**International Journal of Energy Economics and Policy**

ISSN: 2146-4553

available at http: www.econjournals.com

**International Journal of Energy Economics and Policy, 2025, 15(2), 466-483.**

# Nonlinear Relationship between Environmental Quality and Bank Risk-taking in the MENA Region

**Eman Mashaqi*, Mohamed Albaity, Ray Saadaoui Mallek**

Department of Finance and Economics, College of Business Administration, University of Sharjah, Sharjah, UAE.
*Email: emashaqi@sharjah.ac.ae

**Received:** 24 October 2024 **Accepted:** 08 February 2025 **DOI:** https://doi.org/10.32479/ijeep.18304

**ABSTRACT**

This study investigated the nonlinear effects of environmental quality (EQ) on bank risk-taking in the region and the moderating influence on the EQ risk-taking nexus. The study employed generalized quadratic quantile regression techniques to unearth nuanced relationships within 154 publicly traded banks from 10 MENA region countries between 2011 and 2023. The results suggested a U-shaped relationship between bank risk-taking and environmental quality proxied by the environmental performance index EPI. This outcome indicated that initial advances in environmental quality were associated with reduced risk-taking, which may increase beyond a certain threshold. Furthermore, the moderating influence of bank size was substantial, as larger banks typically exhibited a more robust ability to manage environmental hazards without increasing their risk-taking behaviour. The implications for policy and practice are substantial, indicating that developing effective risk management strategies should consider both the size of banks and environmental improvements.

**Keywords:** Environmental Performance Index EPI, Environmental Quality EQ, Interaction, Nonlinear, and MENA
**JEL Classifications:** G10; G15, G21

## 1. INTRODUCTION

The banking system is a critical component of the financial market, operating as the foundation for allocating financial resources (Miftari, 2023). The economy and financial markets are significantly affected by the stability of the banking sector (Korneev et al., 2023). Failing banking systems impact the actual economies substantially leading to more severe financial crises. The 2008 global financial crisis (GFC), which originated with US subprime bonds, significantly affected both virtual and real economies worldwide (Bernanke, 2018). A crisis study suggested that the primary cause of the crisis was the propensity of financial institutions to engage in high-risk activities (Iqbal and Vähämaa, 2019). As a result, evaluating banks' propensity for taking risks has once again become a significant concern in both the financial sector and academia. Evaluating such behaviour encompasses the motivations, decision-making, and execution of risk-based operations, arising from the collective actions of banks' stakeholders, including shareholders, creditors, management, and the government. Each has distinct preferences for the level of risk banks should undertake based on their respective interests and responsibilities.

The banking sector is a critical element of any economy, significantly influencing economic development and stability (Bagga and Lekhi, 2017; Korneev et al., 2023; Sut, 2019). Since the banking sector is essential for providing financial services and alternatives to the public, its success or failure substantially impacts the economy (Bagga and Lekhi, 2017). A stable finance sector is essential for the stability of the economy. Multiple factors affect the financial stability of organisations, these include innovations, credit, liquidity, market risks, and regulatory actions (Sut, 2019). The financial sector is important for the economy's overall functioning, as it benefits investors, firms, and individuals.

A secure financial system is essential for preventing economic declines and crises and must sustain stability to accomplish this (Korneev et al., 2023). Therefore, it is essential to carefully monitor and control operational, liquidity, credit, and market risks. A robust and dependable banking system is indispensable for realising economic growth and development goals, as evidenced by high credit ratings and increased foreign capital interest (Yildirim and Ildokuz, 2020). A dual banking system refers to the combination of conventional financial (CF) and Islamic financial (IF) systems, with the IF system becoming an alternative financing model in the Muslim world in the 1970s.The CF system is interest-based and funds all sectors of the economy, while the IF system complies with Islamic legal rules and has limited exposure to speculative activities. Empirical evidence indicates that a dual banking system, which includes Islamic banks, is more stable than a single system (Demez et al., 2017; Nosheen and Rashid, 2021). The successful of the Islamic banking system is demonstrated by its emergence and large expansion beyond Muslim-majority countries, and its supporters have since presented it as a practical alternative to the current economic system (Abdul Hamid et al., 2020).

A combination of conventional and Islamic institutions distinguishes the Middle East and North Africa (MENA) region. Islamic banking follows Sharia principles, prioritising profit-sharing, ethical investments, and prohibiting interest (riba) (Hassan-Bello, 2018). In contrast, conventional banks adhere to conventional interest-based financial practices. This dichotomy in banking systems has created a competitive landscape influencing various aspects of bank performance and risk management (Vujanović and Fabris, 2021). The competition between Islamic and conventional banks in the MENA region has become evident in various risk dimensions, such as credit and liquidity risks (Mokni et al., 2015). Islamic banks encounter distinctive liquidity management challenges due to limitations on specific financial instruments and transactions, contrary to Sharia's principles (Bello et al., 2017). Nonetheless, conventional banks, while more flexible in their operations, are not obligated to incur risks arising from competitive environments and economic conditions. Changes in operating environments have led banks to create diversity in their operations, impacting the risk-return profile of the industry (Delpachitra and Lester, 2013). Banks face various economic performance risks, and the correct identification, measurement, and management of these risks are essential for efficient operation (Neitzert and Petras, 2022). Greater competition in banking causes banks to act more prudently due to more threats of failure, leading to lower risks (Arping, 2019). Greater competition encourages banks to take on more diversified risks, making the banking system less fragile to shocks (Anginer et al., 2014). Different bank business models and specialisations impact the relationship between competition and risk-taking. Cooperatives are better protected against liquidity risks and are more stable (Căpraru et al., 2021). The influence of environmental quality on the risk-taking behaviours of banks is one of the emerging areas of concern in dual banking systems (Alam, 2014). Recent research, Stolbov and Shchepeleva, 2022) It emphasized the increasing importance of environmental factors in financial stability. For example, environmental risks such as climate change and environmental degradation significantly impact banks' credit and liquidity risk profiles (Mirza et al., 2024). Research has suggested that poor environmental quality exacerbates credit risk, which impacts the ability of debtors to repay loans, particularly in sectors susceptible to environmental changes (Arintoko et al., 2024; Mirza et al., 2024). In addition, liquidity risk may be elevated during environmental crises, as banks may encounter abrupt fluctuations in asset values and elevated demand for liquidity (Acharya and Mora, 2015).

The relationship between environmental quality and bank risk-taking has been demonstrated in the studies conducted by Birindelli et al. (2022) and (Gangi et al., 2020). Birindelli et al., (2022) determined that banks in regions with deteriorating environmental conditions tended to increase their risk exposure, particularly in credit portfolios. Banks that have incorporated environmental risk management into their operations demonstrated superior risk-adjusted performance, as demonstrated by Gangi et al. (2020). It was essential to investigate how the dual banking system in the MENA region addressed these challenges, as environmental factors have played a critical role in shaping risk dynamics (Shabir et al., 2024). The MENA region's substantial petroleum reserves are a critical contributor to global economic stability (Ismail et al., 2018). Policymakers face challenges, notably in diversifying their income bases, due to the natural resource curse, which is particularly prevalent in oil-rich MENA region countries (Saeed, 2021). Oil dependency encompasses both economic and geopolitical aspects, with countries relying on oil for energy, economic growth, and international relations (Cappelli et al., 2023; Cappelli and Carnazza, 2023; Greene and Liu, 2015; Herbstreuth, 2014). The European Union is heavily dependent on oil, with Russian exports over recent decades playing a crucial role in shaping the EU's energy future (Cappelli and Carnazza, 2023). The global crude oil market experienced significant changes after an oil price drop in 2014, impacting the international oil trade dependency network (An et al., 2018). Oil dependency has implications for political stability and income inequality, with oil-exporting and oil-importing countries being affected differently (Berisha et al., 2021). There is a need for policymakers to address oil dependency by decoupling oil consumption from GDP growth, reducing geopolitical dependencies, and diversifying economies to overcome the negative effects of oil reliance (Abdalla Alfaki and El Anshasy, 2022; Filimonova et al., 2020).

Gulf Cooperation Council (GCC) economies heavily depend on the energy sector (oil and gas), and energy prices are strongly linked to their economies' performance. Thus, volatility in energy prices can substantially change a country's economic performance (Albaity et al., 2023). This study investigated the relationship between environmental quality and bank risk-taking behaviours in Islamic and conventional banks in the MENA region (Mokni et al., 2016; Yahya and Ibrahim, 2021). By analysing this relationship, the study has sought to deliver insights into the variance influences of environmental quality on liquidity and credit risks in these two distinct banking systems, thereby contributing to a broader understanding of sustainable banking practices in a competitive financial environment.

The size of a bank is also a crucial element influencing how financial institutions react to environmental factors, as well as a significant moderation factor in the context of a relation between environmental quality and bank risk-taking (Bătae et al., 2021). In comparison, larger banks tend to have more financial resources, diversified investment portfolios, and more stringent regulatory frameworks than smaller banks (Mckillop et al., 2020). These attributes allow larger banks to better absorb risks and possibly align their operations with environmental concerns. However, this relationship is not linear, as the ability to manage environmental risks and the likelihood of risk-taking can differ significantly across banks of various sizes. For example, larger banking institutions may be more likely to adopt sustainable practices because of public scrutiny and regulatory pressures, whereas smaller banks may respond to similar pressures to varying degrees because of resource and operational constraints (Settembre-Blundo et al., 2021).

Additionally, the correlation between environmental quality and bank size leads complexities in understanding how environmental elements impact bank stability and risk-taking. The non-linear impact suggests that while larger banks might integrate environmental aspects into their strategic decisions more effectively (Kouzez, 2023; Mazumder and Piccotti, 2023), smaller banks could exhibit unique risk behaviours inclined by localized environmental challenges or market-specific conditions. This moderating role of bank size is crucial to understanding the broader consequences of environmental quality on bank risk-taking and warrants thorough investigation to present nuanced insights into this dynamic relationship.

The objectives of the study are as follows: Initially, the study aimed to thoroughly examine the non-linear correlation between environmental quality and bank risk-taking. Secondly, this study presented bank size as a moderating variable in the relationship between bank risk-taking and environmental quality. The additional bank size is due to the fact that larger banks may demonstrate distinct risk-taking behaviours and stability profiles compared to smaller banks. This study has revealed a comprehensive understanding of the impact of environmental quality on the size of banking institutions by examining the moderating function of bank size.

The study has contributed significantly to environmental quality (EQ) and bank risk-taking literature, specifically within the region of MENA (Middle East and North Africa). EQ and bank risk-taking have been examined independently for the first time in the MENA region, indicating a more nuanced view of how changes in EQ impact bank behaviour. Furthermore, this study has highlighted heterogeneity in bank behaviour and risk profiles by exploring the alteration of bank size on the EQ-risk-taking nexus. This research has also introduced a new approach to assessing effects across different points of bank risk-taking distribution by using a quantile regression method. This methodological innovation leads risk management and policy interferences more effectively. In addition to providing valuable insights for academic research and policy applications in banking and environmental policy, these contributions have enhanced the understanding of the intricate relationship between EQ and bank risk-taking in the MENA region.

## 2. LITERATURE REVIEW

The nexus between environmental quality and bank risk-taking has garnered considerable academic and policy interest in recent years. The present literature review has provided an in-depth examination of current research on Environmental Quality (EQ) and its non-linear impact on bank risk-taking, particularly in the Middle East and North Africa (MENA) region. Furthermore, it has examined how bank size has influenced this relationship, providing a more detailed overview of the functions at work. The present study has added to the existing literature by filling two key gaps: the non-linear correlation between environmental quality and bank risk-taking and the alteration of bank size in that relationship.

The concept of sustainable banking has developed significantly in recent years (Neitzert and Petras, 2022). Environmental quality (EQ) has become a principal measured for evaluating a country's capability to preserve environmental sustainability. It considers different features, involving air quality and biodiversity, to systematically measure ecological well-being (Khan et al., 2020). An environmental indicator typically includes a number indicating the state and development of the environment or conditions that affect the environment. As such, comparisons can be derived with economic values. The score of macroeconomic policy is often measured by accumulated economic indicators such as the Gross Domestic Product (GDP), Net National Income, industrial production, and the current account balance, to mention a few (Alfsen and Sæbø, 1993). Recently, academics have investigated the impact of EQ on the risk-taking behaviour of financial institutions, including banks (Bătae et al., 2021a; Gutiérrez-Ponce and Wibowo, 2023; Shair et al., 2021). Bank risk-taking refers to the ability of banks to participate in activities with the potential for both positive and negative outcomes. It includes the uncertainty linked with borrowers' ability to service loans, the construction of non-performing loans, and the, It also includes the relationship between bank profitability, borrowing constraints, and the influence of monetary policy on risk-taking behaviour (Kun and Duo, 2014; Shamshur and Weill, 2023; Zakaria, 2017; Zhang et al., 2024). Higher bank profitability can lead to increased risk-taking due to loosened borrowing constraints, especially when leverage constraints are looser or new investments can be financed with senior funding (Martynova et al., 2020). Nuanced findings and theoretical implications of earlier studies using Stakeholder Theory to investigate the non-linear interaction between EQ and bank risk-taking have deepened our understanding of environmental factors affecting financial decision-making in banking institutions (Gao and Wang, 2024). According to researchers, the Stakeholder Theory provides a comprehensive framework for examining how banks with higher EQ scores manage their risk-taking procedures. One meaningful finding has been that banks that value environmental sustainability takes a risk-averse approach (Gangi et al., 2019). Reputational hazards and regulations associated with environmental impacts have been the basis for this cautious approach.

