Impact of income diversification on bank stability: a cross-country analysis

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Abstract

Purpose – The impact of diversification on bank stability and risk remains an ongoing topic of discussion with inconclusive results. Hence, this study investigated the implications of income diversification on bank stability within African markets.

Design/methodology/approach – The study utilised longitudinal financial data on 45 countries from 2000 to 2017 and employed static and dynamic panel model estimation.

Findings – The results of the study suggest income diversification technique could improve financial stability throughout typical and crisis periods which validate portfolio management theory. The study also confirms the "too big to fail" hypothesis, extensive diversifying over an optimal range negatively impacts stability. Banks with a high level of liquidity, a higher operating efficiency and a larger deposit ratio become more resilient. Banking capital regulations found to be the appropriate monitoring instrument for lowering risks and maintaining stability. However, profitability was found to have a positive effect on bank risk-taking. The finding also suggests that political institutions have substantial, direct implications that are positively related to bank fragility. Macroeconomic factors such as gross domestic product (GDP) growth and inflation also influenced bank stability.

Practical implications – This study has important implications for bankers, regulators and academicians concerned about the effect of diversification on a bank's risk-taking or stability in developing economies.

Originality/value – To the best of the author's knowledge, this is the first study on Africa to analyse the quadratic influence of income diversification and the effects of political institutions on the level of bank stability.

Keywords Africa, Stability, Risk-taking, Income diversification, Dynamic panel model

Paper type Research paper

1. Introduction

Banks are the pillar of developing markets. Even so, the economic downturn strongly affected the world economy via financial sectors throughout the overall jurisdictions. Thus, a divergent, competitive and secure finance sector is a precondition for cohesive national economic systems (Nisar *et al.*, 2018). Following the global financial crises, the financial sector has been characterised by reform efforts, commercial market liberalisation, competitive pressures (Wu *et al.*, 2020) and high capital adequacy to achieve a more sustainable financial system (Yakubu and Bunyaminu, 2021). In addition, the equity requirements regulation sought to disincentivise bank risk-taking, reduce banking collapse and maintain financial sector healthiness.

Nonetheless, there is no agreement about whether capital regulation means reducing leverage for banks' risk (Dias, 2021). Enormous capital percentages are associated with

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increased costs for financial institutions caused by differences in the financial sector and borrowing tax credits, resulting in decreased profitability and stability. However, the trade-off theory states that doing so lowers the risk reimbursements required to repay for carrying distress expenditures. Regulatory capital criteria impact banking industry exposure by tumbling risk-weighted investment, which also affects banking performance (Mujtaba *et al.*, 2022). Traditional banking inside a dynamic economic climate entails vulnerability to the volatility of interest rate, credit and bankruptcy risk, and bankers are no longer entirely reliant upon its conventional source of interest returns (Nisar *et al.*, 2018; Paltrinieri *et al.*, 2021). Significant financial organisation failures during a banking crisis have indeed been thought to have contributed to expanded vulnerability and the evolution of banking facilities into nonbanking financial operations (Hunjra *et al.*, 2020).

Since deregulation, banks have been allowed to mitigate the impact of deteriorating overall credit conditions by switching away from existing financial intermediation toward nontraditional income streams, including charges, commission and investment securities generating higher margins (Paltrinieri *et al.*, 2021). However, the existing research merely reports inconsistent empirical evidence and inconclusive hypotheses for the relationship between bank diversification and instability. As a result, income diversification advocates such as Nguyen *et al.* (2012), Moudud-Ul-Huq (2019), Hunjra *et al.* (2020), Wang and Lin (2021), Alouane *et al.* (2021), and López-Penabad *et al.* (2021) show clues that banking revenue diversification reduces risks and improves banks' strength using synergies. Banking institutions with more extensive diversification, on the other hand, could keep losing their competitive management expertise and create highly unstable profits (Deyoung and Roland, 2001; Stiroh and Rumble, 2006; Kim *et al.*, 2020; Liang *et al.*, 2020).

In addition to conflicting empirical findings from developed economies, little is understood about developing economies as with Africa. In fact, to the best of the author's knowledge, specific papers have considered the points of focus in settings as well as some African nation sets to a somewhat level. For example, Mathuva (2016) conducted a study on revenue diversification and the financial performance of savings and credit cooperatives in Kenya; Hamdi *et al.* (2017) on diversification, bank performance and risk in Tunisia; Sissy *et al.* (2017) on the effects of revenue diversification on the risk and return of banks in Africa; Duho *et al.* (2020) on bank diversification and performance for Ghana and Adesina (2021) studied bank diversification and performance for 34 African countries. Nonetheless, no agreement has been achieved. Furthermore, these investigations disregarded the possible impact of political institutions and the nonlinearity relationship between revenue diversity and financial safety. This study sought answers to the following questions by taking the preceding factor into account:

Q1. What does income diversification have on African banks' risk-taking?

Q2. What is the effect of income diversification on bank risk-taking at the higher threshold?

The study stresses the African banking industry, providing a reference point for this kind of examination. First, African countries' banking sectors are structured differently from those of developed countries. Second, several countries in the region have commenced banking industry restructuring, including liberalisation and growing engagement in noninterest income businesses (Sissy *et al.*, 2017). Third, despite the desire among monetary professionals, banks and supervisors, there is a scarcity of work efforts in Africa.

