International Journal of Applied Mathematics
Volume 38 No. 10s, 2025
ISSN: 1311-1728 (printed version); ISSN: 1314-8060 (on-line version)

CLIMATE CHANGE RISK AND BANKING INDUSTRY VULNERABILITIES: IMPERATIVE FOR SUSTAINABLE BANKING AND ECONOMIC DEVELOPMENT IN AFRICA

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Abstract

Climate change increasingly threatens global financial stability, yet African banks' vulnerability remains underexplored. This study examines the effects of physical and transition climate risks on African banks' capital adequacy using forward-looking stress tests. Results show that while the baseline Capital Adequacy Ratio (CAR) is 11.58%, it declines to 7.97% under moderate shocks and 4.83% under severe shocks. Physical risks, especially floods in agriculture-dependent regions, have the most immediate impact, reducing CAR to 7.40% under extreme scenarios. Transition risks from adopting low-carbon technologies in high-emission sectors exert moderate but cumulative effects, potentially becoming systemic over time. The findings underscore African banks' significant vulnerability to climate-related shocks and highlight the need for robust climate risk governance, sectoral diversification, and proactive mitigation strategies. Integrating scenario-based stress testing and climate-risk analysis into supervision can help banks anticipate capital erosion and enhance financial resilience.

Keywords: Financial Stability, Climate Change Risk, banking-sector resilience, Sectoral Credit, Capital Adequacy Ratio.

***JEL Classification:** E69, G19, Q54*

1. Introduction

The global climate crisis is one of the most pressing challenges of the 21st century, with far-reaching implications for economies, societies, and ecosystems. In Africa, the impacts of climate change are particularly severe, exacerbating existing vulnerabilities and posing significant risks to sustainable development. The banking industry, as a critical component of the financial system, is not immune to these challenges. It faces various climate-related risks that can threaten its stability, profitability, and capacity to support economic growth.

Climate Change Risks can be broadly categorized into physical and transition risks. Physical risks involve the direct impacts of climate change, such as extreme weather events, rising temperatures, and sea level rise, which can damage infrastructure, disrupt economic activities, and lead to financial losses. Transition risks, on the other hand, arise from the global shift towards a low-carbon economy. This includes policy changes, technological advancements, and market shifts aimed at reducing greenhouse gas emissions. Both types of risks have profound implications for the banking sector, affecting asset valuations, creditworthiness, and operational continuity.

Received: August 09, 2025

International Journal of Applied Mathematics
Volume 38 No. 10s, 2025
ISSN: 1311-1728 (printed version); ISSN: 1314-8060 (on-line version)

Banking Industry Vulnerabilities refer to the susceptibilities of banks to external shocks and adverse conditions, which can undermine their financial health and stability. In the context of climate change, these vulnerabilities are multifaceted. Credit risk can increase as borrowers struggle with climate-induced disruptions, market risk can rise due to volatile asset prices, and operational risk can escalate from climate-related damages to bank facilities and infrastructures. Moreover, liquidity and reputational risks can emerge as banks face heightened demand for loans during climate crises and scrutiny from stakeholders regarding their climate policies and practices.

Given the interconnected nature of climate risks and banking vulnerabilities, there is a compelling need for a paradigm shift towards Sustainable Banking. Sustainable banking involves integrating environmental, social, and governance (ESG) considerations into banking operations and decision-making processes. By adopting sustainable banking practices, banks can enhance their resilience to climate risks, support green finance initiatives, and contribute to the broader goal of sustainable development. This approach not only mitigates risks but also opens new opportunities for innovation, competitiveness, and long-term value creation.

In Africa, the imperative for sustainable banking is particularly acute. The continent's economic development is intricately linked to its environmental sustainability. Agricultural productivity, infrastructure development, and financial inclusion are all areas where climate change poses significant threats, but also where sustainable banking can make a transformative impact. By aligning banking practices with the principles of sustainability, African banks can play a pivotal role in fostering resilience, supporting economic growth, and ensuring that development gains are not undermined by climate-related shocks.

This paper explores the critical intersection of climate change risks and banking industry vulnerabilities in Africa. It underscores the necessity for sustainable banking practices as a strategic response to these challenges and highlights the potential for sustainable banking to drive economic development on the continent. Through a comprehensive analysis, the paper aims to provide insights into how the banking sector can effectively manage climate risks, support sustainable development goals, and contribute to building a resilient and inclusive African economy.