Banks may opt not to fund projects that pose substantial environmental risks or impose harsher lending terms on enterprises with a significant environmental impact (Hui et al., 2024). This risk-averse approach displays banks' commitment to long-term sustainability goals and aligns with stakeholders' expectations of ethical corporate behaviour (Izcan and Bektas, 2022). The Stakeholder theory emphasises that firms should consider multiple stakeholders' interests, including environmental issues (Li et al., 2023). It indicates that effective corporate governance procedures can benefit banks' environmental participation, resulting in less risk. The Stakeholder theory can assist banks in solving the trade-off between the economy and ecology (Gangi et al., 2019). On the other hand, the Stakeholder theory outlines circumstances in which banks take on additional risk to gain a competitive advantage through superior environmental performance. These banks may perceive opportunities to invest in environmentally friendly technology, infrastructural efforts, or ventures into the renewable energy sector (Srivastava et al., 2022). Banks view these investments as aligning with stakeholders' interests and capitalising on the growing demand for environmentally friendly solutions, notwithstanding the higher financial risks associated with such activities. In response to stakeholders' pressure for sustainable development, banks can use this strategic reaction strategy to increase their market positioning and profitability in new green sectors (Sharma and Choubey, 2022). The Stakeholder Theory provides valuable insights into how banks incorporate environmental considerations into their strategic planning and risk management frameworks. Banks may strengthen their competitive advantage, reputation, and resilience in a rapidly changing financial sector by aligning their environmental performance with stakeholder expectations and regulatory requirements. Theoretically, these findings have demonstrated how proactive environmental stewardship shapes appropriate risk-taking behaviours that support long-term economic growth and societal well-being.

Previous studies have used the Agency Theory to investigate the association between EQ and bank risk-taking (Bătae et al., 2021b; Nguyen, 2020). This research provided insights into how managerial behaviours and organisational incentives influenced this relationship. The principal-agent relationship is the basis of the Agency Theory, in which principals (such as shareholders) delegate decision-making authority to agents (such as bank management). Its primary goals are to minimise conflicts of interest and maximise decision outcomes (Marashdeh et al., 2021). According to empirical research, banks with higher EQ ratings usually exhibit different risk-taking behaviours, influenced by agency dynamics. First and foremost, banks that demonstrate excellent environmental performance may reconcile stakeholders' expectations for sustainability with their risk-taking activities (Rehman et al., 2021). These banks prioritise conservative risk management strategies to reduce environmental risks, comply with regulations, and improve their reputation with regulators and socially conscious investors (Aragón-Correa et al., 2020). Aligning managerial incentives with long-term shareholder profit and community expectations reduces agency costs (Greiner and Sun, 2021). On the other hand, the Agency Theory identifies potential downsides, such as how high EQ ratings can encourage risky behaviour. Bank executives may utilise their environmental credentials to make risky investments in environmentally friendly technologies or sustainability projects that they see as profitable but fraught with risk. This ambition could prioritise short-term profitability above long-term sustainability, resulting in agency conflicts between management's self-interest and shareholder value maximisation (Cornell and Shapiro, 2021). The Resource-Based View (RBV) Theory, developed by Barney et al. (2021), emphasises that a firm's competitive advantage stems from its capacity to acquire, develop, and use valuable, rare, unique, and non-substitutable resources. In banking, the RBV provides a framework for understanding how internal resources, such as environmental quality initiatives, impact risk-taking behaviours (Tsai and Fang, 2023).

Several research papers have provided valuable insights into the relationship between environmental quality and bank risk-taking using the Resource-Based View RBV theory. Xie et al. (2020) found that banks that included environmental management into their strategic planning reduced overall risk. Treating environmental quality as a strategic resource allows banks to obtain a competitive edge while reducing long-term concerns such as regulatory penalties and reputational damage. Similarly, Hussain and Hoque (2002) stated that green financing techniques, such as lending to environmentally friendly enterprises, were useful resources. These approaches improve environmental quality, diversify bank portfolios, and reduce exposure to high-risk industries. Brahmanaand Kontesa (2021) pointed to explain the correlation between environmental and financial performance, by leading clean technology as a moderating variable. They found that lower environmental performance leads to lower financial performance, supporting the natural resource-based view theory. Bătae et al. (2021) supported the hypothesized predictions rooted in the Stakeholder Theory and Resources-based view of RBV. These fields reflect a new focus on resource efficiency and environmentally aware products and services as well as the digitalisation of processes by the banks — all in line with an increased concern for reporting environmental risks from investors. Firms, and banks in particular, have strategically aligned sustainability maximise long-term value or competitive positioning. Aslam and Jawaid (2023) stated that green banking positively influenced banks' operational, environmental and financial performance. A strong environmental reputation is considered an intangible resource, enhancing customer trust and loyalty. García-Alcober et al. (2020) pointed out that banks with high environmental quality were perceived to be more consistent and ethical, reducing reputational risks and drawing more stable deposits. Additionally, adherence to environmental regulation is a substantial resource which provides the banks with an opportunity not only save from fines but also avoid legal muddles. This resource is asset or operational efficiency and cost-saving initiatives such as energy-saving technologies. Scholtens (2009) showed that these savings contributed to better financial performance and lower operational risks.

Hypothesis 1: There is Non-Linear Relationship between Bank Risk-Taking, and the Environmental Quality is Positive.

The size of a bank, which is a crucial factor in this relationship, has greatly influenced how banks react to environmental factors (Bătae et al., 2021). Major financial institutions frequently have larger capital reserves, varied investment portfolios, and more comprehensive regulatory responsibilities than smaller banks (Mckillop et al., 2020). These attributes impact their willingness to take risks and their capacity to integrate environmental considerations into their decision-making procedures (Settembre-Blundo et al., 2021). Smaller banks, on the other hand, operate more narrowly or specifically. Such organisations serve certain demographics or sectors, may have fewer resources, and focus on a narrower geographic area. Unlike larger banks, smaller banks have often faced challenges in securing capital, which might impact their lending capacity and growth prospects (Mkhaiber and Werner, 2021). Large banks' risk management is more flexible during GFC; However, small banks' efficiency has generally been higher, and their size has shown less adverse effects on their technical efficiency and risk management (Colesnic et al., 2020). The hypothesis that the size of a bank influences the linear relationship between EQ and banks' risk-taking levels suggests several compelling explanations. First and foremost, larger banks can accommodate greater environmental risks due to their comprehensive risk management systems and diverse between political risk and bank performance was influenced by the scale of the bank, as larger banks were more resilient and less susceptible to political distress than their smaller counterparts. These patterns have begun to be illuminated by empirical research. Research has examined the extent to which banks of varying sizes adjust their risk profiles in response to fluctuations in EQ scores. The results have indicated that specific institutions may exhibit more risky behaviour in economies with higher EQ ratings, indicating stronger environmental performance (Ángel et al., 2022). Nevertheless, the magnitude and orientation of this adjustment can differ significantly among banks of diverse sizes (Chodorow-Reich et al., 2022).

The significance of governance and environmental sensitivity in influencing risk-taking behaviour has been suggested by the fact that effective corporate governance mechanisms positively impact banks' environmental engagement, and banks that are more environmentally sensitive manifest less risk (Gangi et al., 2019). The frequency of extreme pollution days has been the primary factor driving the impact of air pollution on bank risk-taking. Banks in cities with higher governmental environmental concerns and those with smaller asset scales and lower risk resistance are relatively more sensitive to air pollution, indicating the necessity of incorporating environmental factors and bank size into risk models (Pan et al., 2024). The magnitude of a bank moderated the relationship between environmental quality and risk-taking behaviour, Banks that prioritise climate change issues, particularly those in countries with superior environmental performance, have encountered diminished loan risks (Birindelli et al., 2022; Porzio and Battaglia, 2024; Shen et al., 2021). The results have indicated that specific institutions may exhibit more risky behaviour in economies with higher EQ ratings, which indicates stronger environmental performance (Ángel et al., 2022). Nevertheless, the magnitude and orientation of this adjustment have differed significantly among banks of diverse sizes (Chodorow-Reich et al., 2022). Hoque and Liu, (2023) highlighted that banks operating in regions with stringent environmental regulations tended to exhibit lower risk profiles, suggesting a linear relationship between environmental performance and bank risk-taking. Non-linear models better capture the dynamic interactions in financial systems (Galadima and Aminu, 2020). However, the influence of EQ on risk-taking differed based on contextual elements, such as the size of the bank (Saadaoui Mallek et al., 2024).

Hypothesis 2: The size of a bank moderates the relationship between environmental quality and the level of risk-taking banks.

## 3. METHODOLOGY

### 3.1. Sample

The objective of this study is to examine the non-linear correlation between environmental quality and bank risk-taking. This study presented bank size as a moderating variable in the relationship between bank risk-taking and environmental quality. In this study, the sample included annual data for both Islamic and conventional banks in the eighteen MENA countries. The data was collected from the BankFocus database by Bureau van Dijik and topped off by information from the World Bank database. The data from 2011 to 2023 excluded banks with no data for this study's interval. The data was reviewed for any missing values, inconsistencies and outliers. Banks with missing values for EQ and NZscore were removed. The final sample included 154 banks in the ten MENA countries. Central banks, government development banks, investment banks, and finance houses were excluded for homogeneity purposes. Similar to Albaity et al. (2023) and Andrieş and Căpraru (2014) to avoid double counting of parent and subsidiary banks in the dataset we did the following. We used the BankFocus consolidation coding system to eliminate the double entry in the dataset. In other words, we excluded bank-holding companies to avoid double counting in the dataset.

Another issue that might have caused the dataset to be biased were mergers and acquisitions. Following Claessens and Van Horen (2014) and Andrieş and Căpraru (2014), we overcame this problem by looking at any mergers and acquisitions that involved any bank during the study period. Once a merger or acquisition occurred the old bank was considered inactive and the new bank data was used. Only conventional and Islamic banks with complete data from 2011 to 2023 were included. In the end, there were 99 conventional banks and 55 Islamic banks with complete data for the study period (Table 1).

Due to some unique characteristics of the MENA region, such as Islamic finance, resource dependence, and political instability,

**Table 1: Distribution of banks across 10 countries**

| Country | Banks |
|---|---|
| Bahrain | 24 |
| Egypt | 21 |
| Israel | 9 |
| Jordan | 16 |
| Kuwait | 17 |
| Morocco | 11 |
| Oman | 9 |
| Qatar | 9 |
| Saudi Arabia | 10 |
| UAE | 28 |

banks in the region operate in an economically and legally unique environment. This study identifies specific factors influencing bank performance and behaviour in this region based on an analysis of banks' performance and behaviour. Through comparisons of several countries in a similar context, we were also able to minimize the impact of other variables that are specific to each country, such as cultural and legal similarities. Publicly traded banks typically provide more access to financial data than private banks. As a result, it was possible to analyze the impact of the Arab Spring on banks during the period 2011-2023, which encompassed both before and after that time period. Furthermore, the COVID-19 pandemic, economic challenges, and political factors have continued to affect the banking sector in MENA. Additionally, research covering these banks can assist in shaping regional policy decisions by providing information about current risks. A distinctive feature of the MENA region is its specific financial markets, which are largely financed by banks and monopolized by governments, particularly in oil-exporting countries (Albaity et al., 2023; El Khoury et al., 2023) Besides, the region also enjoyed significant economic growth from 2011 to 2023 before the COVID-19 pandemic broke out. MENA region has undergone significant social and political turmoil, containing civil unrest and conflict in various countries, which may have concerned the performance of the global financial markets, especially the banking sector (Albaity et al., 2021). Therefore, examining environmental quality indicators in this period provided insight into how instability affected the banking industry. The MENA region has implemented significant reforms in the financial sector in recent years, involving privatization, liberalization, and government directives. Hence, by analysing environmental quality over this period, we can understand how these changes are affecting the banking industry (Mateev et al., 2022).

### 3.2. Empirical Model

This empirical study uses a panel quantile regression (PQR) model with non-additive fixed impacts to examine how the influence of environmental quality (EQ) on bank risk-taking differs at various points in the risk distribution (Powell, 2022). This study implements quantile regression analysis both because the nature of bank risk-taking (the dependent variable) is a distributional type and because quantile analysis can capture the variations in independent variables' effects along the quantiles. This approach delivers a more nuanced understanding of how EQ influence banks with different risk profiles.