The paper adds to the current body of literature in the accompanying tips. First, the majority of research evaluates the effects of diversifying primarily from advanced economies. In comparison, this study investigates the impacts of income diversity in African countries using national pooled panel data. Second, the study aimed to investigate the significance of a

parametric relationship between diversifying and solvency ratios. Finally, the study adds to the limited evidence on whether revenue diversity is necessary for better optimal resilience in developing markets.

Based on a two-step method of moments dynamic panel regression approach, the findings support the positive side of diversification that income diversity reduces risks and increases bank financial stability. Furthermore, banks with significant liquidity, high cost-effectiveness and a large deposit would be more stable. However, banks with high-profit margins in countries with strong political institutions, unimproved economies and hyperinflationary pressure are less stable. This result adds to the ongoing discussion about diversity. It also has substantial implications for banking institutions, legislators and academics concerned about diversification's impact on a bank's stability.

The rest of this article is arranged as follows: Section 2 presents the relevant literature, the materials and empirical framework are described in Section 3, and the results are discussed in Section 4. Finally, Section 5 presents the conclusion and affords some policy implications.

2. Literature review

2.1 Theoretical issues

Banks' financial soundness is still a contentious issue and a major fret among regulators and supervisors. Insolvency risk is one of the risks that banks face. Diversifying is the first method bankers use to minimise risks, although numerous others exist. However, there is still a lack of agreement in the literature and hypotheses about whether bank diversity is advantageous. According to conventional wisdom, banking system revenue diversification could significantly reduce the risk. The first is portfolio management theory, also known as average portfolio allocation, which proposes that optimal investment diversification can minimise idiosyncratic risk and contribute to higher anticipated income (Wang and Lin, 2021). Whenever a company's assets or operational operations are diverse, the income diversification content increases as the risks that companies face decrease. The second explanation is that the synergy effect (economies of scope and scale) results in scale efficiencies. Due to the highly improved knowledge provided by its conventional activities, bankers could generate modest income while undertaking new business models (Sissy *et al.*, 2017; Wang and Lin, 2021). With technical innovation and management abilities, bankers could consider expanding potential means of revenue that ultimately enhance stability. It may also improve incomes while lowering the cost of noninterest operations (Paltrinieri *et al.*, 2021).

Contrary to the preceding notions of "diversity advantages," certain opposing viewpoints, such as the concentrations hypothesis, caution regarding "diversifying overheads" or the negative impacts of diversifying on financial health. For instance, noninterest revenue might increase bank operational earnings' unpredictability (Wu *et al.*, 2020). Additionally, diversifying operations leads to working outside generic skills, resulting in information asymmetries (Deyoung and Roland, 2001; Duho *et al.*, 2020).

The theory's inconsistency in the rewards and risks of diversifying underpins the conflicting outcomes of empirical evidence. The first section emphasises the benefits of banks' revenue diversification and argues that a well-diversified bank may reap several incentives from economies of scale, improved allocation of resources using domestic financial markets, diminished bank risk-taking and financial institutions competitiveness (Nguyen *et al.*, 2012; Moudud-Ul-Huq, 2019; Hunjra *et al.*, 2020; Wang and Lin, 2021; Alouane *et al.*, 2021; López-Penabad *et al.*, 2021).

The second view shows the detrimental consequences of a bank's income diversification on stability. In their study, Stiroh (2004), Deyoung and Roland (2001), Stiroh and Rumble (2006), Williams (2016), Ammar and Boughrara (2019), Phan *et al.* (2019), Liang *et al.* (2020),

Sarpong-Kumankoma *et al.* (2020), Wu *et al.* (2020), and Adesina (2021) suggest that noninterest revenue enhances systemic and market risk, owing to the increased risk of insolvency. At the same time, the third body of literature highlighted varying impacts and inconsistent outcomes. For example, Abuzayed *et al.* (2018), Kim *et al.* (2020), and Paltrinieri *et al.* (2021) demonstrated that modest banking diversity improves bank stability, but extreme diversity has the opposite impact.

Banking system legislation and political institutions have been recognised as key predictors of bank stability in the existing studies (Ashraf *et al.*, 2016a, b; Ashraf, 2017). As Ashraf (2017) contend, political structures are multifaceted and can have either direct or oblique consequences on bank stability. The author argued that considering the institutional influence on governmental confiscation threat, political institutions could directly affect bank instability through their effects of information asymmetry concerns, competitive dynamics and moral hazard. Following the studies of Ashraf (2017) and lacking from the previous study on whether political structures influence bank risk-taking or stability in Africa, this study addresses such a gap by taking the political constraint index as a control variable.

Capital regulation also seems crucial when analysing banks' stability or risk-taking operations. However, the studies provided contradictory evidence concerning the connection between capitalisation restrictions and bank risk. Regulating capital could generally grant credible marketing with excellent governance and considerable discretion. On the other hand, in focusing on moral hazards, far less skilled management could be motivated to take some risks to accommodate for reduced earnings (Mujtaba *et al.*, 2022). According to some research, more significant banking regulations incentivise bankers to engage in risk-taking. Investigating the relationship between regulatory bank capital and banking system vulnerability in Asian countries (Mujtaba *et al.*, 2022) found that regulatory capital favorably affects risk-taking. Mahdi and Abbes (2018) studies also demonstrate bidirectional direct correlations across regulated capital and volatility in the MENA region. The second line of research implies that increased capital requirements reduce banks' risk. As per Ashraf *et al.* (2016a, b), risk-based capitalisation control reduces investment portfolio riskiness in banks. Their results suggest that risk-based capital regulations drive institutions to engage in risky investments until bankers appropriately establish risk weighting.

