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Article

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Research in Globalization

Provided in Cooperation with:

Elsevier

Suggested Citation: Alemu, Minyahil; M.K., Jayamohan; Mulugeta, Wondaferahu (2025) : Global connectivity and resilience in African Banking: Role of technology and regulation, Research in Globalization, ISSN 2590-051X, Elsevier, Amsterdam, Vol. 10, pp. 1-15, <https://doi.org/10.1016/j.resglo.2025.100285>

This Version is available at:

<https://hdl.handle.net/10419/331207>

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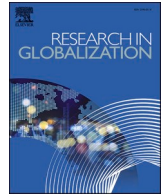
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Global connectivity and resilience in African Banking: Role of technology and regulation

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ARTICLE INFO

Keywords:

Africa
Banking Globalization
Banking Regulation
Digital Banking
Financial Resilience
Financial Markets

ABSTRACT

This study emphasizes three solid questions: (i) the extent to which African banking systems are globalized; (ii) the role of regulation and technology in this process; and (iii) whether economic globalization reinforces banking stability. We conceptualize financial globalization through two symbiotic dimensions; connectivity and resilience, both affected by technological and regulatory designs. Covering 21 African nations and five major global economies, we employ comovement analysis (2000–2023), generalized impulse response functions, and System-GMM (2010–2023). We found strong comovement between African and global banks, especially during the 2007/08 global financial crisis, followed by partial decoupling in its aftermath. Yet, African banks tend to be highly reactive to world liquidity conditions. Financial technology has a dual role: automated teller machine proliferation fosters cross-border activity, whereas mobile banking, though active for domestic inclusion, did less as a global connector due to infrastructural and regulatory curbs. Regulatory capital cushions, chiefly Tier 1 ratios, favor both stability and integration by lowering risk and refining solvency. Trade openness, one facet of economic globalization, also upholds banking stability through greater risk diversification. We suggest adaptive regulatory approaches, like sandbox outlines, and especial support for smaller African banks, for more inclusive and sustainable integration into global financial markets. Future research must expand on regulatory on scope to capture institutional asymmetry and incipient risks within Africa's finance.

1. Introduction

In an era of striking technological and regulatory riots, global finance finds itself at a crossroads. Nowhere is this makeover more vivid than in African banking system¹ where the rise of financial technology (fintech) has redefined not only operational models but also margins of inclusivity. Kenya's M-Pesa, a money mobile platform that enhanced financial access for millions (Ndung'u, 2018), can be a good case in point. The like advances, as noted by Markovich & Snyder (2017), ease financial accessibility, spur income growth, smooth cross-border financial flows, and boost confidence among investors in Africa's financial markets, thereby integrating financial systems across the continent more intricately into global finance.

At the core of this metamorphosis is the evolving role of regulation that increasingly mediates intersection between innovation and institutional resilience. Nowadays, regulators are confronted with a critical

trade-off: to nurture innovation and dynamism while preserving systemic integrity and protecting consumer interests (Zetzsche et al., 2017). The effectiveness of this balancing act hinges on the ability of regulatory systems to inspire trust without stifling creativity. Regulatory sandboxes, structured environs permitting fintech trialing under supervisory oversight, emerge in response to this encounter (Goo & Heo, 2020). Yet, as innovation gains momentum, cross-border asymmetry in regulatory standards within Africa erodes collective headway, cementing division and impeding sustainable integration into regional and global markets.

As digital finance is yet to negotiate exclusion and systemic risk in Africa, it becomes critical to configure technological and regulatory structures. It is true that emerging technologies, including blockchain and artificial intelligence, are transforming the core of banking operation (Baptista & Oliveira, 2015). Nonetheless, without parallel progressions in cybersecurity, data protection, and regulatory stability, it is likely that they amplify systematic risks. Indeed, globalization of finance

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¹ In much of Africa, banks dominate financial systems and, generally, financial derivatives, due to mostly missing secondary markets, are not widely traded. As such, African bank models can effectively represent overall financial systems.

not only introduces new tools but also exposes local systems to greater systematic risks. What is more upsetting is Africa's intense asymmetry in technology, regulatory standard, and the levels of financial development. Despite incredible advances in access, two-thirds of adults in Sub-Saharan Africa (SSA) remained out of formal financial services (Avom et al., 2021). Skepticism toward institutional banking; rooted in political instability and economic lapse, works against technological adoption in much of the region (A. David et al., 2015). But still, fintech innovations are vital solutions to underserved populations. Even so, as Alabi et al. (2023) and (Ahamed et al., 2021b) contend, regulatory inconsistency is deterring the expansion of cross-border banking, mainly in countries with overly restrictive legal requirements.

A credible case thus emerges for lucid, technology-adaptive regulation. Reformist legal systems not only boost innovation but also protect against predatory practices and systemic risk (Sodokin et al., 2023). To Okoli & Tewari (2020), ensuring liable fintech growth depends on identifying regulatory conditions that promote interconnectedness without conceding prudential protections. African banks are still encumbered by legacy systems, deficient human capital, and poor digital infrastructures, further compounded by rising cyber fears: all increasingly critical for consumer confidence and institutional credibility (Skare & Soriano, 2021).

Global integration brings both promise and peril. On one hand, it opens up roads for increased capital flows, knowledge transfer, and market access. On another, it makes local economies more exposed to exogenous shocks, as was starkly revealed during the 2007/08 Global Financial Crisis (GFC). Swift financial contagion of the day has proved the fragility of globally tied financial systems, more severely within Europe (Diebold & Yilmaz, 2009). Multinational banks, operating with opaque and complex structures, can provoke systemic shocks during the like crisis episodes (Leaven & Levine, 2009; Obstfeld & Taylor, 2004). Provided that financial ecosystems in much of Africa are still fusing, it is imperative to probe how such risks spillover and can be contained.

Other than banking globalization, overall economic openness to world markets demands specific attention. Economic globalization has been accredited as a way toward large-sized markets, yet its actual outcomes proved to be far from being consistent. Success does not inevitably come from just opening up to global market forces, but from strategic management of that integration through preserving local priorities and institutional integrity (Pike & Stiglitz, 2004). Conversely, many developing countries, mainly in Africa, practiced globalization as an externally prescribed by the IMF. The outcome has mostly been sustained economic instability, weak safety nets, and stunted development. These raise critical questions: who truly benefits from open markets, and under what regulatory conditions? Milanovic (2003) also argues against globalization as innately benign, pointing to distortions seen in countries that were forced to liberalize without the means to industrialize. Globalization tended to worsen the already prevailing income disparities in these nations rather than close.

Some regions have utilized global integration to spur growth, but others, mainly in Africa, have thrashed to keep momentum (AU, 2019). Periods of openness have largely been followed by backlashes, as seen during the late 19th-century protectionist wave or the interwar collapse in international cooperation (Afolabi, 2022). Hence, globalization is not a one-way path but a process influenced by politics, economics, and institutional conditions. In recent years, global trade has slowed and skepticism toward internationalization has grown while reigniting new views on its stability and future. Yet, globalization today is not only about trade and capital; it critically emphasizes environmental safety, technology, and institutional stability. For African banks, this means both a challenge and opportunity; how well they can withstand external shocks and adapt via smart regulation and technology. This perspective is a key to ensuring long-term stability within the continent's financial ecosystem operating under increasingly uncertain global condition.

While escaping from globalization may seem tempting, it is neither viable nor conceivable. As Hillebrand (2010) notes, rescue from world

markets is unlikely to close inequality and could, in fact, aggravate it. The issue lies in controlling associated risks, like volatile capital flows, public health threats, and environmental pressures, while still hitching its economic potential (Hudson, 2009). Globalization can, therefore, be both an opportunity and threat with this duality needing a shift in approach globalization is abstracted and operationalized. In connection to this, Sumner (2004) identifies between globalization as *liberalization* and globalization as *internationalism*. Liberalization alone does not guarantee stability; what matters most is how it is managed through strong institution, rational regulation, and technological readiness. As to him, globalization turns costly when revealed partially, but when complete could effectively be translated into economic prospects. The way African banks adapt to the needs of global financial markets in this era of rapid digitization and regulatory multiplicity is vague and calls extensive research, which being a significant extension to Africa's financial literature.

While fintech and regulation have gained notable empirical attention separately, little has been paid on their joint impact on bank performance in the spirit we presently are moving with. Much of the literature is compartmentalized; focusing on regulatory reform or technological innovation in isolation without considering how they interact under globalized market functions (Aguegboh et al., 2022; Ahamed et al., 2021a; Chinoda & Kapingura, 2023; Gondwe et al., 2024; Ke et al., 2020; Motelle & Biekpe, 2015). Further, the effect of regulatory inconsistency on banks' ability to absorb external shocks and engage competitively on a global stage remains underexplored.

Typical assumptions linking digital infrastructure investment to higher financial stability warrant revision in Africa. While in developed economies, fintech like automated teller machine (ATM) networks and mobile banking are synonymous with improved efficiency and outreach (Baptista & Oliveira, 2015), such outcomes are not given. African banks operate under different regulatory conditions and harsh capital control limiting foreign entry and suppress competitiveness (Avom et al., 2021). Traditional banking models across the continent have long favored high-net-worth clients, further alienating lower-income segments (Konte & Tetteh, 2023). Even amid increased technological deployment, the sustained prevention of marginalized groups from formal financial services cautions against the return on these investments and inclusiveness of digital banking. We, therefore, posit a more cautious interpretation of the presumed enabling effects of fintech in Africa.