The PQR methodology introduced by Powell (2022) addresses some limitations of traditional quantile regression models and provides robust insights into the different influences of independent variables across the risk-taking distribution. Unlike ordinary least squares (OLS), which indicate the conditional mean, the PQR approach estimates conditional quantiles, presenting a more nuanced understanding of relationships across different levels of bank risk-taking.

One of the key advantages of the PQR framework is its ability to model heterogeneous effects while remaining robust to outliers (Maiti, 2021). This robustness confirms that the findings are not overly affected by extreme values. Moreover, PQR does not assume a parametric distribution for error terms, making it a semiparametric approach suitable for examining complex relationships (Powell, 2022). Powell's method enables simultaneous estimation of additive fixed effects, providing reliable results even in the presence of endogeneity and control variables. This makes the approach particularly useful for analyzing the MENA banking sector, where varied economic and environmental conditions overcome.

The PQR model is also able to investigate the impacts of independent variables across various market conditions, such as periods of financial stability or distress, by estimating the impact at different quantiles. Compared to OLS, which provides an average estimate, PQR offers detailed insights into how environmental and innovation factors influence banks with different levels of risk-taking. Following previous studies (Güngör, 2023; Wu et al., 2023), this study adopts the PQR model to explore the non-linear and distributional effects of EQ and IE on bank risk-taking. Also, the study provides a comprehensive understanding of the role of these variables across the spectrum of risk profiles in the MENA banking sector.

The use of quantile regression in this context is particularly advantageous, as it overcomes the limitations of cross-sectional dependence (Alvarado et al., 2021) and allows for robust analysis under varying economic conditions. The methodological approach adopted here reflects the growing recognition of quantile regression as a powerful tool for addressing the complexity of relationships in financial and environmental research.

Using the following panel regression model, we assessed the predictive power of bank risk (Z-score), commonly tested bank-specific and country-specific variables, and the type of bank (Islamic/conventional) on bank stock returns. Using a linear model as a baseline, we can predict the following:

$$RT_{i,j,t} = \gamma_0 + \gamma_1 RT_{i,j,t-1} + \gamma_2 EPI_{j,t} + \varphi X_{i,j,t} + \delta Y_{j,t} + \varphi (Year)_t + \delta_i + \varepsilon_{i,j,t} \quad (1)$$

Where $RT_{i,j,t}$ is bank risk-taking proxied by Z-Score for bank $i$ in country $j$ during year $t$. The lagged dependent variable captures the persistence of bank risk-taking over time. Subscript $EPI_{j,t}$ represents the environmental performance index. $X_{i,j,t}$ is the vector of the bank-specific control variables. The first variable is efficiency ($Eff_{i,j,t}$) proxied by cost-to-income ratio. The second is liquidity ($LQ_{i,j,t}$), calculated as net loans divided by Deposits. The third bank-specific variable is bank size ($Size_{i,j,t}$), calculated as the natural logarithm of a bank's total assets to bank size. The last bank-specific variable is the leverage ratio ($Lev_{i,j,t}$) proxied by the ratio of equity to total assets. Finally, the vector $Y_{j,t}$ is included to capture country-specific risks associated with bank risk-taking, namely the geopolitical risk, GDP growth rate, oil returns ($Oil_{j,t}$), and inflation via the consumer price index ($CPI_{j,t}$). Lastly, year and individual effects are included to capture time and the bank effects.

To test the non-linear effect of the EPI on risk-taking, we amended the baseline equation as follows:

$$RT_{i,j,t} = \gamma_0 + \gamma_1 RT_{i,j,t-1} + \gamma_2 EPI_{j,t} + \gamma_3 EPI_{j,t}^2 + \varphi X_{i,j,t} + \delta Y_{j,t} + \varphi(Year)_t + \delta_i + \varepsilon_{i,j,t} \quad (2)$$

Where $EPI_{j,t}^2$ represents the squared value of the environmental performance index.

To examine the quadratic effect of EPI on bank risk-taking, alongside previously tested bank-specific and country-specific variables, we specify the following equation:

$$RT_{i,j,t} = \gamma_0 + \gamma_1 RT_{i,j,t-1} + \gamma_2 EPI_{j,t} + \gamma_3 EPI_{j,t} * Size_{i,j,t} + \varphi X_{i,j,t} + \delta Y_{j,t} + \varphi\left(Year\right)_t + \delta_i + \varepsilon_{i,j,t} \quad (3)$$

Where $EPI_{j,t} \times Size_{i,j,t}$ captures the panel's interaction between EPI and bank size. The interaction coefficient $\gamma_3$ captures the dependence of the EPI-bank risk-taking nexus via the size effect. If $\gamma_3$ is significant, the size strengthens or weakens the link between the EPI component and bank risk-taking. The other parameters are the same as those in Equation (1).

Generally, a bank's activities are associated with credit risk, and credit risk is one of the key factors in credit intermediation (Kun and Duo, 2014). In banking, the Z-score is widely used as a measure of risk (Brown et al., 2015; Laeven and Levine, 2009). Z-scores are inversely related to bankruptcy rates; therefore, a higher Z-score translates into more stability for the bank (Laeven and Levine, 2009). Compared to other predictors, the Z-score is more accurate for large and commercial banks. According to Chiaramonte et al. (2015), when bank business models are more complex, financial institutions are more numerous, and accounting practices are scrutinized, the Z-score is superior. Empirical studies have used different methods of measuring bank risk-taking, including credit risk and overall bank risk. Based on Laeven and Levine (2009), bank risk-taking was measured using the Z-score, which is equal to ROA plus capital asset ratio divided by the standard deviation of asset returns. A bank with a high Z-score is considered more stable. Since the Zscore is highly skewed, its natural logarithm is used, which has a normal distribution (Rachdi and Ben Ameur, 2011).

#### *3.2.1. Environmental performance index EPI*

The Environmental Performance Index (EPI) is an index of the environmental performance of a country, created by Yale University, which covers air quality, water resources, and biodiversity among other measures. Studies found that environmental performance significantly affects economic operations, especially in the financial sector. The EPI encompasses two dimensions for environmental health and ecosystem vitality which includes environmental burdens on human health as well as ecosystem vitality addressing the health of ecosystem and natural resources (Arfanuzzaman, 2016; Pinar, 2022). The EPI is a combined index that assesses environmental performance using systems of measurement such as CO2 emissions, per capita income, and the human development index (HDI). The EPI measures 180 nations based on their environmental performance in 32 parameters, including the carbon footprint, volatile organic complex emissions, and waste. EPI ratings are sensitive to the subjective weights applied to environmental performance indicators and categories, emphasising the necessity of sensitivity analysis of composite indices in improving reliability and transparency (Sineviciene et al., 2018). The EPI metrics provide an overview of the difference in performance between countries and concerns, with quality of governance and economic liberalism being crucial explanatory variables for environmental performance (Zhang et al., 2024). The EPI is a valuable tool for assessing environmental performance on national and regional scales, and its dimensions and responsiveness to different factors make it important for policy makers and environmental stakeholders (Rodrigues et al., 2021). EPI and bank risk-taking are not linearly correlated; they have a complex relationship (Ernaningsih et al., 2024).

#### *3.2.2. Control variables*

Geopolitical risk (GPR), as defined by Caldara and Iacoviello (2018), encompasses a range of political uncertainties—including tensions, wars, terrorist attacks, and military disputes—that destabilize markets and erode economic confidence (Alqahtani et al., 2021; Bouri et al., 2019). Empirical evidence shows that heightened GPR reduces bank profitability and performance across various contexts, such as Turkey, Tunisia, and China (El Fodil Ihaddaden, 2020; Belkhir et al., 2019; Lee and Lee, 2021). Beyond banking, GPR discourages new investments, constrains corporate financing, and influences global economies—both oil-exporting and importing—through shifts in OPEC policy and changes in investor behaviour (Huang and Luk, 2020;Albaity et al., 2023).

Efficiency (measured as cost-to-income ratio) is an indicator of a bank's management quality and financial performance (Mozaffari et al., 2014; Hoe et al., 2018). Moreover, lower cost-to-income ratios show greater efficiency performance, income diversity, and risk management that together ameliorate bank risk-taking behavior (Amin et al., 2017). While empirical findings consistently support a negative and significant relationship between efficiency and bank risk-taking, the nature of this association may vary depending on efficiency types and market structures (Nyangu et al., 2022).

Liquidity, usually measured by the ratios of deposits and funding liquidity, is a relevant control variable that determines banks' risk-taking behaviour. Higher deposits, however, can induce banks to take on more risk, and lower monitoring (Lee and Chih, 2013), while liquidity's effect may differ by bank size and affiliation (Sarmiento and Galán, 2017). In general, the better liquidity positions and a lower risk of liquidity should make banks more risk-taking (Abbas et al., 2021; Dahir et al., 2018; C. Wang and Zhuang, 2022). Conversely, during financial hardship (e.g., GFC), liquidity risk being low made it less likely for institutions to take risk (Khan et al., 2017), or for banks to act aggressively in developing economies (Rokhim and Min, 2020). In addition, proper liquidity management promotes financial stability and mitigates systemic risk (Davydov et al., 2021; Agarwal, 2019; Roy et al., 2019). One of the most critical leverage ratios, equity total assets (ETA), indicates the total amount of a firm's assets being financed by equity (Otaka, 2024). Higher ETA ratios imply a more robust capital structure and lower leverage on the firm's behalf and, consequently, could result in weaker bank risk-taking. But as higher capital requirements tend to push banks to reduce risk initially, an increase in capital requirements may paradoxically lead to increased risk-taking (Dias, 2021). Research on capital regulation and risk-taking has mixed findings – some studies, find that risk-based capital requirements limit the riskiness of banks' asset portfolios whereas others find that risk-based capital requirements do not sufficient for reducing risk in all contexts (Beltratti and Paladino, 2016). Moreover, both stricter regulation and tighter supervision and sufficient capitalization have been shown to reduce risk taking by banks, whereas deposit insurance and some macroeconomic or political conditions might add to it (Zhang et al., 2024). Overall, then, ETA's relationship with bank risk-taking is negative, but the wider regulatory, macroeconomic, and political environment can affect the degree to which raising equity ratios can foster stability.

As one of the key macroeconomic indicators, the growth of GDP usually affects the risk taken by banks as it creates market conditions and investment opportunities. Although sturdy growth might enhance borrower creditworthiness and lower risk, more liquidity and less monitoring efforts can similarly). In particular, relaxed monetary conditions are likely to raise risk-taking (Athari and Irani, 2022; Chen et al. Bank-specific characteristics like size, capitalisation and efficiency can temper these macroeconomic cycles and as such soften the negative outcomes of expansionary policies (Bui et al., 2023; Montes and Scarpari, 2015).

Inflation, measured by changes in the Consumer Price Index, similarly affects risk-taking incentives. Rising prices erode purchasing power and potentially destabilise property markets, which can reduce bank stability and increase the volatility of returns (Zhubi et al., 2024; Wang and Luo, 2021). Although better capitalisation, higher liquidity, and greater market power can counterbalance inflation's negative effects, lower interest rates introduced to curb inflation may still encourage banks to assume more risk (Abbate and Thaler, 2023; Awdeh et al., 2024). The impact of inflationary pressures on bank stability also depends on institution-specific factors and regulatory changes introduced post-GFC to enhance resilience (Bui et al., 2023; Schäfer and Utz, 2022).

Oil rents, measured as the net oil contribution to GDP, reflect an economy's oil dependency (World Bank). While structural oil shocks explain variations in financial stability across GCC countries (Maghyereh et al., 2022) and oil rents influence the risk-return dynamics of MENA banks (Albaity et al., 2023), their broader developmental impact remains uncertain (Sweidan and Elbargathi, 2022). Some studies find no negative growth effects from oil rents or a significant role for institutional quality. Overall, oil rents are expected to affect bank risk-taking, though the direction and magnitude may depend on regional contexts and institutional frameworks.

## 4. EMPIRICAL RESULTS AND DISCUSSION

The descriptive statistics in Table 2 offer valuable insights into the heterogeneity of the environment and macroeconomic conditions under which the sampled banking institutions operate as well as their risk-taking behaviours. The mean NZscore of 0.095 and the comparatively moderate standard deviation (0.147) suggest that while several banks have fairly similar risk profiles, some banks take profusely more or less risk than the major banks. This variation aligns with prior research that shows institutions characteristics, regulatory environments, and market conditions influence risk preferences (Belkhir et al., 2019; Nyangu et al., 2022). A moderate range of environmental quality is noted with the Environmental Performance Index (EPI) mean = 33.78 and standard deviation = 6.204. Some institutions act on more environmentally demanding bases than other institutions act on less environmentally favorable bases. Previous literature has indicated that such environmental variations could affect bank behavior since good environmental practices are generally linked to higher commitments towards sustainability and possibly lower risk profiles (Amin et al., 2017; Albaity et al., 2023). Conversely, poorer environmental performance may lead to increased uncertainty, which could lead banks to ramp up their pursuit of risk to offset worsening operating environments. In contrast, the various macro-level indicators, such as GDP growth (mean of 2.997) and Inflation (INF) at 3.111, reflect fluctuating economic conditions that can alter banks' strategic decisions. For instance, supportive economic growth may encourage prudent lending, while inflationary pressures or heightened geopolitical risks—captured by GPR (mean of 98.165)—can amplify uncertainty, prompting shifts in banks' risk-taking stances (Caldara and Iacoviello, 2018; Athari and Irani, 2022; Bui et al., 2023).