Similarly, Yakubu and Bunyaminu (2021) for Sub-Saharan and Hunjra *et al.* (2020) for Asian indicate a negative relationship between bank capital and risk-taking. Moreover, according to Dias (2021), the link between capital requirements and banks' risk has an asymmetric pattern. As capital adequacy rises, a bank will accept less risk at first and then greater risk.

In inference, inconsistent empirical evidence has demonstrated that the effects of diversification on stability are equivocal and the impact of political institutions absent from African studies. Hence, the objective of this study is to discuss this issue from the perspective of Africans.

3. Materials and methods

3.1 Data

Following Yakubu and Bunyaminu's (2021) studies, the study utilised longitudinal country-level bank data from African nations from 2000 to 2017. The data in this study are gathered from many source materials. Bank-level data are retrieved from the Financial Development databases, derived from the BankScope and Orbis Bank Focus records and the Bureau van Dijk (BvD) data system. The country-level indicators compiled from the World Bank Development Indicators Dataset were used to assess the influence of macroeconomic fundamentals. To account for the influence of bank regulation, World Bank's bank regulation and supervision dataset was used. Data for political institutions are gathered from the political constraint index (Henisz, 2015), political rights index (Freedom_House, 2020), and

Polity IV Project datasets (Marshall and Elzinga-Marshall, 2017). Sampling was constructed by excluding those financial entries lacking the required data. The first population of this research comprises all African countries. For every one of the model parameters, the sample population should have at least seven years' worth of data. Countries in which the data of the banking sector or country-level parameters were missing were eliminated. Last, all samples with fewer than seven credible observations throughout the period of analysis were eliminated. The study eventually had 45 nations applying the selection criteria, resulting in an uneven panel. Appendix 1 shows the nations that were sampled.

Appendix 1 is available online at: https://docs.google.com/document/d/1QisDpEcP302EzG58CybVlHp0fjubApMz/edit

3.2 Variable description and expected sign

3.2.1 Stability measures. The *Z*-score is an indicator of a banking institution's financial soundness, calculated as the summation of return on assets (ROA) and capital to asset ratios, then divided by the standard deviation of ROA (Hunjra *et al.*, 2020). A higher *Z*-score indicates less risk. This is a metric of debt default, defined as a scenario for which losses exceed capital. The *Z*-score was determined as follows:

$$Z - Score = \frac{ROA + \frac{E}{TA}}{sdROA} \tag{1}$$

where ROA is the bank's return on assets, E/TA is the calculated equity-to-total-assets percentage and *sd*ROA is the standard deviation of ROA, providing unpredictability in return on investment. The study also used the nonperforming loans to gross loans ratio as an alternative measure of bank risk-taking (instability) metrics. This fraction indicates loans considered impossible to recover and serves as an ex-post indicator of bank default risk (Ashraf, 2017). Based on previous research, such as Kim *et al.* (2020), Banna and Alam (2021), and Mohammed (2022), the study utilises the volatility of ROA (*sd*ROA) and the volatility of ROE (*sd*ROE) as a robustness analysis.

3.2.2 Diversification measures. A proportion of net noninterest income to operating income was utilised as a proxy for income diversification. A higher value suggests increased involvement in noninterest income-generating businesses (Moudud-Ul-Huq, 2019; Hunjra *et al.*, 2020). As a substitute, the study constructs each country bank's noninterest income-based indicator of diversification using a Herfindahl–Hirschman index (HHI). Income HHI is computed as the summation of revenue portfolio components squared:

$$\text{Income diversification HHI} = 1 - \left(\frac{(Interest\ income)^2}{total\ operating\ income} + \frac{(non - interest\ income)^2}{Total\ operating\ income} \right) \tag{2}$$

where the level of noninterest income diversity varies from 0 to 1. The substantial figures advocate a better variety of earnings in a diverse income source operation. Consequently, a positive association between diversity and stability is anticipated.

3.2.3 Control variables. Regulatory capital is an indicator of a bank's capital requirements in relation to risk-weighted assets. Increased capital standards are required to guarantee that financial institutions have sufficient capital to support unanticipated uncertainties from bankruptcies and other threats. If well-capitalised institutions possess higher capital buffers, they could be encouraged to increase various nontraditional businesses. A greater capital requirement indicates that banks must reserve more risk capital (Abuzayed *et al.*, 2018). Well-capitalised banking institutions either have established larger capital levels through decreasing

risk-weighted assets or have boosted their portfolios of risk-weighted instruments due to more substantial capital support (Ashraf *et al.*, 2016a, b). Consequently, the regulatory capital requirement is expected to contribute to banking sector stability positively. *Liquidity (LIQ):* The ratio of liquid assets to total assets is used as a proxy. A bank with a small proportion of liquid assets would not have enough liquidity to meet unanticipated financing needs. The higher the ratios are, the more liquid the bank's holdings are, and the bank may not even be profiting as much as it could be. Hence, the impact of this ratio is expected to be positive with stability.

