during the pre-subprime period. However, throughout periods of crises, MAJ significantly and positively affected banks' SDROE. This suggests that large shareholders tend to invest in riskier firms to extract more private benefits of control. Modern financial theory posits that higher risk leads to higher returns on investment (Lintner, 1965; Ross, 1976; Sharpe, 1964). According to Demsetz (1983) and Demsetz and Lehn (1985), as a firm's risk increases, the monitoring effectiveness of large shareholders improves when they hold more shares.

Moreover, the board size of the bank is significantly and negatively related to the volatility of the return on equity, suggesting that a large number of board members helps mitigate the financial risk of the bank. This result aligns with our findings in model *I*. A noteworthy observation in this table is the change in sign between the board size and SDROA, which becomes positively significant in crisis periods, indicating that periods of crises have an impact on governance mechanisms. The table also reveals a positive association between the duality factor (DUAL) and SDROE variable in the crisis periods regressions and a lack of correlation in the pre-crisis period.

Furthermore, an increase in institutional investor members on the board has a significant and positive influence on the financial risk of Tunisian banks during the pre-crisis period. This relationship becomes insignificant in crisis periods. The regulation variable (REG) has a positive impact on SDROE in times of crisis and a negative association in the pre-crisis period.

Table 3. Regression analysis: SDROE and governance factors SDROE.

	Pre-subprime (2000–2006)	**Including subprime Period (2000–2009)**	**Including revolution Period (2000–2019)**	**Including Pandemic Period (2000–2021)**
	Model II (a)	**Model II (b)**	**Model II (c)**	**Model II (d)**
MOW	0.0400	−0.0003	0.0010525	−0.0010
INST	0.0882[b]	−0.0099	0.0012103	0.0035
MAJ	0.0243	0.0419[a]	0.017519[b]	0.01798[a]
BSIZE	−0.0099[c]	0.0043[a]	0.0023975[a]	0.0025[a]
DUAL	−0.0081	0.0063[b]	0.0073672[a]	0.0079[a]
BIND	−0.0023	−0.0109	0.0034957	0.0006
REG	−0.8686[a]	0.1715[a]	0.1226393[a]	0.1173[a]
SIZE	−0.0478[b]	−0.0028	−0.0068[c]	−0.0067[b]
AGE	−0.0054	0.0006	0.0002041	0.0003
LIQUID	0.0115	−0.0085[b]	−0.0034[b]	−0.0013
LLOSS	0.6278[a]	−0.0677[b]	0.0176	0.0212
LOANS	−0.0081	−0.0137	−0.0344[b]	−0.0376[b]
NBI	0.0577[b]	−0.0024	0.0051	0.0053[b]
Cons	0.1616	0.0311	0.0302	0.0260
Ad.R^2	0.5989	0.3949	0.2552	0.2737

a, b, c a indicate respectively the significant level *p* values at 1%, 5%, 10%.

Table 4: Considering the disparities in the regression results between the pre-crisis period (Model III(a)) and crises (Model III(b), III(c), and III(d)), this table offers an interpretation of these findings using SDROA as a measure of bank risk. The results reveal a significant and positive coefficient for the institutional investors (INST) variable in the SDROA's regression during the pre-subprime period, with a lack of significance of INST in the crises periods regressions. Additionally, the coefficient for the duality variable (DUAL) is insignificant across the pre-crisis regression and significantly negatively associated with SDROA when crises periods are included. The concentration of capital (MAJ) variable's coefficient is significant before the crisis but becomes insignificant from the revolution period (Model III(c)). Conversely, the manager ownership (MOW) variable has a significant negative influence on SDROA when including the revolution period and the pandemic period.

Table 4. Regression analysis: SDROA and governance factors SDROA.