The correlation matrix (Table 3) highlights key relationships between various factors and bank risk-taking, measured by NZscore, where a higher NZscore indicates greater risk-taking. NZscore is significantly and negatively correlated with the Environmental Performance Index (EPI) (-0.209, $P < 0.01$) and Efficiency (Eff) (−0.117, $P < 0.01$), suggesting that better environmental quality and higher efficiency are linked to lower risk-taking. Conversely, NZscore shows positive and significant correlations with Non-Linear Debt (NLD) (0.174, $P < 0.01$) and Size (0.161, $P < 0.01$), indicating that larger banks and those with more complex liability structures are more inclined toward risk-taking. Geopolitical risk (GPR) and oil dependence (Oil) are not significantly correlated with NZscore, while GDP has a small, non-significant positive correlation (0.024), and inflation (INF) has a weak negative correlation (−0.050, $P < 0.1$), implying minimal

**Table 2: Descriptive statistics**

| Variable | Mean | SD | Minimum | Maximum |
|---|---|---|---|---|
| NZscore | 0.095 | 0.147 | 0 | 1 |
| EPI | 33.78 | 6.204 | 21.988 | 47.674 |
| GPR | 98.17 | 21.054 | 77.294 | 160.584 |
| Eff | 59.3 | 74.176 | −34.025 | 2068.486 |
| LQ | 14.91 | 2.15 | 3.347 | 19.218 |
| Size | 15.547 | 1.86 | 9.494 | 19.605 |
| Lev | 19.688 | 20.568 | −47.245 | 99.267 |
| GDP | 2.997 | 3.234 | −8.855 | 13.375 |
| INF | 3.111 | 4.393 | −2.54 | 29.507 |
| Oil | 15.276 | 14.792 | 0 | 58.369 |

SD: Standard deviation, EPI: Environmental performance index, INF: Inflation, GPR: Geopolitical risk

**Table 3: Correlations**

| Variables | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| (1) NZscore | 1.000 | | | | | | | | | |
| (2) EPI | −0.209*** | 1.000 | | | | | | | | |
| (3) GPR | 0.011 | 0.129*** | 1.000 | | | | | | | |
| (4) Eff | −0.117*** | −0.030 | −0.018 | 1.000 | | | | | | |
| (5) LQ | 0.174*** | 0.102*** | 0.030 | −0.270*** | 1.000 | | | | | |
| (6) Size | 0.161*** | 0.121*** | 0.021 | −0.286*** | 0.942*** | 1.000 | | | | |
| (7) Lev | −0.091*** | −0.042* | −0.021 | 0.259*** | −0.609*** | −0.627*** | 1.000 | | | |
| (8) GDP | 0.024 | −0.164*** | 0.322*** | −0.033 | 0.042* | 0.055** | −0.060** | 1.000 | | |
| (9) INF | −0.050* | −0.023 | 0.234*** | −0.075*** | −0.117*** | −0.060** | −0.133*** | 0.269*** | 1.000 | |
| (10) Oil | 0.025 | −0.223*** | −0.074*** | 0.027 | 0.029 | 0.019 | 0.250*** | 0.083*** | −0.120*** | 1.000 |

*P<0.1, **P<0.05, ***P<0.01. EPI: Environmental performance index, INF: Inflation, GPR: Geopolitical risk

impact on risk-taking. A high correlation between Size and NLD (0.942, P < 0.01) suggests potential multicollinearity, warranting further analysis. Additionally, EPI and Oil are negatively correlated (−0.223, P < 0.01), indicating that greater oil dependence is associated with lower environmental performance.

Table 4 presents quantile regressions (Q10–Q90) to explore the linear link between Environmental Performance Index (EPI) and bank risk-taking (NZscore). Most importantly, we also observe that the coefficient on the lagged NZscore (lNZscore) is positive and statistically significant at all quantiles, suggesting the same inclination to take risks persists in the future. On the contrary, this shows that stronger environmental performance discourages banks from taking risks (in fact, the results indicate the negative coefficient is even stronger for higher risk banks), which consistently ends up with a negative and significant association for EPI with NZscore across all quantiles.

The empirical analysis is based on nonlinear quantile regression to assess the impact of bank risk-taking (N-Zscore) and environmental performance (EPI). Table 5 presents the findings of quantile regressions, focusing on how different degrees of bank stability influence this relationship. Overall, the lagged NZscore (NZscoret-1) coefficient was significant and positive from the $10^{th}$ to the $90^{th}$ quantile. This strong positive relationship leads us to believe that past risk behaviours are integral in the process of predicting current stability. The higher riskiness at the top quantiles of initial risks is persistent in banks that have initially been more risky assets. The durable impact of the persistence effect makes it clear that past performance needs to be taken into account when managing bank risk. Moreover, there is clear evidence that the findings are particularly related to banks having high initial risk behaviour which again shows how the historical performance of such institutions has profound implications for the effective management of risks. The effect of the Environmental Performance Index (EPI) was to decrease the NZscore, particularly at very high quantiles, resulting in a strong negative linear association. This indicates that as far as it is shown by improved environmental performance and decreased bank risk-taking.

Firstly, an increase in environmental performance can lead to a temporary rise in risks due to the expenses related to adopting tougher ecological norms. Yet, with growing EPI the negative relationship enhances further than that in general, which implies higher environmental performance might even be more stabilizing on a longer timeframe as such. This finding is consistent with earlier research that suggests similar post-cost effects of sustainability improvement on environmental quality which stands correlated with inducing risk-taking behaviours (Rehman et al, 2021; Aragón-Correa et al., 2020). Given the positive and significant coefficients for $EPI^2$ across all quantiles, it implies that at low levels of environmental performance, greater sustainability efforts might be resource-depleting and or lead to higher risks (Table 5). However, when EPI levels are taken into account at the higher end there arise benefits like goodwill enhancement leading to possible regulatory incentives and overall lifetime cost gains that outweigh initial costs hence reducing in net bank riskiness. The U-shape relationship implies that the environmental performance-risk nexus is nonlinear, and it suggests only when reaching a threshold level of improvements may lead to any benefits in risk reduction. It is interesting to note that bank stability (NZscore) also shows a significant dependence on geopolitical risk (GPR), with GPR having a positive effect across the quantiles. Banks in riskier, geopolitically elevated regions often implement more rigorous countermeasures to minimise potential risks which increased stability and decreased desire to take serious risks. The positive relationship between GPR and bank stability is in line with earlier research (Bouri et al., 2019; Alqahtani et al., 2020) who argue that due to perceived increased risk of adverse economic or political events, banks reduce their appetite for risk-taking. (Şanlısoy Assist et al., n.d.) have found that political risk Geopolitical risks, as evidenced by the peak of risk during Arab Spring, and regulatory reserves in emerging markets such as Turkey are a negative factor for bank profitability according to Aydemir and Ovenc, 2016. This paper takes the same idea further by showing that higher geopolitical risk shifts banking towards greater caution which has a positive impact on stability. The results of this study are also in line with previous studies (El Fodil Ihaddaden, 2020; Belkhir et al., 2019) that examine the relationship between geopolitical risks and banking performance indicating that geopolitical risks adversely affect bank performance, especially during times of political unrest thereby emphasizing on responsible risk management conduct within a fundamentally geopolitically unstable universe. Efficiency (Eff) was a consistently significant and negative relation with NZscore for the entire quantiles suggesting that risk-taking is low for efficient banks. Operational efficiency is very important in order to get the banks into a stable player position as good bank operations can allocate resources more accurately, control expenses and adjust for changes in the macro-economy.

**Table 4: Baseline model of the linear relationship between environmental performance index and bank risk-taking**

| Variables | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| | Q10 | Q20 | Q30 | Q40 | Q50 | Q60 | Q70 | Q80 | Q90 |
| lNZscore | 0.085*** | 0.133*** | 0.197*** | 0.277*** | 0.391*** | 0.521*** | 0.727*** | 0.909*** | 1.071*** |
| | 0.006 | 0.002 | 0.001 | 0.004 | 0.005 | 0.006 | 0.006 | 0.002 | 0.003 |
| EPI | −0.001*** | −0.001*** | −0.001*** | −0.001*** | −0.001*** | −0.001*** | −0.002*** | −0.002*** | −0.005*** |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| GPR | 0.000*** | 0.001*** | 0.001*** | 0.001*** | 0.001*** | 0.001*** | 0.001*** | 0.001*** | 0.003*** |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Eff | −0.000*** | −0.000*** | −0.000*** | −0.000*** | −0.000*** | −0.000*** | −0.000*** | −0.000** | −0.000*** |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| NLD | −0.000 | 0.001*** | 0.000*** | 0.001*** | 0.002*** | 0.003*** | 0.002*** | 0.003*** | 0.012*** |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 |
| Size | 0.003*** | 0.002*** | 0.003*** | 0.001** | −0.000 | −0.002** | 0.000 | −0.001 | −0.004** |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.002 |
| ETA | 0.000*** | 0.000*** | 0.000*** | 0.000** | −0.000 | −0.000 | 0.000 | 0.000 | 0.000*** |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Dummy_IS | −0.004*** | −0.004*** | −0.003*** | −0.004*** | −0.001 | −0.002 | −0.001 | −0.006*** | −0.011*** |
| | 0.000 | 0.001 | 0.001 | 0.001 | 0.002 | 0.002 | 0.001 | 0.002 | 0.002 |
| GDP | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.001*** | 0.001*** | 0.001*** | −0.000 | −0.000 |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| INF | −0.000*** | −0.000*** | −0.001*** | −0.001*** | −0.001*** | −0.000*** | −0.001*** | −0.001*** | −0.003*** |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Oil | 0.000*** | 0.000*** | −0.000 | −0.000 | 0.000 | 0.000** | −0.000* | 0.000*** | 0.000 |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Year | 0.001*** | 0.001*** | 0.001*** | 0.001*** | 0.002*** | 0.002*** | 0.003*** | 0.002 | 0.004*** |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 |
| Constant | −1.773*** | −2.406*** | −2.326*** | −3.020*** | −4.285*** | −4.385*** | −5.820*** | −3.331 | −7.914*** |
| | 0.123 | 0.238 | 0.310 | 0.716 | 0.849 | 1.075 | 0.718 | 2.446 | 0.951 |
| Observations | 1,104 | 1,104 | 1,104 | 1,104 | 1,104 | 1,104 | 1,104 | 1,104 | 1,104 |

*P<0.1, **P<0.05, ***P<0.01. SEs in parentheses. EPI: Environmental performance index, INF: Inflation, GPR: Geopolitical risk, SE: Standard error

**Table 5: The nonlinear impact of environmental performance on bank risk-taking**

| Variables | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| | Q10 | Q20 | Q30 | Q40 | Q50 | Q60 | Q70 | Q80 | Q90 |
| $NZscore_{t-1}$ | 0.085*** | 0.131*** | 0.192*** | 0.282*** | 0.385*** | 0.486*** | 0.723*** | 0.887*** | 0.990*** |
| | 0.000 | 0.001 | 0.002 | 0.003 | 0.004 | 0.003 | 0.004 | 0.003 | 0.014 |
| EPI | −0.001*** | −0.003*** | −0.004*** | −0.008*** | −0.012*** | −0.016*** | −0.014*** | −0.023*** | −0.036*** |
| | 0.000 | 0.000 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.002 |
| $EPI^2$ | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| GPR | 0.000*** | 0.001*** | 0.001*** | 0.001*** | 0.001*** | 0.001*** | 0.001*** | 0.001*** | 0.004*** |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Eff | −0.000*** | −0.000*** | −0.000*** | −0.000*** | −0.000*** | −0.000*** | −0.000*** | −0.000*** | −0.000*** |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| LQ | 0.000** | 0.000*** | 0.000 | 0.001** | 0.002*** | 0.002*** | 0.001*** | 0.002** | 0.010*** |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 |
| Size | 0.003*** | 0.003*** | 0.004*** | 0.004*** | 0.004*** | 0.004*** | 0.003*** | 0.003*** | 0.008*** |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.002 |
| Lev | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000* | 0.000*** | 0.000*** | 0.000 | −0.000 |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Dummy_IS | −0.004*** | −0.004*** | −0.00*** | −0.003*** | −0.001 | −0.003*** | −0.001*** | 0.000 | −0.007*** |
| | 0.000 | 0.000 | 0.001 | 0.001 | 0.001 | 0.001 | 0.000 | 0.002 | 0.002 |
| GDP | 0.000*** | 0.000 | 0.000*** | 0.000*** | 0.000*** | 0.001*** | 0.001*** | −0.000 | −0.001 |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 |
| INF | −0.000*** | −0.000*** | −0.000*** | −0.001*** | −0.000*** | −0.000 | −0.000* | −0.000* | −0.003*** |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Oil | 0.000*** | 0.000*** | −0.000*** | −0.000 | 0.000 | 0.000* | −0.000 | −0.000 | 0.000*** |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Year | 0.001*** | 0.001*** | 0.001*** | 0.002*** | 0.002*** | 0.002*** | 0.003*** | 0.003*** | 0.010*** |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.001 |
| Constant | −2.268*** | −2.709*** | −2.994*** | −3.324*** | −3.041*** | −3.913*** | −5.194*** | −5.923*** | −20.527*** |
| | 0.042 | 0.103 | 0.144 | 0.579 | 0.868 | 1.175 | 0.764 | 2.174 | 2.159 |
| Observations | 1,108 | 1,108 | 1,108 | 1,108 | 1,108 | 1,108 | 1,108 | 1,108 | 1,108 |

*P<0.1, **P<0.05, ***P<0.01. SEs in parentheses. SE: Standard error, EPI: Environmental performance index, INF: Inflation, GPR: Geopolitical risk, SE: Standard error

It illustrates the key role of assessing bank efficiency and stability by utilizing cost-to-income ratio (CIR) data in this relationship. Banks with a lower CIR tend to be of solid financial strength and better performance in terms of general management, indicating less risky behaviours.