Operational efficiency is determined as the sum of all operating expenditures divided by total operating profit. Moral hazard theory states that underperformers seem to be more susceptible to vulnerability, and the likelihood of instability (risk-taking) would surge in institutions with poorer operating efficiency (Dias, 2021). Hence, a positive association between operating efficiency and stability is expected. *Deposit Ratio* was calculated as a ratio of deposits to total assets. Deposits are a cheap form of financing that assists a bank in making a profit when those resources are transferred at a better rate. In contrast, when additional interests are paid to clients with higher deposits, revenue gains may decrease, leading to instability (Mohammed, 2022). The deposit proportion is therefore expected to have a favorable effect on banking stability. *Return on equity (ROE):* A bank's on- and off-balance sheet activities are taken into account by the ROE, computed as profit or loss after tax divided by total equity. Profitable businesses are more likely to move closer to the urge to make riskier nontraditional ventures (Ashraf *et al.*, 2016a, b). As a result, it is anticipated to have a negative effect on banking stability.

Political institutions: according to Ashraf (2017), these are compliance standards that determine the administration's pattern of intentional function. If it has historically bailed out banks, it is indeed sure to persist in doing so in its legal parameters. Henisz's (2015) political constraints technique is used to determine the number of autonomous parts of the government that have considerable influence on assessing the level of limitations on a policy formulation choice. The political constraints index ranges from 0 to 1. Higher scores indicate substantial political restraints, more authoritarian political structures, and separate departments having legislative powers in political systems that regulate the governing body's choice (Ashraf, 2017). Additional proxies of political institutions, including political rights and polity, have been used to thoroughly assess outcomes' reliability. The Polity parameter reflects the concurrent characteristics of democratic and autocratic legitimacy within governance and is taken from the Polity IV Project dataset (Marshall and Elzinga-Marshell, 2017). Political rights are also used to evaluate objectivity and competition, serving as a stand-in for political risk and future results of political negotiations that influence the borrowers' and lenders' future potential costs and benefits considerations. Information on political rights was gathered from the Freedom_House's (2020) Political Rights Index.

GDP: the nation's economic progress is controlled using the natural logarithm of GDP growth. Better economic conditions may significantly boost stability. As a result, a favorable impact on the stability indicator is anticipated. *Inflation:* the consumer price index is used as a proxy. By reducing inflationary pressures, citizens' spending capacity is increased, and institutions' working capital rises, improving institutional solvency and assisting them in preventing unforeseen failures (Yakubu and Bunyaminu, 2021). Inflation and stability are therefore predicted to have a negative connection. *Crisis dummy:* The crisis dummies were used to account for the effects of the global financial crisis and were given a value of one for both 2008 and 2009.

3.3 Empirical model specification

The study used the generalised methods of moments estimation technique (GMM) proposed by Arellano and Bover (1995). To obtain accurate and reliable predictions for large N and short T frames, dynamical methods are essential. It is used to mitigate the bias introduced by

omitted variables in cross-section (Roodman, 2009) and when endogenous lag factors were used as the regressor. One-step GMM and two-step method of moments are the two alternatives available to the systemic GMM for doing analysis (Mujtaba *et al.*, 2022). The study employed the two-step system dynamic panel approach since it is accurate and robust to the issues of autocorrelation, heteroscedasticity and endogeneity introduced by causality moving from instability to bank diversification. The Arellano–Bond (AR2) test in detecting likely second order serial correlation in the research and the Hansen J statistics to check the reliability of the instruments are both used. Therefore, using the Arellano and Bover (1995) dynamic model, the estimation framework is quantified as follows:

$$\begin{aligned} Z\,\text{score}ROA/ROE\text{i, t, } = {} & \beta 0 + \beta 1 Z\,\text{scorei, t} - 1 + \beta 2\text{INDVi, t} + \beta 3\text{LIQi, t} + \beta 4\text{OEi, t} \\ & + \beta 5\text{DTAi, t} + \beta 6\text{ROEi, t} + \beta 7\text{GDPi, t} + \beta 8\text{IFi, t} + \beta 9\text{Crisisi, t} \\ & + \beta 10\text{Reg-capi, t} + \beta 11\text{Polcon} + \beta 12\text{IDV\^{}2} + \beta 13\text{IDV} * \text{Crisisi, t} \\ & + a_i + Uit, \end{aligned} \tag{3}$$

$$\begin{aligned} \text{NPLs/sdROA/sdROEi, t, } = {} & \beta 0 + \beta 1\text{NPLs/sdROA/sdROEi, t} - 1 + \beta 2\text{INDVi, t} \\ & + \beta 3\text{LIQi, t} + \beta 4\text{OEi, t} + \beta 5\text{DTAi, i} + \beta 6\text{ROEi, t} + \beta 7\text{GDPi, t} \\ & + \beta 8\text{IFi, t} + \beta 9\text{Crisisi, t} + \beta 10\text{Reg-cap}i\text{, t} + \beta 11\text{Polcon}i, t \\ & + \beta 12\text{IDV\^{}2}i, t + \beta 13\text{INDV} * \text{Crisis}i\text{, t} + a_i + Uit, \end{aligned} \tag{4}$$