Accordingly, this study confronts a critical question: How do technological and regulatory setups impact global integration of African banks, and how does globalization, in turn, influence bank resistance to systematic risk. We articulate this through three guiding queries: (a) To what extent is Africa's banking sector engaged into global financial markets? (b) How actively are regulatory conditions and digital technologies playing in this process? (c) How does globalization affect banking stability within Africa; does it act as a shock absorber or a stress catalyst? Addressing these, this study pointedly improves on prior works in Africa's banking literature. Of its most unique contributions is the introduction of new metric to capture global exposure by banks: *the share of foreign liabilities in total banking liabilities*. This proxy is more efficient than orthodox indicators, like mere presence of foreign banks (Gondwe et al., 2024; Kusi et al., 2022; Sodokin et al., 2023; Sulemana et al., 2018), in showing how embedded African banks are in global financial circles. Moreover, our simultaneous modeling of banking connectivity and resilience represents a crucial analytical novelty by reflecting on how regulation and technology converge under globalization.

2. Literature Review

2.1. Theoretical insights from Porter's Diamond model

Porter's Diamond Model is a framework for analyzing the competitive advantage of countries in global markets. The model demonstrates

four interrelated elements shaping the environment in which local firms compete: factor conditions (nation's resources), demand conditions (nature of local demand), related and supporting industries (presence of supplier and related industries), and firm strategy, structure, and rivalry, revealing how companies are managed and compete (Grant, 1991). Accordingly, the interplay of these factors can lead to sustainable competitive advantages, affecting innovative potential (Porter, 1991). Regarding Africa's banking sector and its global connectivity; affected by regulatory and technological frameworks, which eventually explain the sector's capability to compete on a global scale.

Within Africa's banking system, *factor conditions* constitute the rich of human capital, financial resources, and technological infrastructures. Africa is endowed with a dynamic labour force that drives innovation and the adoption of fintech solutions, which are vital for boosting the sector's performance (Afolabi, 2022). However, poor infrastructure and digital divides remain challenges that hinder their growth and efficiency (AfDB, 2024). Furthermore, regulatory frameworks can impact the availability of specialists and investment in technology, determining how well banks can exploit their factor conditions to compete on a global scale (Wiersema & Liebeskind, 1995). Moreover, *demand conditions* are a crucial aspect of Porter's framework, referring to the nature and intricacy of home demand for banking services (Ketels, 2006). In Africa, there is a growing demand for open financial services, propelled by urbanization and a growing middle class, thereby fueling innovations like mobile banking and digital wallets (Baptista & Oliveira, 2015). In addition, as customers become more informed and discerning, banks are prompted to foster service quality and diversify their offerings to meet the evolving consumer needs. This, in turn, creates a competitive milieu that drives them to connect with global standards and practices.

Another concern in the theory is the presence of *related and supporting industries*, which is vital for enhancing competitiveness. For example, the development of a robust telecommunications network has facilitated the rapid adoption of digital banking technologies (Vimalkumar et al., 2021) in Africa. Moreover, partnerships with fintech companies can cause innovative solutions that foster efficacy and customer outreach (Zetzsche et al., 2017). By fostering synergies with these related industries, African banks can strengthen their value chain and enhance their role in global finance. Firm strategy, structure, and rivalry made a more case in point. Competitive strategies adopted by banks are vital for navigating the intricacies in the global banking system. Rivalry among institutions within local markets encourages innovation and efficiency, allowing banks adopt international best practices (Konte & Tetteh, 2023). Again, regulatory frameworks, like those set by the African Development Bank, may create a more conducive environment for banks to pursue strategic alliance and merger. As per Ketels (2006), this competitive setup, in turn, compels firms to adopt strategies that prioritize international expansion and technological advancement.

Regulatory landscapes play a crucial role in shaping the reliability of each element in Porter's framework. In Africa, the diverse regulatory setups driving banking operations pointedly impact how institutions engage on a global scale (Sodokin et al., 2023). By harmonizing regulations across borders, banks can improve competitiveness through rationalized operations and lower transaction costs. Additionally, stable regulatory frameworks foster investor confidence, driving greater technology investment that foster banking performance and global market share (Yakubu & Bunyaminu, 2023). Technological environment also profoundly interacts with Porter's model, as the swift adoption of digital technologies is transforming banking operations, service delivery, and customer relations across Africa (Skare & Soriano, 2021). Innovations like blockchain and AI are boosting efficiency and security for effective global competition. In turn, technology facilitates greater interoperability among financial markets in Africa, allowing them to broaden their reach and fortify their competitiveness.

2.2. Existing evidence on Fintech, financial Integration, and beyond

Exploring the intersection of financial technology and banking globalization, particularly within Africa, we uncover a landscape ripe for further inquiry. Despite the growing relevance of fintech, the academic discourse remains remarkably limited. Notable research, such as that by Agoba et al. (2020), indicates vital links between financial globalization, evidenced by FDI flows, and institutional background, particularly central bank independence (CBI), for 48 African nations during 1970–2012. In their findings, while legal CBI appears to have a neutral impact on FDI, the instability brought about by frequent changes in CB leadership detracts from foreign investment flows. This dynamics advocates for stronger political institutions to cultivate an environment conducive to financial globalization. Vitally, the reciprocal relationship identified, where increased FDI can fortify both legal and de facto CBI, stresses a multifaceted view of globalization that integrates technology, governance, and capital flows.

Limited focus to Africa in broader works of banking globalization, including Claessens & Horen (2015) and Minoiu & Reyes (2013), points at a significant research gap. Their analyses of the global financial crisis (GFC) illuminate shifts in cross-border lending, with non-OECD banks gaining ground even as their OECD counterparts retreated. This bifurcation implies a potentially fragmented yet resilient banking system: an important shift for realizing the roles of technology and regulatory conditions in Africa. Yet, inadequate representation of Africa lends a degree of doubt vis-à-vis localized insights into banking dynamism and technology's specific effects. In a broader basis, Skare & Soriano (2021) contextualize the interdependencies of globalization and digital technology, edifying that nations with deep technological adoptions often benefit from enhanced globalization. This underpins the notion that as African standards for technology adoption rise, the potential for deeper financial integration increases.

Further, Asongu et al. (2017) discuss the implications of ICT on financial development across 53 African nations, revealing a robust link between mobile and internet penetration and advances in financial depth and efficiency. Notably, they articulate how public credit registries and private credit bureaus foster information flows, crucial for bolstering financial intermediation. However, they also caution against over-reliance on mobile technology, which exhibits diminishing returns beyond certain thresholds, suggesting that while ICT is pivotal for firming financial systems, enhanced understanding of utilization limits is vital for sustainable growth. Ajide et al. (2019) contribute by exploring dollarization in 25 Sub-Saharan African (SSA) countries. Results show the interplay of social and political factors, which often eclipse economic concerns in driving dollarization trends. This study points the need for addressing macroeconomic vulnerabilities to stabilize local currencies, profoundly crucial for nations that are increasingly reliant on foreign capital flows.

Mobile money has emerged as a transformative force for financial inclusion, as noted by Avom et al. (2023). Their exploration across 50 African nations elucidates that mobile money pointedly advances financial access, suggesting a paradigm shift in traditional banking models. Similarly, a comparative study of China and Nigeria by Alabi & Olaoye (2022) demonstrates the complex link between technological innovations in finance and economic geography, further emphasizing the global interplay at work in nurturing financial inclusivity. Ejemeyovwi et al. (2020) locate ICT and innovation as crucial enhancers of financial development, arguing for proactive ICT investment. Through utilizing of Bayesian Vector Autoregressive (BVAR) technique, the authors revealed that synergistic relation between technology and finance is vital for nurturing inclusive economic growth, a claim that resonates with Ofori et al. (2022), who articulate that improved ICT infrastructure correlates with growth in inclusive financial practices across SSA.

The archetypical benefit of ICT within the fourth industrial revolution is poignantly illustrated by David & Grobler (2020), who advocate for strategic investments in both mobile and fixed-line

telecommunications as critical for harnessing the full economic potential of digitalization. Their work avers that refining a well-rounded ICT setup is foundational for maximizing globalization's benefits. While notable progresses in digital technologies promise significant benefits, challenges remain. Both [Ndung'u \(2018\)](#) and [Iheanachor et al. \(2021\)](#) reveal gaps in research. Ndung'u's analysis of M-Pesa's role in Kenya marks its substantial contribution to its GDP, yet it raises concerns about its implications for transnational financial relations. Iheanachor et al. divulge the operational challenges to financial service agents in Nigeria, favoring adaptive business models amidst evolving regulatory landscapes.

Recent research links financial digitalization, land governance, and inclusiveness, which is vital for agrarian Africa traversing structural change. Studies from China, such as [Xiong et al. \(2024\)](#) and [Zhou et al. \(2023\)](#), file compelling evidence that financial digitization can foster agricultural productivity and ecological quality while facilitating land circulation. By lifting credit controls and fostering market access, it supports consolidation and modernization of smallholder farming. [Xu et al. \(2024\)](#) further shows that productivity gains of technology are better when integrated with investments in energy infrastructure and human capital, contributing to inclusive growth and climate resilience. All these are directly transferable to Africa where land fragmentation hampers productivity. Yet, technological inclusion alone cannot counterbalance severe structural inequality in Africa. As [Goodfellow \(2024\)](#) and [Ouma et al. \(2023\)](#) recently noted, colonial property regimes and institutional legacies continue to reproduce socio-economic stratification in the continent. From a stratification economics, Ouma et al. reframes the dialog emphasizing systemic exclusion over individual access. Without institutional reform, digital and financial innovations risk strengthening rather than reducing existing gaps. Feminist and intersectional views suggest interrogating access to land, finance, and technology as driven by power relations. In general, meaningful inclusion entails not only technological diffusion, but a reconfiguration of institutional settings governing property, finance, and opportunity.