	Pre-subprime (2000–2006)	**Including subprime period (2000–2009)**	**Including revolution period (2000–2019)**	**Including pandemic period (2000–2021)**
	Model III (a)	**Model III (b)**	**Model III (c)**	**Model III (d)**
MOW	0.0009	−0.0066	−0.0090[c]	−0.009[c]
INST	0.0198[b]	0.0110	0.0053	0.0050
MAJ	−0.0256[b]	−0.0191[c]	−0.0054	−0.0043
BSIZE	−0.0059[a]	−0.0040[a]	−0.0031[a]	−0.0034[a]
DUAL	−0.0051	−0.0065[b]	−0.0066[a]	−0.0069[a]
BIND	−0.0011	−0.0023	−0.0056	−0.0037
REG	−0.0811	−0.0756[c]	−0.0022	−0.0016
SIZE	−0.0085[c]	−0.0156[a]	−0.0073[b]	−0.0048[b]
AGE	0.0050[a]	0.0066[a]	0.0070[a]	0.0070[a]
LIQUID	0.0113[c]	0.0080[b]	0.0030[c]	0.0019[c]
LLOSS	−0.0179	0.0036	−0.0341[b]	−0.0374[b]
LOANS	0.0297	0.0299	0.0289[a]	0.0269[a]
NBI	0.0047	0.0092[c]	0.0014	−0.0014
Cons	0.1209[b]	0.1533[a]	0.1101[a]	0.1133[a]
R-square	0.5374	0.4951	0.5103	0.5088

a, b, c a indicate respectively the significant level *p* values at 1%, 5%, 10%.

4.3. Robustness tests

We examine the robustness check by using Value at risk model to resume all bank risks in one model as follows:

$$\mathrm{VAR(TA)} = -Z\mathrm{score} * \mathrm{SD(ROA)} * \mathrm{Invest} \quad (5)$$

where VAR is Value at Risk, *Z*-score is bank risk according to Equation (1), Std is standard deviation of asset, and *invest* is amount of Investment. When we applicate this model to bank risk measures, we can propose two different measures related to the bank asset type: Total assets or total equities:

$$\mathrm{VAR(TA)} = -Z\mathrm{score} * \mathrm{SD(ROA)} * \mathrm{TA} \quad (6)$$

$$\mathrm{VAR(TE)} = -Z\mathrm{score} * \mathrm{SD(ROE)} * \mathrm{TE} \quad (7)$$

where VAR(TA) and VAR(TE) are Value at Risk related respectively to total Asset and Total equities, SD(ROA) and SD(ROE) are the second and the third measure of bank risk according to Equations (2) and (3). and TA and TE are amounts of total asset and total equities.

The estimation results of the VAR (TA) are presented in **Table 5**. We see clearly that during subprime and revolution period, the coefficients are not significant, implying that governance variables along these crises do not affect the bank risk. However, during Covid-19 period, we remark that the coefficient of INST and DUAL are significant and negative, indicating that the ownership structure affects negatively the bank risk. The coefficient of BSIZE and BIND are also significant and negative, reflecting that the board has an important effect on bank risk. The coefficient of REG is not significant, suggesting that the regulation do not affect the bank risk. Furthermore, we perceive that the value of these variables during COVID-19 period are smaller compared to subprime and revolution periods which represents the severe impact of the COVID-19 on bank risk.

Table 5. Estimation results of VAR (TA).

Variables	All period	Subprime crisis	Tunisian revolution	Covid-19 period
VAR-1	−0.0348	−0.2453	0.0224	0.4250[b]
MOW	72.0379	61.0269	20.9636	−140.1855
INST	2.96473	119.5729	21.3864	−233.1019[a]
MAJ	11.3871	−138.0787	−2.9868	−1057.308[a]
BSIZE	1.4135	21.3335	−1.4762	−12.5910[a]
DUAL	−8.8209	6.9739	4.3516	0
BIND	43.6397	9.0082	−13.3578	284.3662[a]
REG	−17.9516	3598.87	−18.7584	−73.6737
SIZE	17.3041	66.4445	19.1680	−51.8133
AGE	−46.5288[b]	−508.305[a]	5.2666	59.3675[a]
LIQUID	−0.0733	−1.2185	−3.3472	−3.9129[c]
LLOSS	−56.2592	−16.9256	35.2459	190.3965[c]
LOANS	−71.4196	−45.5922	−23.4177	−739.4299[a]
NBI	-7.2×10^{-6}	-38.9×10^{-6}	$-0.49.6\times 10^{-6}$	$-0.17.2\times 10^{-6}$
Cons	−156.5773	−263.4995	−294.0429	2072.326[a]
Wald chi 2	13.86	29.48**	5.22	128.27*

The estimation results of the VAR (TE) are presented in **Table 6**. According to obtained results, the coefficient of ownership, board and regulation are not significant in both subprime crisis and revolution periods. However, these coefficients are significant and negative during COVID-19 period. In particular the values of these coefficients are smaller during COVID-19 period reflecting the severe effect of this pandemic COVID-19. The coefficient of REG is not significant, suggesting that the regulation do not affect the bank risk. According to the obtained results, we can

conclude that the COVID-19 pandemic has an unprecedented impact of the bank risk compared to other types of crises.