where *Z*-score states the inverse measure of overall bank (in)stability of banks in country *i* at period *t*, whereas NPLs/sdROA/sdROE relates to alternative metrics for ban risk-taking; the measures of *Z* score i,t−1, NPLs/*sd*ROA/E,t−1 are one-year lag measurements of bank (in) stability or risk-taking; INDVi,t denotes banks income diversification metrics of banks in country *i* at period *t;* LIQi,t symbolises the liquidity of banking in country *i* at time *t*; OE is banks' operational efficiency for the banking system in country *i* at time *t*; DTAi,t stands for leverage of bank in country *i* at time *t*; the bank's net interest margin of country *i* at time *t* is denoted as ROEi,t; GDPi,t is the yearly percentage of GDP growth, while IFi,t is the annual rate of consumer price index; Crisis is the worldwide financial crisis dummy that affects banks in country *i* at time *t*; Reg-cap*i,t,* represents the regulatory capital*;* Polcon*i,t* refers to the political constraint index in country *i* at time *t; INDV*^2 represents the quadratic term of income diversification; INDV*Crisis,t is the interaction of income diversification, and the recent global financial Crisis, *ai* is the unobserved cross-section effect; *Uit* is the random term, and *ai* and *Uit* are scattered independently and uniformly.

4. Empirical results

4.1 Descriptive statistics

Table 1 presents summary statistics for the study's variables. The *Z*-score of banks in the sampled economies has a mean of 0.131 and a standard deviation of 0.089. The highest and lowest *Z*-scores are 0.634 and 0.011, respectively, revealing more national variability in bank risk-taking/stability. Having corresponding standard deviations of 0.13 and 0.11, *sd*ROA and *sd*ROE have averages of 0.007 and 0.065, respectively. The ratio of nonperforming loans seems to be relatively modest, demonstrating that banks continue to monitor nonperforming lines of credit as well.

Table 1 is available online at: https://docs.google.com/document/d/1znmPGultucmkBO6_RU0sqfJgOeCANqx8/edit

Table 2 is available online at: https://docs.google.com/document/d/1G4b1KClzW6DNK1hz-D-a2FokNPlGQrF0/edit

ROE has a sample mean of 0.2012 and a standard deviation of 0.181, whereas INDV does have an average of 0.4335 and a standard deviation of 0.14. These could also imply that African banks gained on a typical 43 percent of revenue from noninterest means. Liquidity, as measured by the amount of liquid asset/total asset, has a sample mean of.428 and a standard deviation of 0.24, but the deposit-to-asset ratio has a mean of.77 and a standard deviation of 0.20. Both the liquidity and deposit ratios showed that banks in the sampled countries possess a significant degree of liquidity and deposits in general. The average score for capital requirements is 0.17, with a standard deviation of 0.065.

This low standard deviation suggests that capital regulatory reform varies little within nations. The sampled banking industry is highly capitalised on average, meaning that they are considerably over the required levels based on an international given criterion. These figures reveal significant heterogeneity in political constraint on administrative action for sampled nations. The operational efficiency measured by cost-to-income ratios is much higher (0.57), indicating unrealised economies of scale and scope and increased monitoring expenses. Inflation has a sample mean of 0.4177 and a standard deviation of 8.73, whereas GDP has a mean of 0.04 and a standard deviation of 0.0732. This could suggest that nations with less variation in economic progress have slightly more variety in national inflationary pressures. The mean and standard deviation for political constraints is 0.42 and 0.20, respectively. The correlation matrix in Table 2 demonstrates no substantial correlation among the independent factors, indicating no multicollinearity problem.

4.2 Regression results

Tables 3 and 4 present the empirical findings of a regression of the driving factors and their interactions with banks' stability/risk. The Sargan test reveals no evidence of overidentification constraints. The AR(2) test was similarly insignificant, indicating that the model's moment assumptions are genuine without a second-order correlation. The extraordinarily significant coefficients of the lag outcome variable highlight the dynamic structure of the model estimation and thus its importance throughout all models. The results suggest a significant bank stability/risk-taking persistence, thus validating the model's dynamic character. Consequently, the following discussion is based on the results of the two-step system dynamic panel model estimation.

Table 3 is available online at: https://docs.google.com/document/d/1vKV3UZQIACSiAtyssHnlXNwiHzOWSEL_/edit

Table 4 is available online at: https://docs.google.com/document/d/1Q5ZV3goBzDb1KaK6VyfF5bklKgcetKuV/edit

The findings indicate that income diversification affects bank stability positively and significantly (Table 3, model 3), but negatively and significantly, on indicators of bank risk. This implies that when banking institutions use nonconventional revenue sources, there is an increment in noninterest income and an improvement in *z*-score, signaling that the threat of bankruptcy is decreased. This finding follows the portfolio management hypothesis; banking institutions with varied noninterest revenue streams are better equipped to mitigate systematic risks and thus become more stable. The result also reinforces the synergies exposure hypothesis of scale economies that enable institutions to benefit from additional information when engaging in noninterest operations. Additionally, the finding agrees with earlier research by López-Penabad *et al.* (2021) and Wang and Lin (2021). Compared to a substantial negative correlation with bank stability, INDV^2 indicates a significant positive

relationship with bank risk-taking, negatively affect stability. The results suggest that bank financial stability would be lessened when diversification increases over the optimum rate. This may be because higher diversification would reduce the efficiency of banks. This is consistent with the "too big to fail" assumption. The result also implied that instability and the anticipated factor of crises dummy are substantially correlated. At the same time, it is significant and positive for risk-taking.