Hoe et al. also provided evidence of this finding Amin et al. (2017). Previous studies by have found that lower CIR ratios are good at reducing risk-taking behaviours and enhancing financial stability Additionally, Nyangu et al. Situational factors Banks, are better managed in terms of efficiency and suffer less income risks (Berger et al., 2020). The inverse relationship between efficiency and risk-taking, ultimately underscores the importance of operational optimization in managing risks for financial stability. The overall effect on bank stability was ambiguous because of a bifurcated response to liquidity at the 90 is no different as liquidity was found to have a positive significant relationship with NZscore implying more liquid banks are safer, especially under high-risk conditions. Liquidity positions must be strengthened in order to provide banks with the necessary buffer for absorbing shocks and doing justice to their obligations during times of financial distress. This confirms results of previous research showing banks with higher liquidity risk are more stable during financial crises and exhibit less risky behaviors (Davydov et al., 2021; Khan et al., 2017). At the lower quantiles, however, the effects of liquidity on stability were less strong suggesting that banks with low levels of liquidity might choose to consume more risk when they do not consider themselves as weakly positioned for a lack in liquid funds. It emphasises the need for adequate management of liquidity to ensure bank stability and to reduce systemic risks (Abbas et al., 2021; Wang and Zhuang, 2022). Large banks are scoring high in all quantiles while the NZscore is positively correlated to bank sizes at most of them, meaning that the bigger a bank is, more secure it turns out. The effect was particularly pronounced at high quantiles, which indicates that larger banks enjoy economies of scale, as well as the benefits from diversifying portfolios and strong market positions to enhance stability. These results are also consistent with prior works (Bătae et al., 2021 and Mckillop et al, 2020) which suggest that larger banks have lower levels of risk-taking capacity owing to better access to capital, more sophisticated risk management tools as well as greater regulatory capabilities. The smaller banks, however, have greater difficulty in raising capital and managing environmental risk which makes them more conservative to their approach towards risks. The findings indicate that the risk-buffer capacities of big banks is attributed to being more diversified and having access to these resources not available in some small local bank.

Furthermore, the evidence also indicates that bank size moderates the effect of environmental quality on risk-taking power such as larger banks particularly those located in region where they face severe regulation to control emissions could mitigate environmentally related risks (Saadaoui Mallek et al., 2024). We used leverage and when we observed quantile effect on the NZscore there were some decreases at higher but not significance point level. This implies that the contribution of leverage is very important in stabilizing less risky banks. Greater leverage at lower risk levels can improve financial returns in ways that enhance systemic stability. But growing leverage among riskier asset profile foray banks could amplify risks beyond a point. This result also confirms the Agency Theory, according to which bank-specific risk is increased by high leverage; nevertheless, only effective in case of low average risk (Otaka, 2024). The implications suggest the need for banks to use leverage in moderation by employing a level of capital structure that provides stability as well as aligning their efforts with the risk/return equation. In addition, leverage affects bank stability; however, the level of impact can be different in other financial factors including profitability, DE (debt to equity) ratio and asset management efficiency (Medyawati and Yunanto, 2014). We found out that the more rapid GDP growth, for which there is quite a sizable increase in NZscore to be observed. A better operating environment usually also helps banks financially, reducing the inherent risk of owning them. Results are consistent with the previous studies that economic growth creates an environment of stability to operate banking activities and reducing risk taking (Athari and Irani, 2022).

Enhancing overall financial stability Banks have always been very vulnerable to the performance of GDP growth, directly affecting their capacity to manage risks and abidance of the system during high economic periods. The importance of macroeconomic conditions in determining banks' risk profiles and the role economic policies may play to generate stability in the banking sector is another main conclusion reached by our findings. Inflation, on the other hand, had a negative and significant correlation with NZscore, suggesting that higher inflation increases bank risk. Inflation reduces the value of assets and leads to economic instability, which then can causes turbulence in financial institutions. With increased inflation the purchasing power of money decreases, hence greater volatility in asset values can be observed which increases risk for banks (Zhubi et al., 2024). The relationship between inflation and bank stability was negatively depicted, hinting that high the pressure of inflation exerts detrimental effects to financial efficiency and enhances risks in lending. However, increased capitalization and liquidity as well market power can cushion the negative impact (Awdeh et al., 2024).

The impact of oil rents on bank stability varied. Though the impact of oil rents varied depending on quantile, it again tended to work in favor of greater stability at higher risk levels indicating that they have been able to derive some financial stabilisation from their reliance upon incomes generated by petroleum. However, oil rents may serve to improve the economy and provide extra sources of funds for banks in regions abundant with them. Nevertheless, the narrowing oil price range can only result in a less volatile and risky real economy during periods of high oil prices (Umar et al., 2021). The effect of oil rents on bank risk, therefore, depends on the stability of oil prices and banking system structure across the different types of countries.

Table 6 shows the environmental performance index (EPI) variable consistently showed a positive impact on NZscore under several model configurations, representing that higher environmental quality tended to correlate linearly with increased bank risk-taking. However, this relationship became more nuanced once bank size was introduced as a moderating factor. The Size_EPI interaction term had negative and statistically significant coefficients across several models, implying that as the size of the bank increased, the positive relationship between environmental quality and risk-taking decreased. In several models, the relationship between the bank's size and risk had a negative and statistically significant coefficient (Size_EPI) interaction term, meaning that as the size increased, environmental quality had less effect on risk-taking. These findings confirm that bank size is an important moderator in the relationship between environmental quality (EQ) and bank risk-taking. Because of their larger resources, more robust capital buffers and advanced risk management systems, larger banks reacted to the improving environment with less aggressive adjustments to their risk profiles. In a way consistent with the resource-based view (RBV) theory (Jahanger et al., 2022) and risk-management theory (Shen et al., 2021), this result can explicate that institutions with superior capabilities will enable to integration such environmental factors without strongly affecting *in-vivo* behaviours of risk-taking attitude (Berger et al., 2020; Gangi et al., 2019; Hoque and Liu, 2023; Saadaoui Mallek et al., 2024). In contrast, the more sophisticated frameworks of the larger banks and their more diversified portfolios help them to better accommodate ecological risks and thus show a moderated reaction to changes in EQ (Ángel et al., 2022; Bătae et al., 2021). In contrast, smaller banks which are resource-constrained in terms of risk management capabilities exhibited higher sensitivity to changes in environmental quality, and their risk-taking behaviour adjusted more strongly as environmental conditions changed, offering a better explanation than Colesnic et al. (2020) for why these institutions struggled to manage environmental uncertainties successfully (Mkhaiber and Werner, 2021.). This difference in response by size highlights the need to take into account of bank-size effects in risk models and regulatory frameworks so that policies are crafted with recognition of how banks' behaviour varies based on what they can do.

Relevance to MENA: Instead, larger institutions that are best equipped to incorporate climate considerations into their strategies may be able to adjust more readily to the changing environment and not see any big increase in risk-taking. Smaller banks that have yet to do a lot of work in this area may need more help and encouragement from regulators or policymakers if they are also to deal efficiently with the risks associated with climate change. Matching this knowledge with regional conditions could support the design of customized prudential measures and risk mitigating practices that strengthen financial resilience to climate-related shocks.

## 5. ROBUSTNESS CHECK

The robustness analysis for Tables 7-9 confirms the reliability of the results across all models. Key factors, such as the environmental performance index (EPI) and bank size, maintain their significance and consistent direction, highlighting the robustness of the results. The non-linear relationship between EPI

**Table 6: The results of the moderating effect of size on the nonlinear environmental performance index -stability nexus**

| Variables | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| | Q10 | Q20 | Q30 | Q40 | Q50 | Q60 | Q70 | Q80 | Q90 |
| NZscore | 0.087*** | 0.129*** | 0.194*** | 0.277*** | 0.386*** | 0.501*** | 0.738*** | 0.891*** | 1.077*** |
| | 0.001 | 0.003 | 0.002 | 0.002 | 0.005 | 0.007 | 0.003 | 0.001 | 0.003 |
| EPI | 0.004*** | 0.005*** | 0.006*** | 0.005*** | 0.006*** | 0.006*** | 0.005*** | 0.005*** | −0.001 |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.001 | 0.001 | 0.002 |
| GPR | 0.000*** | 0.001*** | 0.001*** | 0.001*** | 0.001*** | 0.001*** | 0.001*** | 0.002*** | 0.003*** |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Eff | −0.000*** | −0.000*** | −0.000*** | −0.000*** | −0.000*** | −0.000*** | −0.000*** | −0.000*** | −0.000 |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| LQ | 0.000*** | 0.001*** | 0.001*** | 0.001*** | 0.002*** | 0.003*** | 0.002*** | 0.004*** | 0.010*** |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 |
| Size | 0.012*** | 0.0142*** | 0.018*** | 0.0176*** | 0.016*** | 0.016*** | 0.014*** | 0.017*** | 0.006** |
| | 0.000 | 0.001 | 0.001 | 0.001 | 0.002 | 0.002 | 0.001 | 0.002 | 0.003 |
| Size x EPI | −0.000*** | −0.000*** | −0.000*** | −0.000*** | −0.000*** | −0.000*** | −0.000*** | −0.000*** | −0.000** |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Lev | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000 | −0.000 | −0.000 | 0.000*** | 0.000*** |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Dummy_IS | −0.004*** | −0.004*** | −0.003*** | −0.003*** | 0.001 | −0.003*** | −0.000 | −0.005*** | −0.008*** |
| | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.002 |
| GDP | 0.000*** | 0.000** | 0.000*** | 0.000*** | 0.001*** | 0.001*** | 0.001*** | 0.000 | −0.000 |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| INF | −0.000*** | −0.000*** | −0.001*** | −0.001*** | −0.001*** | −0.001*** | −0.000*** | −0.001*** | −0.003*** |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Oil | 0.000*** | −0.000 | −0.000*** | −0.000*** | −0.000** | 0.000 | 0.000 | −0.000 | 0.000 |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Year | 0.001*** | 0.001*** | 0.001*** | 0.001** | 0.001*** | 0.002*** | 0.002*** | 0.002*** | 0.006*** |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.001 | 0.001 |
| Constant | −1.993*** | −2.301*** | −2.797*** | −1.326*** | −5.985*** | −4.101*** | −5.062*** | −3.871*** | −12.914*** |
| | 0.084 | 0.379 | 0.216 | 0.412 | 1.765 | 1.266 | 0.445 | 1.101 | 1.785 |
| Observations | 1,104 | 1,104 | 1,104 | 1,104 | 1,104 | 1,104 | 1,104 | 1,104 | 1,104 |

*P<0.1, **P<0.05, ***P<0.01. SEs in parentheses. SE: Standard error, EPI: Environmental performance index, INF: Inflation, GPR: Geopolitical risk, SE: Standard error