[Manji \(2010\)](#) unpacks the intersection of land titling, credit access, and social stratification. To his empirical observation, asset-backed lending, under the guise of financial inclusion, can inadvertently reinforce gendered and institutional gaps. This is relevant for Africa, as formal land rights remain contested and commercial finance largely excludes women and marginalized rural populations. [Shen et al. \(2023\)](#) further extend this by demonstrating, through empirical analysis in China, that digital inclusive finance can facilitate agricultural land transfer and enhance green total factor productivity. They add, technology-enabled finance, coupled with sound policy and digital infrastructure, can improve both economic and environmental outcomes. These mechanics render instructive parallels for African economies seeking to balance productivity, sustainability, and equity in land use.

Adding to this, [Agwu \(2021\)](#) discusses persistent exclusion of rural populations in developing countries from digital finance. He stresses the critical role of informal financial systems, initiated by trust and social proximity, in serving the unbanked, noting the limits of purely technological fixes without social embeddedness. Rapid growth in financial technology, while likely advancing inclusiveness, can also exacerbate environmental degradation unless complemented with suitable regulatory oversight and resource governance ([Liu et al., 2024](#)). Inclusion, by and large, whether financial, spatial, or institutional, depends not only on technological adoption, but on how they are set in equitable property regimes, responsible governance, and right institutional design. All suggest getting deep into Africa's structural stratification and to craft inclusive schemes in digital financial transition.

2.3. On economic globalization and bank resilience: a review

The discussion surrounding the implications of economic globalization on banking resilience in Africa pinpoints a multi-faceted interplay

between FDI, financial digitization, and economic sophistication. This body of literature emphasizes not just the mechanisms through which these factors converge but also the effects on financial stability. In their seminal analysis, [Nguea et al. \(2022\)](#) dissect the causal linkages inherent in these dynamics using a panel regression covering 27 African nations during 1996–2017. Their findings show the role of financial globalization, trade openness, and FDI in augmenting economic sophistication, while paradoxically suggesting that internet usage may hinder this trajectory. Such dichotomy calls for consistent and coherent policies to foster global integration, promoting sustained efforts to drive product diversity and innovation in banking sectors. The authors advocate for a strategic embrace of globalization that aligns with a nation's broader development agenda—one that concedes both the opportunities and challenges from economic interconnectedness. Broadening this dialogue further, [Agbloyor et al. \(2013\)](#), discuss the reciprocal relation between financial markets and FDI, illuminating how progresses in the banking sector can pointedly amplify foreign investment inflows. Using data from 1970 to 2007, they demonstrate that well-structured financial markets are instrumental in enhancing FDI, fortifying the prominence of a robust domestic financial system. This reciprocal connection paints a picture of interdependence: as banks flourish, they not only facilitate but actively attract foreign capital, which in turn nurtures domestic banking environments.

[Chinoda & Kapingura \(2023\)](#) expand upon these by exploring how digital finance impacts bank stability across SSA. Their use of digital financial inclusion metrics alongside traditional stability indicators, such as the Herfindahl–Hirschman Index and non-performing loans (NPLs), leads to compelling conclusions. They show a positive correlation between inclusive digital finance and bank stability, suggesting that enhanced financial inclusion contributes to reduced NPL levels, a promising indicator for the overall resilience of banking institutions. However, the study also warns of the destabilizing effects that intensified banking competition may engender, illustrating the delicate balance between promoting innovations through competition and ensuring financial stability. In another study, [David et al. \(2015\)](#) scrutinize the interplay among global financial and trade integration and financial development in SSA. Their results reveal a complex picture; while the integration of trade and finance is often heralded as beneficial for development, insufficient evidence supports a direct linkage when accounting for overarching economic factors like GDP per capita. The echoed sentiment here is that the potential benefits of financial integration are often contingent on robust institutional structures. The authors advocate for proactive governance and regulatory reforms aimed at exploiting on the benefits of global integration.

[Banyen & Biekpe \(2020b\)](#) further this debate by probing the link between financial integration and bank profitability within various regional economic communities (RECs) in Africa. They reveal regional heterogeneity in responses to financial globalization, favoring tailored policy schemes that address specific systematic issues. Such understanding of regional asymmetries can inform policymakers navigate the complexities of financial globalization, ensuring that strategies are customized to local contexts. In an exciting counterpoint, [Motelle & Biekpe \(2015\)](#) caution against the unchecked progression of financial integration, positing that it may indeed precipitate systemic instability, particularly in the Southern African Development Community (SADC). Their conclusions resonate with the notion that effective monetary policies and the management of interest and exchange rates are vital in moderating the likely destabilizing effects of deeper financial integration. This points a crucial outlook: without concerted regulation, the benefits of globalization could overshadow significant vulnerabilities within domestic banking systems.

Furthermore, [Oladunjoye & Tshidzumba \(2023\)](#) provide an empirical analysis of the interplay between technology adoption and financial market performance across Nigeria and South Africa, revealing a divergence in outcomes that prompts reflection on the contextual factors affecting financial stability. While technology adoption positively

shapes market performance in Nigeria, the opposite is seen in South Africa, suggesting that such a relation depends on market dynamics and regulatory atmospheres. Asongu & Minkoua (2018) add to understanding financial dynamics more by examining different lines of openness, financial, trade, institutional, and political, on financial development across 28 African nations. Results light the duality of financial openness, whereby some forms stimulate financial system depth while others, like certain types of FDI, can inhibit growth. This informs a nuanced approach to policy-making, as it becomes increasingly clear that distinctions between de jure and de facto measures of openness significantly influence the effectiveness of strategies aimed at enhancing financial development outcomes.

To conclude, studies reveal the criticality of ICT in promoting financial inclusivity and economic development in Africa. However, a significant gap persists apropos the engagement of banks on the continent with global markets, essential for achieving the African Union's goals of regional convergence (AU, 2019). So far, the focus has been primarily on fintech's role in development while neglecting its relationship with banking globalization. The few existing ones provide only short understanding. For instance, while Agoba et al. (2020) discusses financial globalization through FDI inflows, the roles of fintech and regulation discounted. Similarly, although works by Claessens & Horen (2015) and Minoiu & Reyes (2013) discuss global banking connectivity, they inadequately represent Africa, limiting the applicability of their findings to the whole continent.

Toward addressing these gaps, we analyze the dynamics of African banking within the context of globalization, seeking to answer: the degree of interconnectedness with global finance, the effect of banking regulations and digital technologies on this interconnectedness, and the implications of growing economic globalization for resilience in African banking. This study contributes by developing an empirical model of banking globalization, emphasizing that openness to capital flows is more important than the mere presence of foreign banks. While foreign investments can boost banking stability and economic growth, their success highly depends on existing regulatory and institutional qualities. This justifies exploring how fintech and regulation can shape banking globalization in Africa, especially as economic globalization deepens. Another unique feature of this study rests on its simultaneous analysis of banking resilience and globalization. Analyzing the impact of rising economic globalization on banking stability is crucial due to greater systematic risk and competition. Hence, this study will effectively aid in framing policies that balance openness with protective measures, ensuring their competitiveness and stability in an interconnected financial landscape.

3. Methodology

3.1. Data and sample selection

This study draws on annual data from 21 African nations alongside five major global economies, using two distinct time periods to suit the nature of the analysis. To examine how African bank returns, both in stocks and assets, move in relation to global trends, dataset spans from 2000 to 2023 to ensure consistent coverage across all included economies. However, when it comes to investigating the forces behind banking globalization and resilience, the analysis focuses on the period from 2010 to 2023. This shorter window reflects the availability of time-series data on financial technologies, ATM infrastructure, and mobile banking, more widely recorded across much of Africa starting in 2010. To enhance international comparison, five key economies; the United States, United Kingdom, Germany, Japan, and China, are included, given their dominant role in global trade and finance. The full list of countries in the sample is presented in Table 1. The selection of African countries is primarily guided by data availability.

Data from diverse sources including World Bank's World Development Indicators (WDI), IMF's Financial Soundness Indicators (FSI),

Federal Reserve Bank of St. Louis database, and relevant central bank reports are consolidated to obtain banking, institutional, regulatory, macroeconomic, and financial information comprehensively.

3.2. Description of variables

Our investigation into the global connectivity of the African banking sector used data on banks' stock returns and return on assets (ROA). By comparing African banks with those from larger global economies, we explore their comovement and responses to foreign shocks to evaluate their level of global integration.

The rest of questions require estimating two distinct models. The first, which surveys drivers of banking globalization, follows Kim et al. (2015) Kim et al. (2015) and Fiador et al. (2022) by using banks' foreign liabilities as a share of total liabilities to assess exposure to international financial markets. The second model assesses the influence of increasing economic globalization on financial stability in African banks, using Z-scores as the response variables. Z-scores, a robust gage of banking resilience, have been validated in many studies, such as those by Mol-gómez-vázquez et al. (2022), Naili & Lahrichi (2022), and Chinoda & Kapingura (2023). A bank's Z-score is computed using Altman's formula $(1.2A + 1.4B + 3.3C + 0.6D + 1.0E)$,² first developed to forecast bankruptcy risk for manufacturing firms has since been adapted to assess bank stability (Altman, 1968). A score beyond 2.99 is generally considered safe, while it below 1.81 is risky, implicit in the literature on banking stability (Ali & Puah, 2019; Kusi et al., 2022; Sulemana et al., 2018). Its usage is validated by several compelling reasons: Firstly, its simplicity in computation and interpretation makes it a favorable choice (Mol-Gómez-Vázquez et al., 2022). Further, by integrating measures of capital adequacy and profitability, it offers a more complete assessment of the overall financial health of banks (Beck & Ferasso, 2023).