2. Literature Review

Climate change has emerged as one of the most formidable threats to global economic and financial stability, with its effects particularly pronounced in regions such as Africa, where economies are structurally vulnerable to climatic disruptions (Trisos et al., 2022; African Development Bank [AfDB], 2020). Climate risks generally take two main forms: physical and transition risks. Physical risks arise from sudden or chronic climate events, including flooding, droughts, elevated temperatures, and extreme weather conditions that damage infrastructure, reduce productivity, and disrupt socio-economic systems (IPCC, 2014; Stern, 2007). In contrast, transition risks stem from the global shift toward low-carbon economies, reflected in new regulations, technological shifts, carbon-pricing policies, and changing consumer preferences that can render high-emission assets unprofitable (Campiglio et al., 2017; Hong, et al., 2019; TCFD, 2017). These risks highlight the complex ways in which climate change affects both the real economy and the financial system, necessitating that financial institutions integrate environmental considerations into their risk-management processes (Batten, et al., 2020; Allen & Saunders, 2019).

Within the banking sector, climate risks translate into material vulnerabilities because banks play a central role in credit intermediation and economic financing. Physical climate impacts can weaken borrowers' repayment capacity, particularly in agriculture, transportation, energy, and manufacturing sectors heavily exposed to climate variability, thereby increasing credit risk (Deryugina & Hsiang, 2014; Agrawala & Fankhauser, 2008). Transition risks can also influence asset valuations, affecting market risk through repricing shocks, regulatory changes, and shifts in investment portfolios (Andersson, et al., 2016; Bolton et al., 2020). In addition, extreme weather events can disrupt banking operations, heightening operational risk, while liquidity risk may emerge when climate shocks trigger unusual withdrawal patterns or increase loan demand (Cerutti & Claessens, 2018; BIS, 2020). Reputational risk also becomes relevant as banks face growing expectations to support sustainability goals and disclose their climate-exposure profiles (Wilson, 2010; Eccles & Klimenko, 2019). These multifaceted vulnerabilities underscore the need for banks to treat climate change not only as an environmental challenge but also as a core financial-stability concern (Carney, 2015; Krogstrup & Oman, 2019).

The concept of sustainable banking has therefore gained prominence as a framework for integrating environmental, social, and governance (ESG) principles into banking operations. Sustainable banking emphasizes environmental responsibility, socially inclusive financing, sound governance structures, and resilience-driven risk-management practices (Weber & Feltmate, 2016; GRI, 2019). Global regulatory efforts, particularly the Task Force on Climate-Related Financial Disclosures (TCFD), have further shaped the emerging landscape by outlining disclosure expectations related to governance, risk management, scenario planning, and climate-related metrics (TCFD, 2017; Batten, et al., 2020). These initiatives reflect a growing recognition that climate-risk integration into banking systems is now essential to protecting financial stability, enhancing transparency, and supporting long-term development goals (NGFS, 2019; Bank of England, 2018).

Africa's heightened vulnerability to climate change amplifies the relevance of these issues. The continent faces recurrent droughts, flooding, temperature-induced productivity losses, and severe food-security pressures, all of which have direct and indirect consequences for financial institutions (AfDB, 2020; FAO, 2022). The banking sector is particularly exposed because it finances many climate-sensitive sectors and households with limited adaptive capacity (AfDB, 2018; IMF, 2022). Weak infrastructure, low insurance penetration, and high poverty levels exacerbate the speed with which climate shocks transmit into financial instability (Trisos et al., 2022; UN-Habitat, 2021). Consequently, banks must incorporate climate-risk considerations into their lending decisions, capital-adequacy frameworks, and overall governance systems to safeguard both firm-level resilience and macroeconomic stability across African economies (Allen & Saunders, 2019; Lamperti, et al., 2019; Carney, 2015).

Empirical studies further demonstrate the deep linkages between climate change and economic systems. Early comprehensive assessments, such as Stern (2007), show that the economic costs of climate inaction far exceed mitigation efforts, while subsequent empirical work, including Deryugina and Hsiang (2014), establishes strong relationships between climatic shocks and disruptions to labour markets, output, and long-term economic performance. Researchers increasingly highlight the systemic nature of climate-related financial risks. Campiglio et al. (2017) argue that both physical and transition risks can generate systemic shocks within financial systems, while Hong, Li, and Xu (2019) find evidence of climate-risk pricing within asset markets. Battiston, et al. (2017) extend this argument by showing how climate-related vulnerabilities propagate across interconnected financial institutions, a viewpoint echoed by Cerutti and Claessens (2018), who document the adverse effects of extreme climate events on banking-sector asset quality and financial stability.