**Table 7: Robustness results: The nonlinear impact of environmental performance (EPI) on bank stability**

| Variables | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| | NZscore | NZscore | NZscore | NZscore | NZscore | NZscore | NZscore | NZscore | NZscore |
| lNZscore | 0.101*** | 0.136*** | 0.218*** | 0.297*** | 0.366*** | 0.484*** | 0.737*** | 0.789*** | 1.011*** |
| | 0.000 | 0.002 | 0.018 | 0.024 | 0.002 | 0.005 | 0.005 | 0.004 | 0.008 |
| EPI | −0.003*** | −0.005*** | −0.013*** | −0.019*** | −0.022*** | −0.023*** | −0.023*** | −0.040*** | −0.070*** |
| | 0.000 | 0.001 | 0.001 | 0.001 | 0.001 | 0.002 | 0.000 | 0.001 | 0.002 |
| EPI2 | 0.002*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.001*** |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| GPR | 0.001*** | 0.001*** | 0.001*** | 0.001*** | 0.001*** | 0.001*** | 0.003*** | 0.002*** | 0.006*** |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Eff | −0.000*** | −0.000*** | −0.000*** | −0.000*** | −0.000*** | −0.000*** | −0.000*** | 0.000 | 0.000 |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| NLD | 0.000*** | 0.001*** | 0.001*** | 0.002*** | 0.002*** | 0.002*** | 0.003*** | 0.005*** | 0.010*** |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 |
| Size | 0.002*** | 0.003*** | 0.002*** | 0.002*** | 0.002*** | 0.001*** | −0.001*** | −0.002*** | 0.002 |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 |
| ETA | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000** | 0.001*** |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Dummy_IS | −0.005*** | −0.003*** | −0.003*** | −0.002*** | −0.001 | −0.001 | 0.002*** | 0.003** | 0.001 |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 |
| GDP | 0.000*** | 0.001 | −0.000*** | −0.000** | −0.000 | −0.000 | 0.000*** | −0.000 | −0.004*** |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| INF | −0.001*** | −0.001*** | −0.000*** | −0.000 | 0.000 | 0.000 | 0.00034 | 0.002** | −0.001 |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.001 |
| Oil | 0.003*** | 0.000*** | 0.001*** | 0.001*** | 0.001*** | 0.001*** | 0.001*** | 0.001*** | 0.002*** |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Year | 0.002*** | 0.002*** | 0.004*** | 0.005*** | 0.007*** | 0.004*** | 0.005*** | 0.009*** | 0.026*** |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.001 |
| Constant | −4.309*** | −4.815*** | −8.560*** | −9.868*** | −12.961*** | −7.062*** | −10.374*** | −18.288*** | −51.965*** |
| | 0.053 | 0.449 | 0.222 | 0.710 | 2.200 | 0.745 | 0.867 | 1.006 | 2.778 |
| Observations | 681 | 681 | 681 | 681 | 681 | 681 | 681 | 681 | 681 |

*P<0.1, **P<0.05, ***P<0.01. SEs in parentheses. SE: Standard error, EPI: Environmental performance index, INF: Inflation, GPR: Geopolitical risk, SE: Standard error

**Table 8: Robustness results: Baseline model of the linear relationship between EPI and bank risk-taking**

| Variables | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| | NZscore | NZscore | NZscore | NZscore | NZscore | NZscore | NZscore | NZscore | NZscore |
| lNZscore | 0.098*** | 0.141*** | 0.230*** | 0.298*** | 0.413*** | 0.515*** | 0.748*** | 0.837*** | 1.166*** |
| | 0.000 | 0.002 | 0.003 | 0.005 | 0.009 | 0.005 | 0.005 | 0.004 | 0.004 |
| EPI | −0.001*** | −0.001*** | −0.001*** | −0.002*** | −0.002*** | −0.002*** | −0.002*** | −0.003*** | −0.006*** |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| GPR | 0.000*** | 0.001*** | 0.001*** | 0.001*** | 0.001*** | 0.001*** | 0.001*** | 0.00115*** | 0.005*** |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Eff | −0.000*** | −0.000*** | −0.000*** | −0.000*** | −0.000** | −0.000*** | −0.000*** | −0.000*** | 0.000 |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| NLD | 0.001*** | 0.001*** | 0.001*** | 0.002*** | 0.003*** | 0.004*** | 0.004*** | 0.006*** | 0.014*** |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Size | 0.002*** | 0.002*** | 0.002*** | 0.001*** | 0.000 | −0.001*** | −0.003*** | −0.005*** | −0.006*** |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.001 | 0.001 |
| ETA | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000** | −0.000 | −0.000 | 0.000*** |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Dummy_IS | −0.004*** | −0.004*** | −0.003*** | −0.002* | −0.001 | −0.003*** | −0.003* | −0.003* | −0.003 |
| | 0.000 | 0.000 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.003 |
| GDP | 0.000*** | 0.000*** | 0.000*** | 0.001*** | 0.001*** | 0.001*** | 0.001*** | 0.000 | −0.001*** |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| INF | −0.001*** | −0.001*** | −0.001*** | −0.001*** | −0.001*** | −0.001* | −0.002*** | −0.001 | −0.009*** |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 |
| Oil | 0.000*** | 0.000*** | 0.000*** | 0.001*** | 0.001*** | 0.001*** | 0.001*** | 0.001*** | 0.002*** |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Year | 0.002*** | 0.002*** | 0.003*** | 0.003*** | 0.006*** | 0.005*** | 0.004*** | 0.006*** | 0.0198*** |
| | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.001 | 0.000 | 0.001 |
| Constant | −3.871*** | −4.245*** | −6.029*** | −6.449*** | −11.182*** | −9.664*** | −7.804*** | −12.48*** | −40.268*** |
| | 0.049 | 0.275 | 0.644 | 1.585 | 2.094 | 0.444 | 1.534 | 0.762 | 1.275 |
| Observations | 681 | 681 | 681 | 681 | 681 | 681 | 681 | 681 | 681 |

*P<0.1**P<0.05, ***P<0.01. SEs in parentheses. EPI: Environmental performance index, INF: Inflation, GPR: Geopolitical risk, SE: Standard error

**Table 9: Robustness results: The results of the moderating effect of size on the nonlinear EPI-stability nexus**

| Variables | Table | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| | NZscore | NZscore | NZscore | NZscore | NZscore | NZscore | NZscore | NZscore | NZscore |
| lNZscore | 0.098*** | 0.138*** | 0.223*** | 0.299*** | 0.419*** | 0.515*** | 0.755*** | 0.822*** | 1.056*** |
| | 0.000 | 0.002 | 0.001 | 0.004 | 0.002 | 0.004 | 0.006 | 0.011 | 0.004 |
| EPI | 0.003*** | 0.003*** | 0.003*** | 0.004*** | 0.003*** | 0.004*** | 0.004*** | 0.004*** | 0.001** |
| | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 |
| GPR | 0.000*** | 0.001*** | 0.001*** | 0.001*** | 0.001*** | 0.001*** | 0.000*** | 0.001*** | 0.004*** |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Eff | −0.000*** | −0.000*** | −0.000*** | −0.000*** | −0.000*** | −0.000*** | −0.000*** | −0.000 | −0.000*** |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| NLD | 0.002*** | 0.001*** | 0.001*** | 0.002*** | 0.003*** | 0.003*** | 0.004*** | 0.006*** | 0.015*** |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 |
| Size | 0.011*** | 0.010*** | 0.013*** | 0.0135*** | 0.013*** | 0.014*** | 0.012*** | 0.014*** | 0.014*** |
| | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.001 | 0.001 | 0.002 | 0.003 |
| Size_EPI | −0.000*** | −0.000*** | −0.000*** | −0.000*** | −0.000*** | −0.000*** | −0.000*** | −0.000*** | −0.001*** |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| ETA | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | −0.000 | 0.000*** | 0.000*** |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Dummy_IS | −0.004*** | −0.004*** | −0.003*** | −0.002* | −0.001*** | −0.002 | 0.002 | 0.000 | 0.006*** |
| | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.002 | 0.001 | 0.002 | 0.002 |
| GDP | 0.000*** | 0.000* | 0.000*** | 0.001*** | 0.000*** | 0.001*** | 0.001*** | 0.000 | −0.001*** |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| INF | −0.001*** | −0.001*** | −0.001*** | −0.002*** | −0.001*** | −0.001*** | −0.002*** | −0.002*** | −0.009*** |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 |
| Oil | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.001*** | 0.001*** | 0.001*** | 0.001*** | 0.002*** |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Year | 0.002*** | 0.002*** | 0.003*** | 0.003*** | 0.004*** | 0.004*** | 0.004*** | 0.007*** | 0.015*** |
| | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.001 | 0.001 | 0.001 |
| Constant | −3.897*** | −4.938*** | −5.878*** | −5.805*** | −8.047*** | −8.524*** | −7.557*** | −14.300*** | −30.619*** |
| | 0.074 | 0.269 | 0.258 | 1.328 | 0.763 | 1.254 | 1.926 | 1.225 | 1.072 |
| Observations | 681 | 681 | 681 | 681 | 681 | 681 | 681 | 681 | 681 |

*P<0.1, **P<0.05, ***P<0.01. SEs in parentheses. SE: Standard error, EPI: Environmental performance index, INF: Inflation, GPR: Geopolitical risk

and bank risk-taking is evident, with both EPI and its squared term demonstrating significant coefficients, highlighting the study's argument on the complex interplay between environmental quality and bank stability. Furthermore, variables like geopolitical risk (GPR) and oil prices consistently influence bank risk-taking, further validating the robustness of the results. The use of lagged dependent variables (NZscore) ensures that dynamic effects are appropriately acquired, while interaction terms, such as size and EPI, highlight the alteration of bank size in this context. These consistent findings across multiple quantiles enhance the reliability and applicability of the study's findings.

## 6. CONCLUSION

This study examined the U-shaped association between the EQ and bank risk-taking in the MENA region, highlighting the moderating role of bank size. Using data from ten publicly listed banks from 2011 to 2023, the research discovered that initially, improvements in environmental quality would decrease risk, but after a certain point, higher environmental quality meant higher risk. This pattern was not consistent across the quantiles of the risk distribution, where larger banks were better positioned to manage higher levels of environmental performance due to their more advanced risk management systems and resources. In contrast, smaller banks struggled with increased risk at higher environmental quality levels. The results highlight the significance of designed risk management strategies, specifically for smaller banks, and the need for aimed support from regulatory authorities. The research significantly enhances theoretical comprehension by contesting conventional linear models and advocating for the Resource-Based View (RBV), thereby underscoring the critical role of a financial institution's intrinsic resources in mitigating risks linked to environmental performance.

Although the present study has made considerable contributions, it is important to acknowledge its limitations. Firstly, the research depends on data from publicly traded banks in the MENA region. Secondly, It is important to observe that this data may not accurately represent the banking sector, as it excludes private and smaller organizations which may impact the applicability of the results to all banks in the area. Thirdly, although the investigation involved the timeframe from 2011 to 2023, it may not comprehensively account for the impact of particular external circumstances, such as political instability, economic crises, or significant regulatory changes. The ever-changing characteristics of these elements can impact the correlation between environmental quality and the level of risk taken by banks in ways that this analysis has not completely considered. Moreover, the study's dependence on the Environmental Performance Index (EPI) and other measurable indicators might have oversimplified environmental performance's intricate and diverse characteristics.

Future studies could integrate more qualitative indicators and investigate new aspects of environmental performance. Ultimately, the study emphasised the U-shaped correlation between environmental quality and risk-taking, although the specific factors that caused this pattern are unknown. Additional research is required to examine the fundamental mechanisms and contextual variables contributing to this association.

## REFERENCES


Abbas, F., Ali, S., Yousaf, I., Wong, W.K. (2021), Dynamics of funding liquidity and risk-taking: Evidence from commercial banks. Journal of Risk and Financial Management, 14(6), 0281.

Abbate, A., Thaler, D. (2023), Optimal monetary policy with the risk-taking channel. European Economic Review, 152, 104333.

Abdalla Alfaki, I.M., El Anshasy, A.A. (2022), Oil rents, diversification and growth: Is there asymmetric dependence? A copula-based inquiry. Resources Policy, 75, 102495.

Abdul Hamid, B., Azmi, W., Ali, M. (2020), Bank risk and financial development: Evidence from dual banking countries. Emerging Markets Finance and Trade, 56(2), 286-304.

Acharya, V.V., Mora, N. (2015), A crisis of banks as liquidity providers. Journal of Finance, 70(1), 1-43.

Agarwal, P. (2019), Bank specific determinants of liquidity of public and private sector banks. International Journal of Recent Technology and Engineering, 8(3), 8942-8947.

Alam, N. (2014), Regulations and bank risk taking in dual banking countries. Journal of Banking Regulation, 15(2), 105-116.

Albaity, M., Mallek, R.S., Hassan Al-Tamimi, H.A., Noman, A.H.M. (2021), Does competition lead to financial stability or financial fragility for Islamic and conventional banks? Evidence from the GCC countries. International Journal of Finance and Economics, 26(3), 4706-4722.

Albaity, M., Saadaoui Mallek, R., Mustafa, H. (2023), Heterogeneity of investor sentiment, geopolitical risk and economic policy uncertainty: Do Islamic banks differ during COVID-19 pandemic? International Journal of Emerging Markets, 19, 4094-4115.

Albaity, M., Shah, S.F., Al-Tamimi, H.A.H., Rahman, M., Thangavelu, S. (2023), Country risk and bank returns: Evidence from MENA countries. The Journal of Economic Asymmetries, 28, e00329.

Alfsen, K.H., Sæbø, H.V. (1993), Environmental quality indicators: Background, principles and examples from Norway. Environmental and Resource Economics, 3(5), 415-435.

Alqahtani, A., Bouri, E., Vo, X.V. (2020), Predictability of GCC stock returns: The role of geopolitical risk and crude oil returns. Economic Analysis and Policy, 68, 239-249.