Although both models share several regressors as sources of systematic shocks, each represents unique features. We identify eight potential drivers of global bank connectedness across Africa, informed by empirical literature and theories. Of these, three keys—mobile banking, Automated Teller Machine (ATM) usage, and banking regulatory capital—are critical, as our primary focus is to assess the impact of financial technology and regulatory frameworks on banking stability in Africa. Table 2 presents the panel of variables used in the estimation of the first model:

In our analysis of the impact of economic globalization on the resilience of the African banking system, we consider four key dimensions: trade openness, FDI inflows, ATM infrastructure, and mobile banking services. Trade openness enhances banks' ability to diversify their portfolios and access new markets, fostering stability and promoting economic growth (Asongu & Minkoua, 2018). In particular, banks that engage in international trade financing are better positioned to manage domestic economic fluctuations, improving resilience in volatile milieus (Sulemana et al., 2018). FDI plays a crucial role by not just providing capital but also enhancing technological innovations and expertise that strengthen banks' capital bases and facilitate risk diversification (Bénassy-Quéré et al., 2007). Robust ATM network is also vital greater accessibility, allowing banks to serve customers better and improve operational resilience by reducing transaction costs and increasing customer trust, especially during times of financial distress

² In Altman's Z-score formula specifically adapted for banks, each letter stands for key components: A = Working Capital/Total Assets (showing a bank's operational efficiency and short-term financial health); B = Retained Earnings/Total Assets (reflecting a bank's cumulative profitability and ability to reinvest earnings to support growth); C = Earnings before Interest and Taxes/Total Assets; D = Market Value of Equity/Total Liabilities (used as a gage of a bank's capital structure and provides insight into how the market views the bank's financial stability relative to its liabilities; and E = Sales/Total Assets (indicating a bank's efficiency in generating revenue from its assets).

Table 1
Countries included in the analysis.

Egypt	(a) African Nations	Senegal	(b) Global Economies
Eswatini	Lesotho	Uganda	United States
Gabon	Madagascar	Seychelles	United Kingdom
Ghana	Mauritius	Sierra Leone	Germany
Kenya	Morocco	South Africa	Japan
	Mozambique		China
	Namibia		

Table 2
Variables included in the first model.

Variables	Notation	Definition
(1) Response Variable: Global Connectedness of Banks		
– Foreign Liabilities Ratio	FOLR	The Ratios of Foreign Liabilities to Total Liabilities of Banks
(2) Explanatory Variables		
– Mobile Banking	MOB	Number of Registered Mobile Money Accounts in a Country.
– Automated Teller Machine	ATM	Amount of installed ATMs per 100,000 adults in each Country.
– Regulatory Capital	RCAP	Percentage Ratios of Regulatory Tier 1 Capital as Risk-Weighted Assets of Banks.
(3) Control Variables		
– Z-score (Bank Stability)	STAB	It reflects a bank's possibility of insolvency or financial distress by relating various financial ratios to point its financial health.
– Bank Size	SIZE	Market Capitalization of Banks holdings of Equities.
– Regulatory Quality	RQTY	World Bank's Estimate of countries' strength in their general regulatory frameworks.
– Economic Growth	EG	The Annual Growth Rates in each Country's Real GDP
– Inflation	INF	Annual Growth Rates of Consumer Price Indices (CPI) for each country in the sample.

(Wang et al., 2023). Mobile banking has also improved financial access for unbanked groups, fostering inclusivity and enabling banks diversify customer bases (Kim, 2022).

Furthermore, we have controlled for the effects of regulatory, bank-specific, and macroeconomic factors on banking stability. Regulatory capital, particularly the Tier 1 capital ratio measured against risk-weighted assets, is crucial for banking system stability as it ensures banks maintain a buffer against potential losses, thereby enhancing their resilience to economic shocks (Allen et al., 2012). Larger banks, indicated by higher market capitalization, can diversify their portfolios and absorb risks more effectively, but they may also introduce systemic risks if too big to fail (Terraza, 2015). GDP growth and inflation can affect bank performance; stable growth promotes lending and reduces default rates, while high inflation can erode asset values and decrease real income (Igan et al., 2011). A balanced interaction between these factors; adequate regulatory capital, optimal bank size, and fortunate macro-economy, contributes to a robust banking system, mitigating the risks of financial crises.

4. Data analysis

This study focuses on examining the interconnectedness of the African banking sector with the global economy. It involves evaluating the interactions between local banks and global financial markets, along with assessing the influences of global economic conditions on the resilience of local banking institutions.

4.1. Pair-wise correlations and Impulse-Response functions (IRFs)

Our empirical investigation sets out to unravel the intricate web connecting banks across Africa with their counterparts in major global economies, including the USA, the UK, Germany, Japan, and China. Mirroring the approaches used by Yang et al. (2024) and Binici et al.

(2012), we analyze pair-wise correlation to uncover the comovement of stock returns between African and foreign banks. This enables us to effectively assess the degree of synchronization in bank stock returns, quantifying both the strength and direction of their linear associations (Pesaran, 2007). By calculating correlation coefficients for each pairing of bank stocks, we illuminate the extent to which fluctuations in stock returns are intertwined, capturing market interdependencies and potential systemic risks that traverse regions.

We also have conducted an impulse-response (IR) analysis of African stock returns, assessing the effect of various economic shocks from major global economies. This enables us to capture the dynamic interdependencies and evaluate the sensitivity of African bank stocks to unexpected changes in external economic policies. In spite of examining country-specific foreign shocks, we have analyzed shocks in global oil market in relation to its dynamic influence on African stock returns, enhancing our understanding of the financial markets dynamics on the continent. In this context, African stock returns serve as the response variables in the estimation of a generalized VAR model, including key foreign series (interest rate, money supply, and inflation rate), along with global factor (oil prices) as potential regressors.

Our way relies on analyzing generalized impulse-response functions (GIRFs), as it offers distinct benefits over structural IRs due to its flexibility, ease of implementation, and data-driven nature. Unlike structural methods, which entail rigid theoretical assumptions and model specifications, GIR is based on standard VAR models that capture the actual dynamics among series without imposing stiff constraints (Ewing et al., 2007). This allows for a more accurate representation of real-world interdependencies, making results more robust and applicable across various contexts. Further, its reduced reliance on potentially incorrect structural assumptions ensures that results are rooted in empirical data, ensuring greater reliability (Dees et al., 2007), beyond being well-suited for probing complex links in a pragmatic and accessible manner (Ong & Sato, 2018).

Table 3
Description of variables constituting the estimation of model II.

Variables	Notation	Definition
(1) Response Variable: Banking System Resilience		
– Bank Z-score	STAB	It shows a banks' risk of insolvency or financial grief by taking various financial ratios to point its financial health.
(2) Principal Regressors: Dimensions of Globalization		
– Trade Openness	OPEN	Total Trade (Export + Import) as a Share of GDP for each Country
– FDI Inflows	FDI	Net Inflows of FDI (in natural logarithms) in each Nation
Mobile Banking	MOB	Number of Registered Mobile Money Accounts in a Country.
– Automated Teller Machine	ATM	Amount of Installed ATMs per 100,000 adults in each Country.
(3) Control Variables		
– Regulatory Capital	RQTY	Percentage Ratios of Regulatory Tier 1 Capital as Risk-Weighted Assets of Banks for each nation
– Bank Size	SIZE	Market Capitalization of Banks holdings of Equities.
– Economic Growth	EG	Annual Growth Rates in each Country's Real GDP
– Inflation	INF	Annual Growth Rates of Consumer Price Indices (CPI) for each Nation.

4.2. Dynamic panel System-GMM specification

For two of its enduring objects, this study uses system generalized method of moments (system-GMM) techniques within dynamic panel modeling (DPM) framework, incepted by [Arellano & Bover \(1995\)](#) and further developed by [Blundell & Bond \(1998, 2023\)](#). System-GMM enhances panel analysis with its flexible variance-covariance estimation (VCE), ensuring unbiasedness and greater efficiency ([Banyen & Biekpe, 2020](#)). It seamlessly integrates instrumental variables (IVs) directly into the dataset through a dual-equation system, which includes data differentials and transformations to boost efficiency ([Gondwe et al., 2024](#)).

To our context, the use of system-GMM estimator is supported by several compelling rationales. Firstly, the cross-sectional dimension ($n = 21$) surpassing temporal dimensions ($T = 12$) within each country align well with a requisite ([Blundell & Bond, 2023](#)). Secondly, it houses pre-determined factors, particularly crucial as the regressors are not entirely exogenous and possess pre-determined features. These, correlated with earlier errors and no direct links to later errors, serve as potent instruments ([Adedoyin et al., 2021](#)). Again, system-GMM effectually addresses unobserved temporal effects considering unobservable country-specific effects via differencing and IVs techniques ([Arellano & Bover, 1995](#)). Rigorous tests like Sargan and Hansen ensure instrument validity and guard against residual correlation. Default robust standard errors counter heteroscedasticity issue, fostering reliability further. Its adeptness in mitigating omitted variables bias and endogeneity issues in cross-sectional estimates is notable ([Avom et al., 2021](#)). Using a range of instruments and conversions to enforce exogeneity, it ensures efficiency and mitigates endogeneity, heteroscedasticity, and autocorrelation, making it superior compared to traditional methods ([Asongu & Minkoua, 2018](#)). In alignment with former studies in the literature ([Banyen & Biekpe, 2020](#); [Gondwe et al., 2024](#); [Latif et al., 2018](#); [Ofori et al., 2022](#); [Sulemana et al., 2018](#); [Yakubu & Bunyaminu, 2023](#)), we specify the DPM linking financial technology and banking regulatory capital with respective holdings of foreign liabilities.