The findings also demonstrate that income diversification and financial crisis interaction effects have positively significant stability estimates, suggesting that diversity helps banks by lowering risk exposure during a global crisis. The liquidity factors show a favorable and substantial relationship on bank stability. It could be that better liquid banks can continue expanding into noninterest segments, which improves stability. The findings of a positively significant relationship between the deposit-to-assets ratio and bank soundness indicators are consistent with prior expectations. This then augments the notion that deposits are a cheap source of funding, enhancing a bank's soundness by lowering cost and maximising profitability when these resources are subsequently reissued at a better markup. The cost-to-income ratio is used to determine efficiency, and a greater cost-to-income ratio represents inefficiency. As a result of the negative link between inefficiency and *z*-score, banks with lower levels of efficiency experience less stability, implying significant risk. The result is in line with Dias (2021). The finding reinforces the concept of "bad management": when financial institutions are far less efficient, they engage in more risky investments and experience instability. Bank stability and profitability (ROE) are inversely correlated, implying that profitable financial institutions are more encouraged to make high-risk nonconventional operations. The outcomes corroborate the results of (Ashraf *et al.*, 2016a, b).

The political constraints index shows statistically significant negative coefficients on stability, demonstrating that nations with more political restraints influence banks' threat propensity in a favorable manner. This justifies the implications of moral hazard in which the government bails banks and raises banks' risk by encouraging competition from securities markets (Ashraf, 2017). The positive direct effect of political institutions on bank instability is not insensitive to other particular measures of political institutions, such as the political rights index and polity index.

The effect of bank capital on institutions' solvency and risk-taking behavior is also considered in the analysis. According to the findings, the impact of bank capital regulation on a bank's solvency and risk is significantly positive and negative, respectively. The result indicates that banking regulations seem to become a well-organised strategy factor in fostering stability and minimising the risk of default. Such findings support the work of Ashraf (2017), Ashraf *et al.* (2016a, b), and Yakubu and Bunyaminu (2021), and contradict (Mujtaba *et al.*, 2022), who stated that banks with higher capital ratios are expected to increase in risk-taking. Concerning the macroeconomic factors, the estimates of GDP growth covariates indicate that better economic performance reduced bankruptcy risks and risk-taking.

Furthermore, the impacts of inflation on bank risk and stability are positive and negative, respectively, revealing that greater inflation rates are related to increased risk and weaker solvency ratios. The potential cause would be that more significant yearly inflation could heighten loans' potential losses by lowering customers' capital on hand. This outcome is commensurate with the findings of Paltrinieri *et al.* (2021).

4.3 Robustness tests

Various methods are used to conduct robustness testing. First, in addition to the *Z*-score, I have used NPLs, *sd*ROA and *sd*ROE as alternative indicators of bank stability (risk-taking). Second, I employ the Herfindahl–Hirschman index as an alternative for income diversification measurement, which is calculated as 1-((Interest income)^2/(total operating income)+(noninterest income)^2/(Total operating income)). I have used a two-step dynamic model to handle the endogeneity issue. Third, because the lagged dependent parameter of the

dynamic panel estimate must be within fixed effect estimates (downwards bias) and ordinary least square (uptrend bias), Eqs. (3) and (4) were re-estimated using those dynamically OLS and dynamical fixed effects. Then, it was observed that perhaps the values of lagged dependent variables obtained by dynamic panel models are all within fixed effect estimates and ordinary least square, verifying the reliability of GMM estimations. According to the robustness checks, banking institutions on the African continent with increasing revenue diversification are becoming more stable and far less risky.

5. Conclusions and policy implications

The impact of diversification on bank risk remains an ongoing topic of discussion. Hence, this study investigated the implications of income diversification on bank stability within African markets from 2000 to 2017. Overall, the results of the dynamic panel estimates validate portfolio management theory; the income diversification technique could improve financial stability throughout typical and crisis periods. The study also confirms the "too big to fail" hypothesis; extensive diversifying over an optimal range negatively impacts stability. The results also suggest that banks with a high level of liquidity, a higher operating efficiency and a larger deposit ratio become more resilient. Paradoxically, profitability was found to have a favorable effect on bank risk-taking. As per the analysis, banking capital regulations seem to be the appropriate regulatory instrument for lowering risks and maintaining stability. The finding also suggests that political institutions have substantial, direct implications that are positively related to bank fragility. A bank's stability is influenced by macroeconomic factors such as GDP growth and inflation.