Alqahtani, A., Selmi, R., Hongbing, O. (2021), The financial impacts of jump processes in the crude oil price: Evidence from G20 countries in the pre- and post-COVID-19. Resources Policy, 72, 102075.

Alvarado, R., Tillaguango, B., Dagar, V., Ahmad, M., Işık, C., Méndez, P., Toledo, E. (2021), Ecological footprint, economic complexity and natural resources rents in Latin America: Empirical evidence using Quantile regressions. Journal of Cleaner Production, 318, 128585.

Amin, G.R., Emrouznejad, A., Gattoufi, S. (2017), Modelling generalized firms' restructuring using inverse DEA. Journal of Productivity Analysis, 48(1), 51-61.

An, Q., Wang, L., Qu, D., Zhang, H. (2018), Dependency network of international oil trade before and after oil price drop. Energy, 165, 1021-1033.

Andrieş, A.M., Căpraru, B. (2014), The nexus between competition and efficiency: The European banking industries experience. International Business Review, 23(3), 566-579.

Ángel, P.S., Roberto, C.R., Marival, S.O. (2022), Can a country's environmental sustainability exert influence on its economic and financial situation? The relationship between environmental performance indicators and country risk. Journal of Cleaner Production, 375, 134121.

Anginer, D., Demirguc-Kunt, A., Zhu, M. (2014), How does competition affect bank systemic risk? Journal of Financial Intermediation, 23(1), 1-26.

Aragón-Correa, J.A., Marcus, A.A., Vogel, D. (2020), The effects of mandatory and voluntary regulatory pressures on firms' environmental strategies: A review and recommendations for future research. Academy of Management Annals, 14(1), 339-365.

Arfanuzzaman, M. (2016), Impact of CO2 Emission, per capita income and HDI on environmental performance index: Empirical evidence from Bangladesh impact of CO2 emission, per capita income and HDI on Environmental Performance Index: Empirical evidence from Bangladesh. International Journal of Green Economics, 10, 310674553.

Arping, S. (2019), Competition and risk taking in banking: The charter value hypothesis revisited. Journal of Banking and Finance, 107, 105609.

Aslam, W., Jawaid, S.T. (2023), Green banking adoption practices: Improving environmental, financial, and operational performance. International Journal of Ethics and Systems, 39(4), 820-840.

Athari, S.A., Irani, F. (2022), Does the country's political and economic risks trigger risk-taking behavior in the banking sector: A new insight from regional study. Journal of Economic Structures, 11(1), 32.

Awdeh, A., El Moussawi, C., Hamadi, H. (2024), The impact of inflation on bank stability: Evidence from the MENA banks. International Journal of Islamic and Middle Eastern Finance and Management, 17(2), 379-399.

Aydemir, R., Ovenc, G. (2016), Interest rates, the yield curve and bank profitability in an emerging market economy. Economic Systems, 40(4), 670-682.

Badriah, L.S., Rahajuni, D., Kadarwati, N., Priyono, R. (2024), The impact of macroeconomic variables on credit risk: Evidence regarding sustainable lending in ASEAN countries. International Journal of Sustainable Development and Planning, 19(4), 1589-1597.

Bagga, R., Lekhi, P. (2017), Impact of NPAs on profitability of Indian banks. International Journal of Applied Business and Economic Research, 15(16), 46-53.

Barney, J.B., Ketchen, D.J., Wright, M. (2021), Resource-based theory and the value creation framework. Journal of Management, 47(7), 1936-1955.

Bătae, O.M., Dragomir, V.D., Feleagă, L. (2021a), The relationship between environmental, social, and financial performance in the banking sector: A European study. Journal of Cleaner Production, 290, 125791.

Bătae, O.M., Dragomir, V.D., Feleagă, L. (2021b), The relationship between environmental, social, and financial performance in the banking sector: A European study. Journal of Cleaner Production, 290, 125791.

Belkhir, M., Grira, J., Hassan, M.K., Soumaré, I. (2019), Islamic banks and political risk: International evidence. Quarterly Review of Economics and Finance, 74, 39-55.

Bello, N., Hasan, A., Saiti, B. (2017), The mitigation of liquidity risk in Islamic banking operations. Banks and Bank Systems, 12(3), 154-165.

Beltratti, A., Paladino, G. (2016), Basel II and regulatory arbitrage. Evidence from financial crises. Journal of Empirical Finance, 39, 180-196.

Berger, A.N., Molyneux, P., Wilson, J.O.S. (2020), Banks and the real economy: An assessment of the research. Journal of Corporate Finance, 62, 101513.

Berisha, E., Chisadza, C., Clance, M., Gupta, R. (2021), Income inequality and oil resources: Panel evidence from the United States. Energy Policy, 159, 112603.

Bernanke, B.S. (2018), The real effects of disrupted credit: Evidence from the global financial crisis. Brookings Papers on Economic Activity, 2018(Fall), 251-342.

Bouri, E., Lau, C.K.M., Lucey, B., Roubaud, D. (2019), Trading volume and the predictability of return and volatility in the cryptocurrency market. Finance Research Letters, 29, 340-346.

Birindelli, G., Bonanno, G., Dell'Atti, S., Iannuzzi, A.P. (2022), Climate change commitment, credit risk and the country's environmental performance: Empirical evidence from a sample of international banks. Business Strategy and the Environment, 31(4), 1641-1655.

Brahmana, R.K., Kontesa, M. (2021), Does clean technology weaken the environmental impact on the financial performance? Insight from global oil and gas companies. Business Strategy and the Environment, 30(7), 3411-3423.

Brown, K., Jha, R., Pacharn, P. (2015), Ex ante CEO severance pay and risk-taking in the financial services sector. Journal of Banking and Finance, 59, 111-126.

Bui, T.N., Nguyen, X.H., Pham, K.T. (2023), The effect of capital structure on firm value: A study of companies listed on the vietnamese stock market. International Journal of Financial Studies, 11(3), 100.

Caldara, D., Iacoviello, M. (2018), Measuring geopolitical risk. International Finance Discussion Paper, 2018(1222), 1-66.

Cappelli, F., Carnazza, G. (2023), The multi-dimensional oil dependency index (MODI) for the European Union. Resources Policy, 82, 103480.

Cappelli, F., Carnazza, G., Vellucci, P. (2023), Crude oil, international trade and political stability: Do network relations matter? Energy Policy, 176, 113479.

Căpraru, B., Ihnatov, I., Pintilie, N.L. (2021), Bank competition and risk-taking in the European union: Evidence of a non-linear relationship. Economic Annals, 66(230), 35-65.

Chiaramonte, L., Croci, E., Poli, F. (2015), Should we trust the Z-score? Evidence from the European banking industry. Global Finance Journal, 28, 111-131.

Chodorow-Reich, G., Darmouni, O., Luck, S., Plosser, M. (2022), Bank liquidity provision across the firm size distribution. Journal of Financial Economics, 144(3), 908-932.

Claessens, S., Van Horen, N. (2014), Foreign banks: Trends and impact. Journal of Money, Credit and Banking, 46(Suppl 1), 295-326.

Colesnic, O., Kounetas, K., Michael, P. (2020), Estimating risk efficiency in Middle East banks before and after the crisis: A metafrontier framework. Global Finance Journal, 46, 100484.

Cornell, B., Shapiro, A.C. (2021), Corporate stakeholders, corporate valuation and ESG. European Financial Management, 27(2), 196-207.

Dahir, A.M., Mahat, F.B., Ali, N.A.B. (2018), Funding liquidity risk and bank risk-taking in BRICS countries: An application of system GMM approach. International Journal of Emerging Markets, 13(1), 231-248.

Davydov, D., Vähämaa, S., Yasar, S. (2021), Bank liquidity creation and systemic risk. Journal of Banking Finance, 123, 106031.

Delpachitra, S., Lester, L. (2013), Non-interest income: Are Australian banks moving away from their traditional businesses? Economic Papers, 32(2), 190-199.

Demez, S., Karakoyun, H.D., Hobikoglu, E.H. (2017), Financing economic growth in emerging economies: A theoretical approach. In: Balancing Islamic and Conventional Banking for Economic Growth: Empirical Evidence from Emerging Economies. Cham: Springer International Publishing.

Dias, R. (2021), Capital regulation and bank risk-taking-new global evidence. Accounting and Finance, 61(1), 847-884.

El Fodil Ihaddaden, M. (2020), Impact of political uncertainty on banking productivity: Investigating the Jasmin revolution effect on the Tunisian banking system. Economics Bulletin, 40(1), 437-447.

El Khoury, R., Nasrallah, N., Alareeni, B. (2023), ESG and financial performance of banks in the MENAT region: Concavity-convexity patterns. Journal of Sustainable Finance and Investment, 13(1), 406-430.

Filimonova, I.V., Eder, L.V., Provornaya, I.V., Cherepanova, D.M. (2020), Impact of the oil and gas industry on the economy of producing countries. Ekonomika, 36(4), 693-718.

Galadima, M.D., Aminu, A.W. (2020), Nonlinear unit root and nonlinear causality in natural gas-economic growth nexus: Evidence from Nigeria. Energy, 190, 116415.

Gangi, F., Daniele, L.M., Varrone, N. (2020), How do corporate environmental policy and corporate reputation affect risk-adjusted financial performance? Business Strategy and the Environment, 29(5), 1975-1991.

Gangi, F., Meles, A., D'Angelo, E., Daniele, L.M. (2019), Sustainable development and corporate governance in the financial system: Are environmentally friendly banks less risky? Corporate Social Responsibility and Environmental Management, 26(3), 529-547.

Gao, Y., Wang, X., Li, D. (2024), A study on the impact of the degree of mixed ownership reform of state-owned enterprises on corporate environmental response. Sustainability Accounting, Management and Policy Journal, 15, 934-960.

García-Alcober, M.P., Prior, D., Tortosa-Ausina, E., Illueca, M. (2020), Risk-taking behavior, earnings quality, and bank performance: A profit frontier approach. BRQ Business Research Quarterly, 23(4), 285-304.

Greene, D.L., Liu, C. (2015), U.S. oil dependence 2014: Is energy independence in sight? Energy Policy, 85, 126-137.

Greiner, M., Sun, J. (2021), How corporate social responsibility can incentivize top managers: A commitment to sustainability as an agency intervention. Corporate Social Responsibility and Environmental Management, 28(4), 1360-1375.

Güngör, S. (2023), The relationship between bank capital, risk-taking and profitability: Fresh evidence from panel Quantile approach. Ekonomi, Politika and Finans Araştırmaları Dergisi, 8(3), 378-403.

Gutiérrez-Ponce, H., Wibowo, S.A. (2023), Do sustainability activities affect the financial performance of banks? The case of Indonesian banks. Sustainability (Switzerland), 15(8), 1-17.

Hassan-Bello, A. (2018), Riba and Islamic banking, examining the practices of Jaiz Bank PLC, Nigeria. Ahkam: Jurnal Ilmu Syariah, 18(1), 125-154.

Herbstreuth, S. (2014), Constructing dependency: The United States and the problem of foreign oil. Millennium: Journal of International Studies, 43(1), 24-42.

Hoe, L.W., Jinn, L.S., Siew, L.W., Hai, T.K. (2018), Evaluation on the efficiency of the construction sector companies in Malaysia with data envelopment analysis model. Journal of Physics: Conference Series, 995(1), 012022.

Hoque, H., Liu, H. (2023), Impact of bank regulation on risk of Islamic and conventional banks. International Journal of Finance and Economics, 28(1), 1025-1062.

Huang, Y., Luk, P. (2020), Measuring economic policy uncertainty in China. China Economic Review, 59, 101367.

Hui, Z., Li, H., Elamer, A.A. (2024), Financing sustainability: How environmental disclosures shape bank lending decisions in emerging markets. Corporate Social Responsibility and Environmental Management, 2789, 1-28.