In this study, we estimate two different System GMM specifications. The first models the drivers of African banks' global connectivity while addressing three key issues: persistence in foreign liabilities ($FORL_{it}$), endogeneity among regressors, and unobserved bank-specific heterogeneity (μ_i). Persistence in $FORL_{it}$ is captured by including its lagged terms ($FORL_{i,t-s}$), but this hosts endogeneity since they are correlated with unobserved bank-fixed effects μ_i . More, bank-specific factors are possibly endogenous due to simultaneity or reverse causality. System GMM resolves these by estimating two equations at a time. Difference

is therefore given by

$$FORL_{i,t} = \alpha_1 FORL_{i,t-1} + \alpha_2 FORL_{i,t-2} + \eta_1 \ln MOB_{it} + \eta_2 \ln ATM_{it} + \eta_3 RCAP_{it} + \eta_4 Z.score_{it} + \eta_5 EG_{it} + \eta_6 INF_{it} + \eta_7 RQLTY_{it} + \eta_8 SIZE_{it} + \mu_i + \varepsilon_{it} \quad (2)$$

While the system combines both equations, the model specification for interpretation purposes focuses on the level equation since the difference equation primarily serves a transformation for estimation ([Roodman, 2009](#)). In specifications (1) and (2), $FORL$ denotes bank foreign liability as a percentage of its total liabilities, while MOB indicates the number of registered mobile banking accounts in the i th country. ATM is the existing stocks of Automated Teller Machine infrastructure within a nation, and $RCAP$ is the ratio of regulatory Tier 1 capital to risk-weighted assets for banks. The rest included a set of control variables outlined in [Table 2](#). Panel fixed-effects coefficient μ_i shows the average unique effect of individual banks, accounting for fixed panel-specific influences. It helps address unobservable heterogeneity related to country or time. The error term ε_{it} represents unobserved random shocks impacting banks' foreign liabilities, unexplained by a set of regressors and μ_i .

For the default short-run System GMM coefficients, we fit model (2) using moment conditions³ of $\Delta \varepsilon_{it}$. Above, lagged dependent, $FORL_{i,t-1}$, serves GMM-type instrument, while pre-determined factors in their first-differences are IVs in estimating difference GMM ([Blundell & Bond, 1998, 2023](#)). We again retrieve manually the corresponding model long-run coefficients after fitting the default short-run estimates, following the approach in GMM literature ([Farhadi, 2015](#); [Reed & Zhu, 2017](#)) that is based on dividing only the coefficients that demonstrate short-significance by the differences between unity and a coefficient on lagged dependents, as follows:

$$\beta_\ell = \frac{\eta_\ell}{1 - (\alpha_1 + \alpha_2)} \quad (3)$$

Where β represents long-run coefficients corresponding to each explanatory variable in bank global connectivity model, with α denoting their respective short-run System GMM coefficients from joint estimations of equations (1) and (2).

Likewise, regarding resilience drivers of African banking, we exactly follow the same procedure. System GMM for African Banks' resilience is specified using our variables of interest detailed in [Table 3](#) as follows, with difference equations (4) and level equations (5) appearing subsequently:

$$\Delta Z.score_{i,t} = \alpha_1 \Delta Z.score_{i,t-1} + \alpha_2 \Delta Z.score_{i,t-2} + \eta_1 \Delta OPEN_{it} + \eta_2 \Delta FDI_{it} + \eta_3 \Delta ATM_{it} + \eta_4 \Delta MOB_{it} + \eta_5 \Delta EG_{it} + \eta_6 \Delta INF_{it} + \eta_7 \Delta RCAP_{it} + \eta_8 \Delta SIZE_{it} + \Delta \varepsilon_{it} \quad (4)$$

equation, which eliminates fixed effects μ_i via first differencing for analyzing bank globalization is given by equation (1) below:

$$\Delta FORL_{i,t} = \alpha_1 \Delta FORL_{i,t-1} + \alpha_2 \Delta FORL_{i,t-2} + \eta_1 \Delta \ln MOB_{it} + \eta_2 \Delta \ln ATM_{it} + \eta_3 \Delta RCAP_{it} + \eta_4 \Delta Z.score_{it} + \eta_5 \Delta EG_{it} + \eta_6 \Delta INF_{it} + \eta_7 \Delta RQLTY_{it} + \eta_8 \Delta SIZE_{it} + \Delta \varepsilon_{it} \quad (1)$$

Where, Δ is the first-difference operator, and all the rest notation are as detailed in [table 2](#). Here, lagged levels of endogenous variables are used as instruments for their first-differenced forms. The level equation with lagged first differences as instruments for endogenous variables in levels

And, the corresponding level equations becomes

³ $E(\varepsilon_{it}) = 0, E(\varepsilon_{it}, X_{it}) = 0, E(\varepsilon_{it}, \mu_{it}) = 0, E(\mu_{it}) = 0.$

Table 4

Full-sample Correlation between Bank Stock Returns.

	Africa	USA	UK	Germany	Japan	China
USA	0.2514	1.000				
UK	0.3744**	0.7814***	1.000			
Germany	0.4545**	0.2507	0.3947**	1.000		
Japan	0.3111*	0.4735**	0.5602***	0.3179*	1.000	
China	−0.0169	0.2261	0.1695	0.1156	−0.1043	1.000

***, ** & * conveys significance at the 1%, 5% and 10% levels respectively.

Table 5

Sub-sample Correlations of Bank Stocks.

	Pre-GFC Period Africa	During-GFC Africa	Post-GFC Period Africa
USA	0.0527	0.7788	0.3643
UK	0.2194	0.9339	0.4881*
GER	0.5016**	0.8569	0.1932
Japan	0.3313	0.8970	0.3597
China	−0.1605	0.9112	−0.0855

** & * refers to significant correlations at the 5% and 10% levels.

$$Z.score_{it} = \alpha_1 Z.score_{it-1} + \alpha_2 Z.score_{it-2} + \beta_1 OPEN_{it} + \beta_2 FDI_{it} + \beta_3 ATM_{it} + \beta_4 MOB_{it} + \beta_5 EG_{it} + \beta_6 INF_{it} + \beta_7 RCAP_{it} + \beta_8 SIZE_{it} + \mu_i + \varepsilon_{it} \quad (5)$$

As in the specification for bank connectivity, long-run GMM coefficients for banking stability models are generated by dividing significant short-run estimates by $1 - \alpha_1 - \alpha_2$, where α_1 and α_2 are significant lagged coefficients of dependent variables (bank Z-scores here). From Table 3, key aspects of globalization: FDI inflows, trade openness, and financial technologies (MOB and ATM use), are principal factors of bank stability.

5. Empirical analysis

5.1. African banking sector alignment with major global banks

(a) Comovement of bank stocks

Table 4 reports pairwise correlation coefficients between the stock returns of African banks, averaged across 21 nations, and those of major global banks based in the US, the UK, Germany, Japan, and China. The results below pertain to the full sample period.

We establish a generally positive, though varying, degree of correlation between African bank stock returns and those of key global banks. African banks have a mild association with the US at a correlation of 0.25. While this suggests a degree of comovement, it lacks statistical vigor and may not be dependable. Conversely, the correlation with the UK is notably stronger, at 0.37. This signals a more important degree of interconnectedness; shocks in the UK could greatly disrupt financial markets across Africa. Germany makes an even more marked bondage at 0.45 %; thus developments in its banking system could be key external factor of African stock performance. Investors and policymakers may therefore benefit from closely tracking financial trends in both the UK and Germany, given their outsized influence on African markets.

Turning to Asia, Japan stands out with a positive correlation of 0.31, which reaches significance at the 10 % level. Though somewhat weaker, this still points to a degree of co-movement worth monitoring. Japanese market shocks may exert a ripple effect not only on African stocks but across all regions included in the model, underscoring its growing relevance in global finance. On the other hand, China appears to have trivial role. Shocks to China's financial markets do not obviously impact African equities means a limited financial interdependence between them.

Below, Table 5 summarizes pairwise correlations across three

distinct periods in relation to the potential impact of Global Financial Crisis (GFC)⁴: pre-GFC (2000–2006), during crisis days (2007–2009), and post-GFC (2010–2023). These help probe the extent to which African stocks have moved in tandem with global trends across different economic phases.

Earlier to the crisis, the degree of correlation between African bank stocks and global markets had sizable variation. Germany stood out with the strongest parallel at 0.50; the country had a relatively close connection between African bank stocks. Developments in the German banking system had a discernible influence on African markets during more stable times. Conversely, the weakest, and notably negative, correlation was observed with China (−0.16) to indicate a clear divergence in market behavior. Yet, as GFC unfolded, a swift shift occurred. Correlations surged across all; African stocks became increasingly synchronized with global financial cycles. The US and UK recorded particularly sharp increases, reaching correlations of around 0.78 and 0.94, respectively. Even China, which formerly had minimal connection jumped to 0.91. It is clear that African banks tend to move more closely with those of foreigners during stress conditions.