Table 6. Estimation results of VAR (TE).

Variables	All period	Subprime crisis	Tunisian revolution	COVID-19 period
VAR-1	0.0067	−0.2828	−0.0913	2.0107[a]
MOW	8.9241	5.8802	5.7587	−147.7688
INST	−0.2535	21.7290	17.0527	−111.4452[b]
MAJ	−9.6830	−22.3275	−4.0264	−605.5544[a]
BSIZE	−0.4707	2.1395	−1.2986	−16.1570[a]
DUAL	−3.4462	0.7491	0.2655	0
BIND	13.9435	−6.4642	−3.4652	243.9542[a]
REG	−6.3781	424.4012	−10.2667	113.3602
SIZE	9.8631[b]	7.0968	19.4374[b]	3.9902
AGE	−15.9410[a]	−98.8465[a]	2.8643	36.2968[a]
LIQUID	0.0219	−0.1718	−0.1374	−1.676678
LLOSS	−9.9870	−6.2453	38.4978	168.6849[b]
LOANS	17.4785	−6.6632	7.3442	−385.19[a]
NBI	-2.30×10^{-6}	0.0001	-41.9×10^{-6}	-20×10^{-6}
Cons	−125.5187[c]	54.8557	−311.6666[c]	716.9709[c]
Wald chi 2	16.95	23*	8.23	187.87***

5. Conclusion

The importance of effective corporate governance is emphasized in both developing and developed economies. especially as firms seek access to domestic and international financial resources (Iskander and Chamlou, 2000). In the aftermath of the global financial crisis of 2007–2008. where excessive risk-taking by banks drew considerable criticism. This literature review aims to deepen our understanding of the impact of corporate governance mechanisms. particularly board characteristics. on banks' risk-taking behavior.

An examination of the economic repercussions on the Tunisian economy resulting from supply and demand shocks induced by COVID-19 containment measures reveals significant effects. In Tunisia. the macroeconomic. institutional. and regulatory landscape within which banks operate has undergone substantial changes since the revolution. The combined impact of a more volatile macroeconomic environment and stricter monetary policies is imposing heightened liquidity constraints and market pressures on banks. Additionally. the Central Bank of Tunisia (CBT) introduced a rapid series of regulatory reforms. including an increase in the minimum required capital ratio and the redefinition of regulatory capital instruments. Despite these transformative factors. only a limited number of studies have delved into the reactions of Tunisian banks to this evolving economic and regulatory environment. This literature gap underscores the need for further research to provide a comprehensive understanding of how Tunisian banks navigate and respond to the challenges presented by these dynamic conditions.

This study explores the impact of three distinct crises on the correlation between bank governance and risk-taking adjustments. focusing on a sample of listed Tunisian commercial banks observed from 2000 to 2021. The model considers the influence of financial. political. and pandemic crises. examining bank risk in relation to ownership structure. board characteristics. and regulatory measures. The results indicate that the concentration of capital had a positive but insignificant effect on equity volatility during the pre-subprime period. while it significantly influenced risk positively during crisis periods. Additionally. CEO duality was insignificant in the pre-crisis regression but significantly negatively associated with asset volatility when crises periods were included. The study found a significant positive relationship between the regulatory ratio and insolvency risk. indicating a negative impact on bank risk. which remained consistent during crises. However. certain governance mechanisms. such as board independence and institutional ownership. were associated with an increased level of bank risk.

Author contributions: Conceptualization, MK and LM; methodology, LM; software, MK; validation, NS, MC and WD; formal analysis, LM; investigation, WD; resources, MK; data curation, NS; writing—original draft preparation, MK; writing—review and editing, NS, MC and WD; visualization, LM; supervision, MK. All authors have read and agreed to the published version of the manuscript.

Acknowledgments: This research was funded by the General directorate of Scientific Research & Innovation. Dar Al Uloom University. through the Scientific Research Funding Program.

Conflict of interest: The authors declare no conflict of interest.

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