Regulatory authorities have responded to these developments by advancing climate-risk governance frameworks. Carney's (2015) "Tragedy of the Horizon" speech catalysed global recognition of the need for climate-related financial disclosures and long-term risk integration. The TCFD (2017) subsequently codified key elements of climate-risk reporting, while the Network for Greening the Financial System (NGFS) began issuing guidelines in 2019 detailing supervisory expectations, climate-scenario analysis, and risk-data enhancement. Complementary contributions from Batten, Sowerbutts, and Tanaka (2020) and the Bank of England (2018) emphasize the importance of incorporating climate risks into prudential regulation, macroprudential tools, and forward-looking stress-testing frameworks.

Growing literature also examines climate-risk integration in investment decisions and portfolio management. Studies such as Andersson et al. (2016), Clarke and Dercon (2016), and Lamperti, et al. (2019) show how climate scenarios, governance structures, and modelling uncertainties influence financial-risk assessment. De Bruin (2017) proposes an integrated climate-risk management model for banks, highlighting mitigation, monitoring, and adaptive strategies. Stress testing remains central to these analyses, with Allen and Saunders (2019) demonstrating how forward-looking climate scenarios can reveal structural vulnerabilities in bank balance sheets and guide strategic planning.

Parallel to these developments is the rapid growth of green-finance instruments and sustainable investing. Scholars such as Solana (2017) and Flammer (2021) document how ESG integration and green bonds can mobilize capital for climate mitigation and enhance corporate sustainability performance. Meta-analyses like Friede, et al. (2015) reinforce the financial case for sustainable investing by showing that ESG considerations generally correlate with stronger financial returns. The BlackRock Investment Institute (2016) outlines practical strategies for aligning portfolios with climate-related risks, while Krueger, et al. (2020) show that investors increasingly incorporate climate metrics into decision-making and engage firms on environmental performance.

Collectively, the reviewed literature reveals a consistent narrative: climate change poses material financial risks that can undermine banking stability, particularly in vulnerable regions like Africa. Traditional risk-management tools are insufficient for capturing the long-horizon and systemic nature of climate risks, hence the need for climate-scenario-based stress testing, enhanced disclosures, and the integration of ESG principles into banking operations. At the same time, climate-aligned finance presents significant opportunities for resilience building, capital mobilization, and economic transformation. Therefore, integrating climate-risk considerations into Africa's banking sector is both a necessity for financial stability and a pathway toward sustainable development.

3. Stylized Facts

Climate change presents significant risks to economic and financial systems worldwide, with African economies being particularly vulnerable due to their heavy reliance on agriculture, natural resources, and limited adaptive capacities. The banking industry, as a key facilitator of capital flow and economic growth, faces various challenges in mitigating climate-related risks while maintaining financial stability. These vulnerabilities necessitate a shift towards sustainable banking practices that support long-term economic development, resilience, and environmental sustainability.

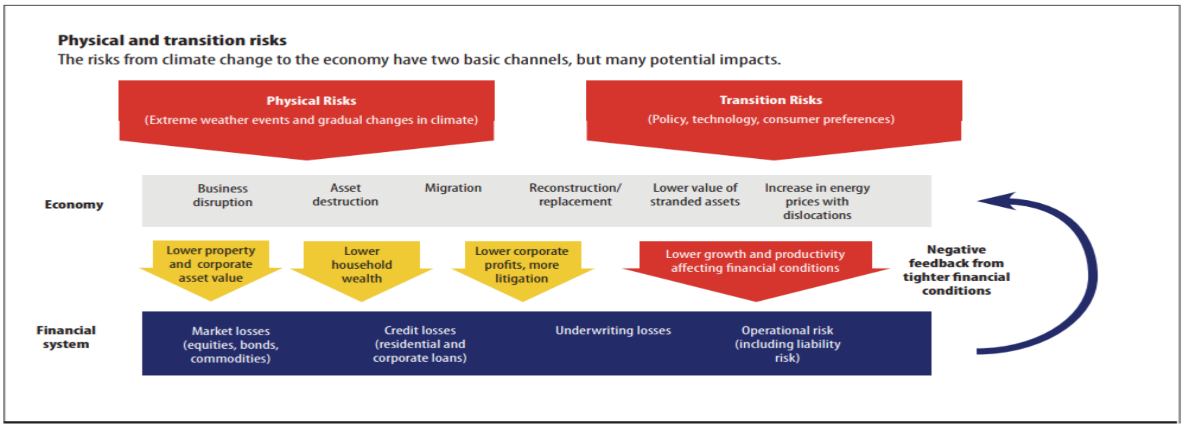
Understanding the relationship between climate change and its impacts on the banking and financial system and sustainable economic development involves examining several key stylized facts. These facts help provide a structured view of how climate change influences financial stability and economic growth.