Post-crisis, this heightened level of interconnectedness began to fade. While the UK maintained a relatively strong correlation at 0.49 %, most other linkages weakened. Germany's intensity of linkage dropped to 0.19 %, and the U.S. down to 0.36 %, both finding they less important in world finance after the shock. Most notably, the relationship with China turned slightly negative again (−0.0855), indicating a renewed divergence in stock movements between African and Chinese banking sectors. By and large, GFC temporarily deepened Africa's financial ties with western markets. But, as conditions stabilized, many of these ties loosened, reflecting both a return to regional trends and growing independence of African banks. For investors and policymakers alike, this submits better resilience and growing autonomy post-GFC of African finance.

We augment this discussion with a bit of graphical analysis next. Fig. 1 depicts a scatterplot of correlation matrix over the entire period

⁴ GFC of the day was the most severe universal downturn since the Great Depression of 1929 (Claessens & Horen, 2015). It was triggered by the collapse of U.S. housing market following a wave of defaults on subprime mortgages. Financial institutions trading in heavy instruments like mortgage-backed securities (MBS) faced substantial losses as the value of these assets declined falling housing prices.

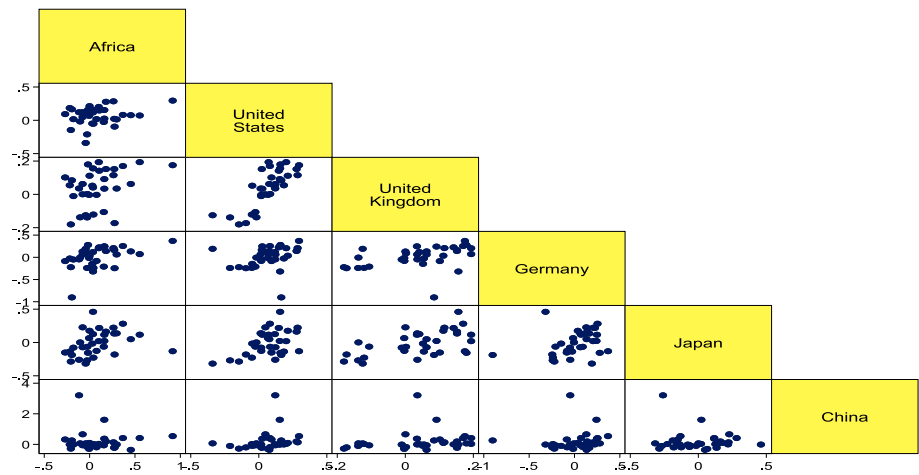


Fig. 1. Stock Return Correlation Matrix Plot.

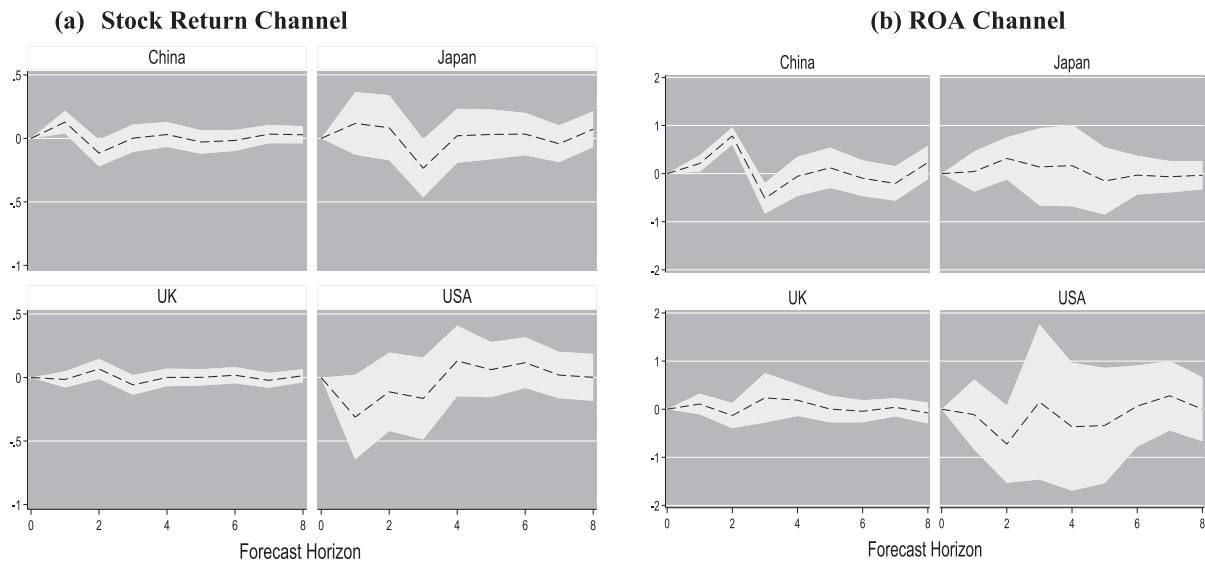


Fig. 2. African Banks Sensitivity to Foreign Interest Rate Shocks.

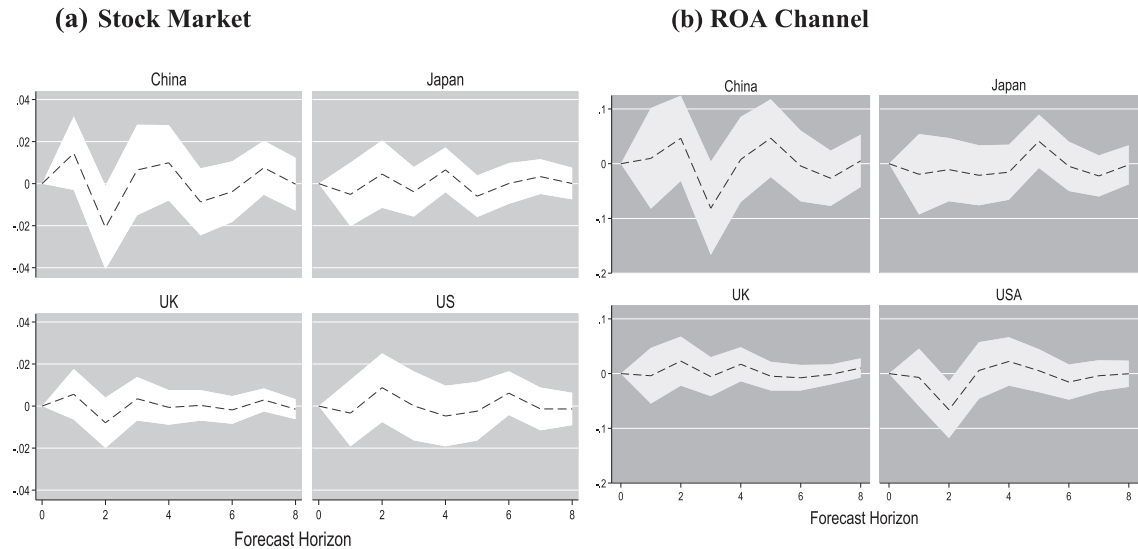


Fig. 3. African Banks Responsiveness to Foreign Liquidity Shocks.

using stock returns:

One of the key takeaways from Fig. 1 is the evident interdependence between African banks and developed markets, most notably the UK, Germany, and Japan. African bank stocks tend to be increasingly shocked by global trends, possibly due to rising FDI inflows, the expansion of cross-border banking activities, and the adoption of international financial regulatory standards (Kuraoune et al., 2020). Increased correlations during GFC resulted in more synchronized actions between African and foreign banks. Lower correlations observed in the more stable post-crisis period, on the other hand, point to some resilience within African banking systems and a partial decoupling from external volatility. With most coefficients remaining below 0.5, African markets appear to retain a degree of independence. This makes them particularly appealing to risk-averse investors seeking diversification, as African assets may yield returns that are less tightly linked to swings in major global markets.

(b) Interdependence between African banking sector and the world market

Here, we analyze the responsiveness of Africa's banking system to sudden shifts in economic and financial policies from larger economies. Utilizing generalized vector autoregressive model, we examine impulse-response functions (IRFs) to assess the effect of foreign shocks on key banking metrics on the continent.

(c) African banks stock returns reaction to shocks in foreign interest rates

In panel (a) of Fig. 2 below is the GIRF showing how stock market returns in Africa react to interest rate shocks from the US, UK, Japan, and China, showcasing the dynamic effect of global monetary policies. Initially, the response to a US interest rate shock reveals a significant negative impact on African bank stock returns, indicating that increases in US rates lead to reduced stock performance. This suggests a strong interconnectedness between the African banking sector and the US market, likely driven by capital flows and investor sentiment. In contrast, the reaction to UK interest rate shocks is also negative but less pronounced than that of the US, showing the UK's relatively reduced role in global finance. Influences from Japan and China are even more subdued, with only a slight negative response to Japanese shocks. Similarly, the response to Chinese shocks is minor, demonstrating that African banks are less sensitive to changes in the monetary policies of these two economies.

In panel (b), the GIRFs illustrate varying levels of bank sensitivity to foreign interest rate shocks through their ROA. Response to US shocks is significant, imposing a substantial negative effect on African banks' ROA. Rising US rates lead to decreased profitability, likely due to capital drainages and large borrowing costs. This negative response being pronounced and sustained signals the dominance of US monetary policy on Africa's financial stability.

Conversely, African banks exhibit less severe reactions to UK and Japanese shocks. ROA drops following interest rate shock in the UK, but with less intensity compared to the US, revealing moderate integration between African and UK financial markets. Responses to Chinese shocks are relatively muted, with minimal negative influence; African banks are less affected by China's interest rate changes due to the nature of their economic ties and financial flows. Overall, US interest rate shocks have a dominant influence on Africa's stock and asset market returns, while the effects from UK, Japan, and China are weaker. Consequently, African banks should closely monitor developments in US monetary policy, as these carry significant implications for their financial stability.