Hussain, M.M., Hoque, Z. (2002), Understanding non-financial performance measurement practices in Japanese banks: A new institutional sociology perspective. Accounting, Auditing and

Accountability Journal, 15(2), 162-183.
Iqbal, J., Vähämaa, S. (2019), Managerial risk-taking incentives and the systemic risk of financial institutions. Review of Quantitative Finance and Accounting, 53(4), 1229-1258.
Ismail, A., Schøtt, T., Bazargan, A., Salaytah, B., Al Kubaisi, H., Hassen, M., de la Vega, I., Chabrak, N., Annan, A., Herrington, M., Herrington, M., Kew, P. (2018), Background to the MENA region. In: Contributions to Management Science. Berlin: Springer.
Izcan, D., Bektas, E. (2022), The relationship between ESG scores and firm-specific risk of Eurozone banks. Sustainability (Switzerland), 14(14), 8619.
Jahanger, A., Usman, M., Balsalobre-Lorente, D. (2022), Linking institutional quality to environmental sustainability. Sustainable Development, 30(6), 1749-1765.
Khan, M.S., Scheule, H., Wu, E. (2017), Funding liquidity and bank risk taking. Journal of Banking Finance, 82, 203-216.
Khan, S.A.R., Yu, Z., Belhadi, A., Mardani, A. (2020), Investigating the effects of renewable energy on international trade and environmental quality. Journal of Environmental Management, 272, 111089.
Korneev, V., Dziubliuk, O., Tymkiv, A., Antkiv, V., Kucherenko, N. (2023), Banking sector stability and economic development: Assessment of risks and efficiency. Economic Affairs (New Delhi), 68(3), 1683-1692.
Kouzez, M. (2023), Political environment and bank performance: Does bank size matter? Economic Systems, 47(1), 101056.
Kun, Q., Duo, M. (2014), Credit risk management of commercial bank. Journal of Chemical and Pharmaceutical Research, 6(5), 1784-1788.
Laeven, L., Levine, R. (2009), Bank governance, regulation and risk taking. Journal of Financial Economics, 93(2), 259-275.
Lee, K., Lee, J. (2021), National innovation systems, economic complexity, and economic growth: Country panel analysis using the US patent data. In: Economic Complexity and Evolution. Germany: Springer Science and Business Media Deutschland GmbH. p113-151.
Lee, T.H., Chih, S.H. (2013), Does financial regulation affect the profit efficiency and risk of banks? Evidence from China's commercial banks. The North American Journal of Economics and Finance, 26, 705-724.
Lee, W.J., Pittman, J., Saffar, W. (2020), Political uncertainty and cost stickiness: Evidence from national elections around the world. Contemporary Accounting Research, 37(2), 1107-1139.
Li, T., Trinh, V.Q., Elnahass, M. (2023), Drivers of global banking stability in times of crisis: The role of corporate social responsibility. British Journal of Management, 34(2), 595-622.
Ma, Y., Li, Z. (2020), Funding liquidity and bank risk-taking: Empirical evidence from China. China Finance and Economic Review, 9(1), 64-82.
Maghyereh, A., Abdoh, H., Al-Shboul, M. (2022), Oil structural shocks, bank-level characteristics, and systemic risk: Evidence from dual banking systems. Economic Systems, 46(4), 101038.
Maiti, M. (2021), Quantile regression, asset pricing and investment decision. IIMB Management Review, 33(1), 28-37.
Marashdeh, Z., Saidat, Z., Alkhodary, D., Al-Haddad, L. (2021), Agency theory and the Jordanian corporate environment: Why a single theory is not enough. Academy of Accounting and Financial Studies Journal, 25(5), 1-15.
Martynova, N., Ratnovski, L., Vlahu, R. (2020), Bank profitability, leverage constraints, and risk-taking. Journal of Financial Intermediation, 44, 100821.
Mateev, M., Nasr, T., Sahyouni, A. (2022), Capital regulation, market power and bank risk-taking in the MENA region: New evidence for Islamic and conventional banks. Quarterly Review of Economics and Finance, 86, 134-155.
Mazumder, S., Piccotti, L.R. (2023), Systemic risk: Bank characteristics matter. Journal of Financial Services Research, 64(2), 265-301.
Mckillop, D., French, D., Quinn, B., Sobiech, A.L., Wilson, J.O.S. (2020), Cooperative financial institutions: A review of the literature. International Review of Financial Analysis, 71, 101520.
Medyawati, H., Yunanto, M. (2014), The Influence of Corporate Social Responsibility To The Value of The Company In Indonesia. Available from: https://www.idx.co.id
Miftari, F. (2023), The contribution of bank intermediation to economic growth: Empirical evidence from CESEE countries. Journal of Governance and Regulation, 12(4), 195-202.
Mirza, N., Umar, M., Horobet, A., Boubaker, S. (2024), Effects of climate change and technological capex on credit risk cycles in the European Union. Technological Forecasting and Social Change, 204, 123448.
Mkhaiber, A., Werner, R.A. (2021), The relationship between bank size and the propensity to lend to small firms: New empirical evidence from a large sample. Journal of International Money and Finance, 110, 102281.
Mokni, R.B.S., Echchabi, A., Rajhi, M.T. (2015), Risk management practiced tools in the MENA region: A comparative study between Islamic and conventional banks. International Journal of Business, 20(3), 261-277.
Mokni, R.B.S., Rajhi, M.T., Rachdi, H. (2016), Bank risk-taking in the MENA region: A comparison between Islamic banks and conventional banks. International Journal of Social Economics, 43(12), 1367-1385.
Montes, G. C., Scarpari, A. (2015), Does central bank communication affect bank risk-taking? Applied Economics Letters, 22(9), 751-758.
Mozaffari, M.R., Kamyab, P., Jablonsky, J., Gerami, J. (2014), Cost and revenue efficiency in DEA-R models. Computers Industrial Engineering, 78, 188-194.
Neitzert, F., Petras, M. (2022), Corporate social responsibility and bank risk. Journal of Business Economics, 92(3), 397-428.
Nguyen, Q.K. (2020), Ownership structure and bank risk-taking in ASEAN countries: A Quantile regression approach. Cogent Economics and Finance, 8(1), 1809789.
Nosheen, Rashid, A. (2021), Financial soundness of single versus dual banking system: Explaining the role of Islamic banks. Portuguese Economic Journal, 20(1), 99-127.
Nyangu, M., Marwa, N., Fanta, A., Uwe, L.L. (2022), The dynamics of bank concentration, competition and efficiency in the East African Community. Journal of Industry, Competition and Trade, 22(1), 21-49.
Otaka, S. (2024), Rethinking the concept of equity in accounting: origin and attribution of business profit. Accounting, Economics and Law: A Convivium, 14(3), 373-394.
Otaka, S. (2024), Rethinking the concept of equity in accounting: Origin and attribution of business profit. Accounting, Economics and Law: A Convivium, 14(3), 373-394.
Pan, Z., Li, S., Li, J., Gong, C. (2024), Air pollution and bank risk taking: Evidence from China. Finance Research Letters, 65, 105594.
Pinar, M. (2022), Sensitivity of environmental performance index based on stochastic dominance. Journal of Environmental Management, 310, 114767.
Porzio, C., Battaglia, F. (2024), Analyzing the role of sustainable investor in global systemically important banks and less significant institutions. Research in International Business and Finance, 68, 102166.
Powell, D. (2022), Quantile regression with nonadditive fixed effects. Empirical Economics, 63(5), 2675-2691.
Pratap Sinha, R., Ahmad Edalatpanah, S. (2023), Efficiency and fiscal performance of Indian states: An empirical analysis using network DEA. Journal of Operational and Strategic Analytics, 1(1), 1-7.
Rachdi, H., Ben Ameur, I.G. (2011), Board characteristics, performance

and risk taking behaviour in Tunisian banks. International Journal of Business and Management, 6(6), 88.
Rehman, A., Ullah, I., Afridi, F.A., Ullah, Z., Zeeshan, M., Hussain, A., Rahman, H.U. (2021), Adoption of green banking practices and environmental performance in Pakistan: A demonstration of structural equation modelling. Environment, Development and Sustainability, 23(9), 13200-13220.
Rodrigues, V., Russo, M., Sorte, S., Reis, J., Oliveira, K., Dionísio, A.L., Monteiro, A., Lopes, M. (2021), Harmonizing sustainability assessment in seaports: A common framework for reporting environmental performance indicators. Ocean Coastal Management, 202, 105514.
Roy, S., Misra, A.K., Padhan, P.C., Rahman, M.R. (2019), Interrelationship among liquidity, regulatory capital and profitability-a study on Indian banks. Cogent Economics and Finance, 7(1), 1664845.
Saadaoui Mallek, R., Albaity, M., Ur-Rehman, I., Thangavelu, S. (2024), The puzzle of convex/concave ESG returns and large banks in MENA region countries. Borsa Istanbul Review, 24(3), 618-633.
Saeed, K.A. (2021), Revisiting the natural resource curse: A cross-country growth study. Cogent Economics and Finance, 9(1), 2000555.
Şanlısoy Assist, S., Aydın Assist, Ü., Elif Ay Yalçınkaya, A. (n.d.), Effect of Political Risk on Bank Profitability. Available from: https://www.ijbmer.com
Sarmiento, M., Galán, J.E. (2017), The influence of risk-taking on bank efficiency: Evidence from Colombia. Emerging Markets Review, 32, 52-73.
Schäfer, T., Utz, S. (2022), Values-based and global systemically important banks: Their Stability and the impact of regulatory changes after the financial crisis on it. Asia-Pacific Financial Markets, 29(1), 5-32.
Scholtens, B. (2009), Corporate social responsibility in the international banking industry. Journal of Business Ethics, 86(2), 159-175.
Settembre-Blundo, D., González-Sánchez, R., Medina-Salgado, S., García-Muiña, F.E. (2021), Flexibility and resilience in corporate decision making: A new sustainability-based risk management system in uncertain times. Global Journal of Flexible Systems Management, 22, 107-132.
Shabir, M., Jiang, P., Shahab, Y., Wang, W., Işık, Ö., Mehroush, I. (2024), Diversification and bank stability: Role of political instability and climate risk. International Review of Economics and Finance, 89, 63-92.
Shair, F., Shaorong, S., Kamran, H.W., Hussain, M.S., Nawaz, M.A., Nguyen, V.C. (2021), Assessing the efficiency and total factor productivity growth of the banking industry: Do environmental concerns matters? Environmental Science and Pollution Research, 28(16), 20822-20838.
Shamshur, A., Weill, L. (2023), Bank risk and firm investment: Evidence from firm-level data. Journal of Financial Services Research, 63(1), 1-34.
Sharma, M., Choubey, A. (2022), Green banking initiatives: A qualitative study on Indian banking sector. Environment, Development and Sustainability, 24(1), 293-319.
Shen, H., Wu, H., Long, W., Luo, L. (2021), Environmental performance of firms and access to bank loans. International Journal of Accounting, 56, 2150007.
Sineviciene, L., Kubatko, O., Derykolenko, O., Kubatko, O. (2018), The impact of economic performance on environmental quality in developing countries. International Journal of Environmental Technology and Management, 21(5/6), 222.
Srivastava, A.K., Dharwal, M., Sharma, A. (2022), Green financial initiatives for sustainable economic growth: A literature review. Materials Today: Proceedings, 49, 3615-3618.
Stolbov, M.I., Shchepeleva, M.A. (2022), The impact of ESG-factors on financial stability. Voprosy Ekonomiki, 2022(11), 136-148.
Sut, U. (2019), Impact analysis of Basel III parameters on the performance of SBI, a leading public sector bank in India. International Journal of Scientific and Technology Research, 8(11), 349-352.
Sweidan, O.D., Elbargathi, K. (2022), The effect of oil rent on economic development in Saudi Arabia: Comparing the role of globalization and the international geopolitical risk. Resources Policy, 75, 102469.
Tsai, H.F., Fang, S.C. (2023), Risk-return paradox? The moderating effects of risk-taking capabilities. Management Decision, 61(5), 1207-1224.
Umar, Z., Gubareva, M., Tran, D.K., Teplova, T. (2021), Impact of the Covid-19 induced panic on the environmental, social and governance leaders equity volatility: A time-frequency analysis. Research in International Business and Finance, 58, 101493.
Vujanović, N., Fabris, N. (2021), Does market competition affect all banks equally? Empirical evidence on Montenegro. Journal of Central Banking Theory and Practice, 10(2), 87-107.
Wang, C., Zhuang, L. (2022), Bank liquidity and the risk-taking channel of monetary policy: An empirical study of the banking system in China. PLoS One, 17, 0279506.
Wang, R., Luo, H. (2021), Real estate prices and bank risk-taking in Japan. Journal of the Asia Pacific Economy, 26(1), 158-181.
Wu, X., Bai, X., Qi, H., Lu, L., Yang, M., Taghizadeh-Hesary, F. (2023), The impact of climate change on banking systemic risk. Economic Analysis and Policy, 78, 419-437.
Xie, J., Nozawa, W., Managi, S. (2020), The role of women on boards in corporate environmental strategy and financial performance: A global outlook. Corporate Social Responsibility and Environmental Management, 27(5), 2044-2059.
Yahya, S., Ibrahim, Y. (2021), Determinants of Islamic and conventional banks profitability: A contingency approach. Asian Journal of Business and Accounting, 14(2), 279-319.
Yildirim, H.H., Ildokuz, B. (2020), Determining the relationship between CAMLS variables and profitability: An Application On Banks In The Bist Bank Index. In Contemporary Studies in Economic and Financial Analysis, 104, 85-103.
Zakaria, S. (2017), The use of financial derivatives in measuring bank risk management efficiency: A data envelopment analysis approach. Asian Academy of Management Journal, 22(2), 209-244.
Zhang, Z., Clovis, J., Moffatt, P., Wang, W. (2024), From theory to practice: Monetary policy transmission and bank risk dynamics. PLoS One, 19, 0299209.
Zhubi, M., Zhubi, D., Kovaçi, I., Tahiri, A. (2024), Impact of inflation on the demand for hotel services in Kosovo. Quality-Access to Success, 25(201), 15-24.