The findings highlight some policy implications for bank regulation, policymakers and banks. First, reform initiatives aimed at increasing income diversification are still effective at promoting financial health in developing markets. Second, bankers need to use economies of scale to capitalise on diversified operations centred on existing key competencies by addressing asymmetric information. Third, because noninterest revenue has a curvilinear influence on stability, authorities need to proceed thoughtfully and gain a detailed sympathetic of diversification's positive and negative sides. Fourth, for bank regulators, risk-based capital regulations help to maintain a healthy and robust financial system in Africa. In addition, central banks should establish strategies that minimise the systemic risk issues of superior political structures. Additionally, corrective policies to increase the national economy and keep inflation at a minimal level shall be properly devised because they are crucial for bank stability. Last, owing to the lack of datasets, the study did not account for various factors. The study suggests that future studies look at governance, funding and asset type of diversification. In addition, future research might include both developed and emerging markets to compare outcomes across subgroups of countries.

References

Abuzayed, B., Al-fayoumi, N. and Molyneux, P. (2018), "Diversification and bank stability in the GCC", *Journal of International Financial Markets, Institutions and Money*, Vol. 57, pp. 17-43, doi: 10.1016/j.intfin.2018.04.005.

Adesina, K.S. (2021), "How diversification affects bank performance: the role of human capital", *Economic Modelling*, Vol. 94, pp. 303-319, doi: 10.1016/j.econmod.2020.10.016.

Alouane, N., Kahloul, I. and Grira, J. (2021), "The trilogy of ownership, income diversification, and performance nexus: empirical evidence from Tunisian banks", *Finance Research Letters*, [Preprint], doi: 10.1016/j.frl.2021.102180.

Ammar, N. and Boughrara, A. (2019), "The impact of revenue diversification on bank profitability and risk: evidence from MENA banking industry", *Macroeconomics and Finance in Emerging Market Economies*, Vol. 12 No. 1, pp. 36-70, doi: 10.1080/17520843.2018.1535513.

Arellano, M. and Bover, O. (1995), "Another look at the instrumental variable estimation of error-components models", *Journal of Econometrics*, Vol. 68 No. 1, pp. 29-51, doi: 10.1016/0304-4076(94)01642-D.

Ashraf, B.N. (2017), "Political institutions and bank risk-taking behavior", *Journal of Financial Stability*, Vol. 29, pp. 13-35, doi: 10.1016/j.jfs.2017.01.004.

Ashraf, B.N., Arshad, S. and Hu, Y. (2016a), "Capital regulation and bank risk-taking behavior: evidence from Pakistan", *International Journal of Financial Studies*, Vol. 4 No. 3, doi: 10.3390/ijfs4030016.

Ashraf, B.N., Zheng, C. and Arshad, S. (2016b), "Effects of national culture on bank risk-taking behavior", *Research in International Business and Finance*, Vol. 37, pp. 309-326, doi: 10.1016/j.ribaf.2016.01.015.

Banna, H. and Alam, M.R. (2021), "Impact of digital financial inclusion on ASEAN banking stability: implications for the post-Covid-19 era", *Studies in Economics and Finance*, Vol. 38 No. 2, pp. 504-523, doi: 10.1108/SEF-09-2020-0388.

Deyoung, R. and Roland, K.P. (2001), "Product mix and earnings volatility at commercial banks: evidence from a degree of total leverage model", *Journal of Financial Intermediation*, Vol. 10 No. 1, pp. 54-84, doi: 10.1006/jfin.2000.0305.

Dias, R. (2021), "Capital regulation and bank risk-taking - new global evidence", *Accounting and Finance*, Vol. 61 No. 1, pp. 847-884, doi: 10.1111/acfi.12595.

Duho, K.C.T., Onumah, J.M. and Owodo, R.A. (2020), "Bank diversification and performance in an emerging market", *International Journal of Managerial Finance*, Vol. 16 No. 1, pp. 120-138, doi: 10.1108/IJMF-04-2019-0137.

Freedom_House (2020), *Freedom in the World 2020: The Annual Survey of Political Rights and Civil Liberties*, available at: https://rowman.com/ISBN/9781538151815/Freedom-in-the-World-2020-The-Annual-Survey-of-Political-Rights-and-Civil-Liberties (accessed 15 July 2022).

Hamdi, H., Hakimi, A. and Zaghdoudi, K. (2017), "Diversification, bank performance and risk: have Tunisian banks adopted the new business model?", *Financial Innovation*, Vol. 3 No. 1, pp. 1-25, doi: 10.1186/s40854-017-0069-6.

Henisz, W.J. (2015), *The Political Constraint Index (POLCON) Dataset*, University of Pennsylvania, Philadelphia.

Hunjra, A.I., Hanif, M., Mehmood, R. and Nguyen, L.V. (2020), "Diversification, corporate governance, regulation and bank risk-taking", *Journal of Financial Reporting and Accounting*, Vol. 19 No. 1, pp. 1985-2517, doi: 10.1108/JFRA-03-2020-0071.

Kim, H., Batten, J. and Ryu, D. (2020), "Financial crisis, bank diversification, and financial stability: OECD countries", *International Review of Economics and Finance*, Vol. 65 January 2019, pp. 94-104, doi: 10.1016/j.iref.2019.08.009.

Liang, S., Moreira, F. and Lee, J. (2020), "Diversification and bank stability", *Economics Letters*, [Preprint], doi: 10.1016/j.econlet.2020.109312.

López-Penabad, M.C., Iglesias-Casal, A. and Neto, J.F.S. (2021), "Competition and financial stability in the European listed banks", *SAGE Open*, Vol. 11 No. 3, doi: 10.1177/21582440211032645.