(d) Responses to foreign liquidity shocks

Fig. 3 provides response patterns of African bank stock returns (panel a) and ROA (panel b) to money supply shocks devising from the same foreign economies as before. In panel (a), which focuses on stock returns, unanticipated changes in liquidity from China and Japan elicit a more pronounced negative reaction. African bank stock returns decline significantly following these shocks, revealing that monetary policy changes in China and Japan can affect investor sentiment and capital flows, thereby affecting African banks. In contrast, response to UK liquidity shocks is also negative but less pronounced than that of China and Japan. While UK liquidity does affect African banking stocks, its influence is comparatively weaker, reflecting a more limited financial interdependence.

From panel (b), liquidity shocks from China and Japan consistently have a significant negative impact on ROA for African banks, leading to a marked profitability decline. Shifts in Chinese and Japanese liquidity affect capital flows and investor sentiment, reducing the financial health of banks. In comparison, UK liquidity shocks also impose negative effect but remarkably less useful as compared to either China or Japan. While UK liquidity does affect ROA of banks in Africa, the pressure is relative weaker; means that it makes more limited financial bondage with Africa. In general, foreign liquidity shocks exhibit a substantial effect on both equity and asset returns of African banks, mainly from China and Japan. Banks on the continent need to closely monitor global monetary developments to foster resilience.

(e) Bank stock sensitivity to foreign inflationary shocks

GIRFs in Fig. 4 present bank responses to foreign inflationary shocks, enlightening generally asymmetric reactions. In panel (a), inflation shocks from China and Japan elicit a muted response from African stocks, suggesting that financial markets on the continent are relatively insulated from price pressures from these countries, perhaps indicating limited direct economic ties.

In contrast, inflation shocks from the UK and the US result in more significant negative effects on stock returns. The pronounced declines following these shocks indicate that African financial markets are markedly driven by inflationary trends in these major economies.

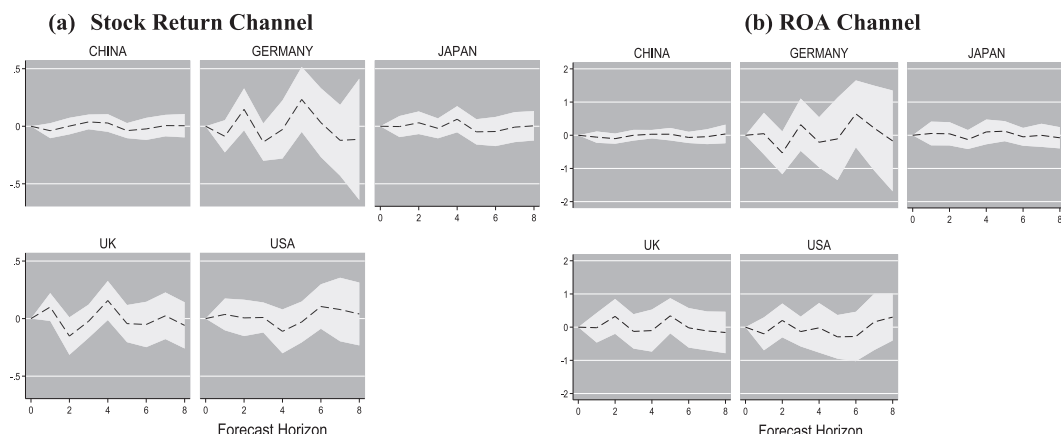


Fig. 4. African Banks Reaction to Foreign Inflationary Shocks.

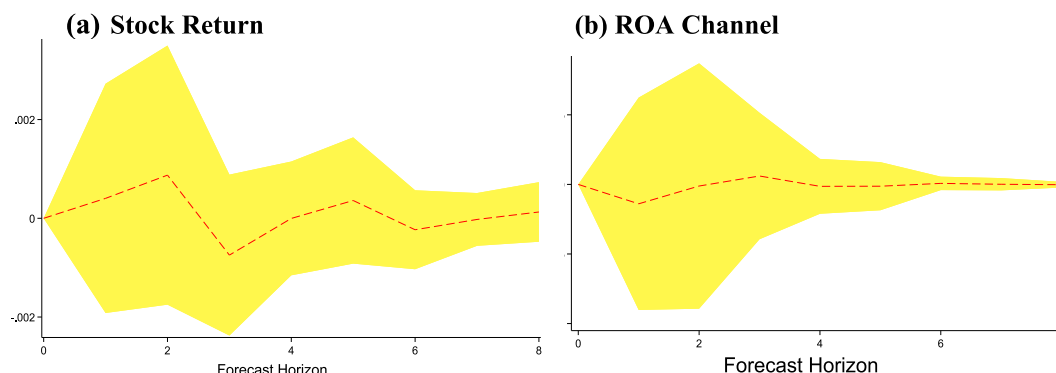


Fig. 5. Reaction to Oil Price Shocks.

German inflation shocks typically lead to moderate negative impacts on African stock returns, suggesting a degree of responsiveness to inflationary forces from Germany, a key player in global trade. The ensuing drop in stock returns may reflect interconnectedness between the European and African markets. Given Germany's profound role in EU trade (Furceri et al., 2022), fluctuations in its inflation can affect European investor perceptions and capital flows toward Africa.

Panel (b) illustrates the varied responses of African banks' ROA to foreign inflationary pressures of different origin. In response to inflation shocks from China, African banks experience a modest negative effect on ROA; inflationary trends in China can affect their financial positions due to interconnected trade and investment channels. German inflation also reduces ROA, albeit to a lesser extent than those from China. While German inflation does affect African banks, the response is more subdued, likely demonstrating a more limited direct economic interconnection. Contrariwise, price shocks from the UK and the US induce more significant drops in ROA, demonstrating substantial impact on African bank profitability. This dynamic informs players in African financial markets to stay alert to inflationary trends in the UK and the US.

(f) Bank reaction to global oil price shocks

Panel (a) of Fig. 5 below presents the GIRF showing how African stock returns react to global oil price shocks over an eight-step horizon. Initially, there is a slight positive response in stock returns, indicating that African markets may benefit from rising oil prices, likely due to increased revenues in oil-exporting nations (Omohoro-Jones & Bonga-Bonga, 2021). However, this response did not persist, but weaken over time and trends toward zero. This dynamic may reveal market adjustment to the shock, as initial optimism is countered by other factors or market sentiments that stabilize returns (Binici et al., 2012). While African stocks may see a temporary boost from rising oil prices, the long-term effects are marginal, prompting investors to consider other fundamentals that could influence market performance permanently.

The response path of ROA to oil price shocks is represented by panel (b). Initially, ROA exhibits slight negative response to rising oil prices, possibly reducing bank profitability in Africa. This may stem from increased operational costs for businesses that depend on oil, potentially reducing lending activity and lowering banks' asset returns (Bapat, 2017). While the immediate effects are negative, they do not result in a sustained decline in bank profitability.

5.2. Global Meeting of African Banking: What role from Technology?

In this sub-section, we examine the factors driving international banking engagement in Africa, placing particular emphasis on the impact of digital technologies and regulation. To enhance our dynamic analysis of Africa's financial sector, we have also considered various macroeconomic and bank-specific factors. Empirical results from our dynamic panel system-GMM regression are in Table 5 below. The dependent variable representing banks' global connectivity is given by

the ratio of foreign liabilities to total liabilities.

Analyzing potential drivers of bank global connectivity in Africa reveals several lessons from Table 5. A significant short-run first-lagged coefficient of FORL(1) stands at 0.553; last year's external liabilities strongly impact this year's connectivity, implying bank persistence in world markets. However, the second-lag effect is notably negative at -0.283 , suggesting an adjustment process in banks' international liability holdings.

When evaluating the ATM infrastructure, a positive short-run coefficient of 0.016 and a long-run coefficient of 0.0356, both significant at the 5 % level, point to its vital role in enhancing banking globalization. This aligns with Porter's demand conditions; improved bank access likely fuels growing demand for financial products, facilitating cross-border transactions (Grant, 1991). Conversely, findings related to banking regulatory capital (RCAP) present robust short-run and long-run coefficients of -0.022 and -0.050 , respectively. This shows that higher regulatory capital requirements may frontier banks' global engagement, echoing Porter's insight into how local demand conditions can shape competitive strategies (Wiersema & Liebeskind, 1995).

The Z-score, which reflects bank stability, shows a marginally significant short-run estimate of 0.579 at the 10 % level and a more pronounced long-run estimate of 1.296. Greater financial stability correlates with increased global connectedness, stressing the importance of institutional health in responding to global demand. Bank size (SIZE), reflective of market capitalization, yields significantly positive coefficients in both short-run (0.010) and long-run (0.023) models. This shows that larger banks are better equipped to engage with foreign liabilities, echoing the competitive advantages discussed in Porter's model, where established firms are often more adept at exploiting demand opportunities in global markets (Ketels, 2006).

Regarding the implications of digital banking practices, findings highlight a mixed impact of financial technology adoption on global

Table 6
Dynamic Panel, two-step, system-GMM Estimates (Model I).