This section elaborates on key stylized facts surrounding the interplay between climate change risks and the vulnerabilities within the banking industry, especially in the African context.

3.1 Schematic of Transmission Channels of Climate Change Risks

Climate Change risks affect the financial system and the economy through two basic channels: Physical Risks and Transition Risks. See blow.

Figure 1: Schematic Transmission Channels of Climate Change Risks



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[1] Adopted from chapter 6 of the October 2019 Global Financial Stability Report.

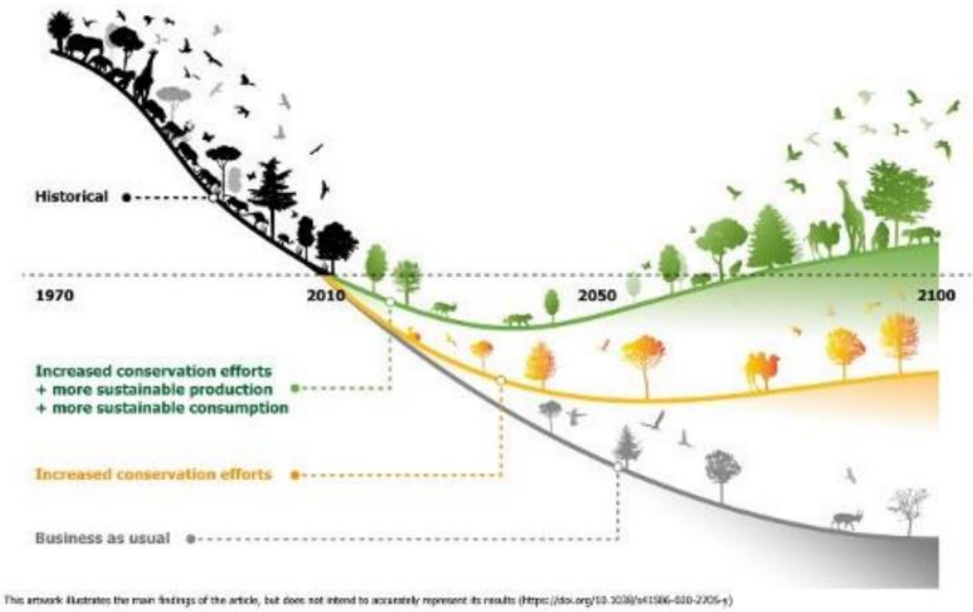
ISSN: 1311-1728 (printed version); ISSN: 1314-8060 (on-line version)

African banks are exposed to climate-related risks which can crystalize in the form of Physical and Transition Risks. Physical risks involve flood, drought, wildfire outbreaks, etc, while Transition Risks involve uncertainties associated with change in business methods/models toward eco-friendly technologies and methods of production, phased reduction in carbon emission, etc.

3.2 Nature and Financial Stability

The 2022 Biodiversity Conference analyzed global physical risks and earmarked low to high-risk regions/areas. Similarly, they conference analyzed transition risks under three scenarios: "Business as Usual," "Increased Conservation Effort," and "Increased Conservation Effort + More Sustainable Production and Consumption." They postulated that the deterioration in the current global climate condition can be reversed by 2050 if the 3rd scenario is implemented. Under this scenario, the state of the global climate condition will return to 1971 levels by 2075 and much better or above 1971 by 2100. See the figures below. They analyzed that global leaders must work to protect 30% of earth's lands, oceans, coastal areas, and inland waters, reduce by US$500 billion annual harmful government subsidies, and cut food waste in half. [2]

Figure 2: Nature and Financial Stability



3.3 High Vulnerability to Climate Change

Africa is among the continent's most vulnerable to climate change despite contributing the least to global greenhouse gas emissions (2022 Biodiversity Conference Press Release/Communique). The continent's socio-economic and environmental systems are highly sensitive to climate variability, making it more prone to climate-related disruptions.