Mahdi, I. and Abbes, M. (2018), "Relationship between capital, risk and liquidity: a comparative study between Islamic and conventional banks in MENA region", *Research in International Business and Finance*, Vol. 45 July, pp. 588-596, doi: 10.1016/j.ribaf.2017.07.113.

Marshall, M.G. and Elzinga-Marshall, G. (2017), "Polity IV Project: conflict, governance, and state fragility", available at: http://www.systemicpeace.org/vlibrary/GlobalReport2017.pdf

Mathuva, D. (2016), "Revenue diversification and financial performance of savings and credit co-operatives in Kenya", *Journal of Co-operative Organization and Management*, Vol. 4 No. 1, pp. 1-12, doi: 10.1016/j.jcom.2015.11.001.

Mohammed, A. (2022), "Impact of diversification on bank stability: evidence from emerging and developing countries", *Discrete Dynamics in Nature and Society*, Vol. 2022, pp. 1-12, doi: 10.1155/2022/7200725.

Moudud-Ul-Huq, S. (2019), "Can BRICS and ASEAN-5 emerging economies benefit from bank diversification?", *Journal of Financial Regulation and Compliance*, Vol. 27 No. 1, pp. 43-69, doi: 10.1108/JFRC-02-2018-0026.

Mujtaba, G., Akhtar, Y., Ashfaq, S., Abbas Jadoon, I. and Hina, S.M. (2022), "The nexus between Basel capital requirements, risk-taking and profitability: what about emerging economies?", *Economic Research-Ekonomska Istrazivanja*, Vol. 35 No. 1, pp. 230-251, doi: 10.1080/1331677X.2021.1890177.

Nguyen, M., Skully, M. and Perera, S. (2012), "Market power, revenue diversification and bank stability: evidence from selected South Asian countries", *Journal of International Financial Markets, Institutions and Money*, Vol. 22 No. 4, pp. 897-912, doi: 10.1016/j.intfin.2012.05.008.

Nisar, S., Peng, K., Wang, S. and Ashraf, B. (2018), "The impact of revenue diversification on bank profitability and stability: empirical evidence from south Asian countries", *International Journal of Financial Studies*, Vol. 6 No. 2, p. 40, doi: 10.3390/ijfs6020040.

Paltrinieri, A., Dreassi, A., Rossi, S. and Khan, A. (2021), "Risk-adjusted profitability and stability of Islamic and conventional banks: does revenue diversification matter?", *Global Finance Journal*, Vol. 50 September 2019, doi: 10.1016/j.gfj.2020.100517.

Phan, H.T., Anwar, S., Alexander, W.R. J. and Phan, H.T.M. (2019), "Competition, efficiency and stability: an empirical study of East Asian commercial banks", *North American Journal of Economics and Finance*, Vol. 50 October 2018, p. 100990, doi: 10.1016/j.najef.2019.100990.

Roodman, D. (2009), "How to do xtabond2: an introduction to difference and system GMM in Stata", *Stata Journal*, Vol. 9 No. 1, pp. 86-136, doi: 10.1177/1536867x0900900106.

Sarpong-Kumankoma, E., Abor, J.Y., Aboagye, A.Q.Q. and Amidu, M. (2020), "Economic freedom, competition and bank stability in Sub-Saharan Africa", *International Journal of Productivity and Performance Management*, Vol. 70 No. 7, pp. 1510-1527, doi: 10.1108/IJPPM-06-2019-0310.

Sissy, A.M., Amidu, M. and Abor, J.Y. (2017), "The effects of revenue diversification and cross border banking on risk and return of banks in Africa", *Research in International Business and Finance*, Vol. 40, pp. 1-18, doi: 10.1016/j.ribaf.2016.09.017.

Stiroh, K.J. (2004), "Diversification in banking: is noninterest income the answer?", *Journal of Money, Credit, and Banking*, Vol. 36 No. 5, pp. 853-882, doi: 10.1353/mcb.2004.0076.

Stiroh, K.J. and Rumble, A. (2006), "The dark side of diversification: the case of US financial holding companies", *Journal of Banking and Finance*, Vol. 30 No. 8, pp. 2131-2161, doi: 10.1016/j.jbankfin.2005.04.030.

Wang, C. and Lin, Y. (2021), "Income diversification and bank risk in Asia Pacific", *North American Journal of Economics and Finance*, Vol. 57 August 2020, p. 101448, doi: 10.1016/j.najef.2021.101448.

Williams, B. (2016), "The impact of non-interest income on bank risk in Australia", *Journal of Banking and Finance*, Vol. 73, pp. 16-37, doi: 10.1016/j.jbankfin.2016.07.019.

Wu, J., Chen, L., Chen, M. and Jeon, B.N. (2020), "Diversification, efficiency and risk of banks: evidence from emerging economies", *Emerging Markets Review*, Vol. 45, p. 100720, doi: 10.1016/j.ememar.2020.100720.

Yakubu, I.N. and Bunyaminu, A. (2021), "Regulatory capital requirement and bank stability in Sub-Saharan Africa", *Journal of Sustainable Finance and Investment*, pp. 1-13, doi: 10.1080/20430795.2021.1961558.

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