Variable	Short-run Coefficients	Long-run Coefficients
FORL (Lag 1)	0.553(0.000)***	
FORL (Lag 2)	$-0.283(0.005)**$	–
Mobile Banking (MOB)	$-0.043(0.657)$	–
Automated Teller Machine (ATM)	0.016(0.004)**	0.0356(0.005)**
Regulatory Capital (RCAP)	$-0.022(0.046)**$	$-0.050(0.041)**$
Z-Score	0.579(0.074)*	1.296(0.028)**
Economic Growth (EG)	$-0.009(0.253)$	–
Inflation (INF)	0.008(0.161)	–
Regulatory Quality (RQTY)	$-0.448(0.246)$	–
Bank Size (SIZE)	0.010(0.000)***	0.023(0.002)**
Wald χ^2 statistic: 3715(0.000) Arellano-Bond test for AR(2) Test: $-1.11(0.265)$ Sargan overid. Restrictions Test: 3.89(0.143) Hansen overid. Restrictions Test: 2.64(0.267)		

Numbers in parentheses () are the p-values. ***, **, & * show significance at the 1%, 5%, 10% levels.

Note: we report only significant coefficients in the long-run.

Table 7
Dynamic Panel Estimates, Two-step System GMM (Model II).

Variable	Short-run Coefficients	Long-run Coefficients
Z-score (Lag 1)	0.733(0.106)***	–
Z-score (Lag 2)	0.124(0.087)	–
Trade Openness (OPEN)	0.131(0.052)**	0.491(0.128)***
Foreign Direct Investment (FDI)	– 0.014(0.012)	–
Automated Teller Machine (ATM)	– 0.004(0.002)**	– 0.017(0.006)**
Mobile Banking (MOB)	– 0.001(0.022)	–
Economic Growth (EG)	– 0.004(0.011)	–
Inflation (INF)	0.001(0.008)	–
Bank Size (SIZE)	0.001(0.0002)**	0.002(0.001)**
Regulatory Capital Tier 1 (RCAP)	0.0003(0.001)	–
Wald χ^2 statistic	239000(0.000)**	
Arellano-Bond test for AR(2) Test	0.39(0.352)**	
Sargan overid. Restrictions Test	1.41(0.235)**	
Hansen overid. Restrictions Test	0.00(1.000)**	

***, ** denote significance at the 1% and 5% levels, respectively.

Note that numbers in the parentheses () are the standard errors, and we report only significant estimates in the long-run.

engagement. While ATM infrastructure emerges as a vital enabler for financial transactions and international operations, mobile banking's role is limited. The positive impact of ATMs supports Porter's demand model by improving access to financial services, increasing foreign liabilities as banks more actively engage in international markets. In contrast, mobile banking does not yet translate into enhanced global connectivity among African banks. This may stem from various factors, including infrastructural constraints (Baptista & Oliveira, 2015), regulatory issues (Picoto & Pinto, 2021), and consumer trust issues (Kamboj et al., 2022; Malaquias & Hwang, 2016). While mobile banking holds promise for boosting financial inclusion, its effect on bank globalization remains underexploited.

5.3. Does globalization enhance banking resilience in Africa?

Another drive for this study is to check whether the rise in economic globalization has wired or dented banking stability in Africa. We have analyzed three aspects of globalization, while also controlling for other relevant factors, through system GMM technique. Table 6 below reports the empirical results.

One key finding from Table 7 is the significant impact of historical bank stability, indicated by the first-lagged Z-score of 0.733; banks exhibiting a strong stability profile are likely to maintain that standing in the following year. This persistence suggests that financial institutions benefit from solid bases and sound practices, supporting Porter's concept of factor conditions (Porter, 2017). Over time, however, this stability does not appear to persist indefinitely, with a lesser second-year coefficient of 0.124, showing the need for ongoing vigilance and proactive measures to sustain financial health. Furthermore, the positive link between trade openness and banking stability underscores the role of globalization in this context. With coefficients of 0.131 in the short run and 0.491 in the long run, increased engagement in global trade appears to enhance bank stability significantly. This finding also aligns with Porter's demand conditions, as greater market exposure helps banks diversify their income sources and mitigate risks associated with localized economic downturns (Porter, 1991). As African nations deepen their integration into world trade, banks can better weather country-specific shocks, fortifying their resilience.

The size of financial institutions also plays a critical role in their stability. Findings indicate that larger banks benefit from economies of scale, with robust short-run and long-run coefficients of 0.001 and 0.002, respectively. This stability can be attributed to their capacity to spread risks effectively, indicating the relevance of firm strategy, structure, and rivalry in Porter's framework (Ketels, 2006). Larger banks not only enhance their resilience but are also better positioned to compete in both regional and global markets.

Conversely, our findings show a negative correlation between ATM usage and financial stability, suggesting that increased access may inadvertently elevate operational costs, thus impairing profitability. The short-run estimate of -0.004 and the long-run estimate of -0.017 indicate that unless banking services efficiently reach unbanked or underbanked populations throughout Africa, investments in technology can lead to adverse effects. This finding implies the necessity of integrating technological advancements within a broader strategic framework, encompassing Porter's concept of related and supporting industries (Grant, 1991). Additionally, the analysis of mobile banking shows a negative coefficient of -0.001 , which, although not statistically robust, raises questions about the effectiveness of technological innovations in enhancing banking stability in Africa. This underscores the importance of ensuring that advancements in technology are coupled with efforts to address infrastructural and educational barriers. Without effectively reaching marginalized demographics, the benefits of mobile banking may remain unrealized, echoing Porter's assertion that competitive advantages are contingent upon leveraging resources and capabilities strategically (Wiersema & Liebeskind, 1995).

What general generally be learnt? Trade openness generally plays a positive role; as African nations deepen their global engagement in trade, banks may benefit from a more integrated financial environment and increased competitiveness. While FDI can lead to significant capital influx and economic growth, its impact on bank stability deserves due attention. Factors like type of investment, regulatory quality, and absorptive capacity of local banks can determine whether FDI boosts resilience or presents new risks (Bénassy-Quéré et al., 2007). The role of technology, analyzed through ATM usage and the proliferation of mobile banking, adds further complexity. Their success often hinges on existing infrastructure, institutional bases, and customer literacy (Alabi et al., 2023). Mixed results across various lines indicate that globalization does not exert a straightforward influence on African banking stability. Instead, its effects are contingent upon specific economic, institutional, and regulatory contexts, as well as the particular dimensions of globalization in question. This needs tailored policy approaches that account for local conditions and asymmetries across countries. While globalization presents opportunities for Africa in trade and technology, the diverse outcomes emphasize the importance of considering conditions that may influence its potential benefits, which is beyond our current scope.

6. Concluding remarks

Banks in Africa are strongly connected globally through their stock returns, especially during crisis episode. African banks are highly exposed to global financial shocks despite some signs of increasing disconnect post-GFC era. Notably, they are extremely sensitive to changes in global interest rates, liquidity conditions, and inflation; financial systems across the continent remain structurally tethered to global capital flows.

ATM networks significantly contributed to more financial globalization of Africa by enhancing financial access, easing cross-border transaction, and increasing foreign claims. But, a trade-off arises: ATM-led global integration, while useful for outreach, may bring new waves of fragility from greater systemic shocks. Banks need to leverage ATM networks to foster global links while concurrently bracing their risk management approaches to contain shocks. Conversely, mobile banking services are less effective in promoting cross-border financial flows due to operational and regulatory issues. Investments in digital infrastructure, regulatory consistency, and building consumer confidence and digital literacy are helpful against these. Capital requirements, though useful to ensure solvency and prudential oversight, can also disincentive internationalization of banks, mainly for smaller ones. Larger banks enjoy scale efficiencies and regulatory arbitrage to remain more globally competitive. There is a need for discerned regulatory conditions preserving stability without unduly coercing global

ambitions, especially for mid-tier and emerging banks.

Increased engagement into global trade networks not only expands income streams but also boosts banks' risk-bearing capacity through exposure to more classy financial instruments and best practices. Bank size and technological readiness mediate such stabilization outcomes, with larger institutions proving greater resilience owing to superior risk management capabilities and technological adaptability.

Harnessing the benefits of globalization, while holding systematic risks related to it, warrants a recalibrated policy design. First, regional trade agreements must be leveraged to undo barriers to cross-border commerce and finance, expanding operational bandwidth of African banks. Second, targeted support initiatives, such as concessional financing, technical assistance, and incentive-led consolidation strategies, must be in place to smaller banks to enhance their competitiveness and scale economies. Third, a phased and inclusive approach to technological adoption is vital to ensure that digital renovation does not accidentally marginalize weaker institutions.

Finally, regular surveillance of global financial trends, alongside proactive stress-testing and contingency planning, will be crucial for African banks navigate the dynamics of global finance. Regulatory frameworks should be agile; promoting innovation and connectivity, yet adequately robust to protect financial system from external pressures. In general, greater participation of banks in Africa into global financial circles has developmental potential, but dictates recalibrated institutional and regulatory responses. Strategic policy coordination, adaptive regulation, and targeted fintech investment, could help them weather global shocks and also become more stable and competitive players worldwide.

Limitations of the research

This research focuses exclusively on Tier 1 capital to risk-weighted assets as a regulatory factor, which may not fully reflect the broader implications of the regulatory milieu. Hence, we suggest future research to explore additional regulatory factors to further enhance the analysis of banking dynamics within Africa. We also recognize limitations related to data availability. Significant economies on Africa, including Algeria, Angola, and Ethiopia, were not in the analysis, which may affect generality. Furthermore, while key trading partners such as France and the broader European Union are key players, they were omitted to concentrate on the effect of globally dominant markets alone. This may also limit generalizability of the results herein.

CRedit authorship contribution statement

Minyahil Alemu: Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Resources, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Jayamohan M.K.:** Supervision. **Wondaferahu Mulugeta:** Supervision.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. The research has received no external funding too.

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