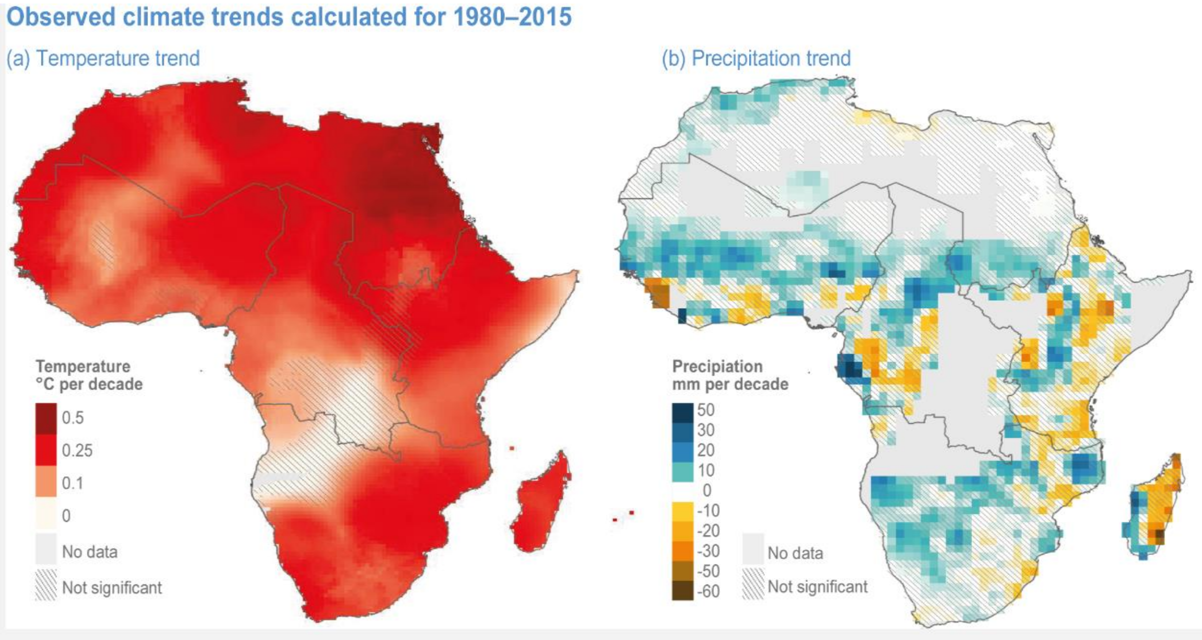
[2] Adopted from the 2022 Biodiversity Conference Press Release/Communique

ISSN: 1311-1728 (printed version); ISSN: 1314-8060 (on-line version)

3.4 Global Warming

The average surface temperature of the Earth in 2023 was the highest since records began in 1880. The map below showed increased temperature and rapid warming above the global average. Similarly, mean average precipitation has dwindled in a span of 35 years. (a) average temperature (°C per decade) and (b) average precipitation in (mm per decade) for 1980–2015.

Figure 3: Global Warming



[3]

3.5 Increasing Frequency and Severity of Natural Disasters

In 2022, the world experienced 387 natural hazards and disasters, affecting 185 million people and causing over 30,000 deaths. Africa accounted for 79 of these events, a figure significantly above historical averages, reflecting the continent's rising exposure to climate-related shocks. The frequency and intensity of disasters such as floods, droughts, and storms are increasing, affecting millions annually. Droughts alone impacted 88.9 million people across six African countries, including the Democratic Republic of Congo, Ethiopia, Nigeria, Sudan, Niger, and Burkina Faso. In Nigeria, floods claimed 603 lives and generated economic losses estimated at US$4.2 billion, while South Africa recorded 544 fatalities due to flooding.

These climate hazards disproportionately affect vulnerable populations, including women, children, the elderly, and the poor, whose social and economic marginalization amplifies mortality, morbidity, and reduced quality of life. Droughts and erratic rainfall exacerbate food insecurity, water scarcity, and displacement, undermining livelihoods and contributing to conflict and migration. Rising health risks linked to climate change further strain Africa's already fragile health systems, increasing the prevalence of malnutrition, waterborne and vector-borne diseases, and heat-related illnesses.

[3] Adopted from 2022 Biodiversity Conference Report

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ISSN: 1311-1728 (printed version); ISSN: 1314-8060 (on-line version)

Economic losses from climate events are substantial. In Nigeria, floods in 2022 caused financial damages exceeding US$4 billion, demonstrating that climate change is not only a humanitarian issue but also a significant economic burden that threatens development gains. The financial sector is equally at risk, as severe climate events can trigger widespread loan defaults, reduce bank solvency, and destabilize economies, particularly in nations dependent on climate-sensitive sectors such as agriculture, tourism, and natural resources. African banks, which have historically financed carbon-intensive sectors like oil, gas, mining, and agriculture, face rising credit risks as global markets transition toward cleaner energy and stricter climate policies, creating potential stranded assets.

Climate change also exacerbates food insecurity by reducing agricultural productivity, particularly in regions reliant on rain-fed farming, heightening risks of famine and malnutrition. The continent's banking sector faces additional challenges due to underdeveloped climate risk assessment mechanisms. Many financial institutions lack advanced systems to evaluate and price climate-related risks, leaving exposures underreported and inadequately managed. While emerging regulations and sustainability initiatives in countries like Nigeria, South Africa, and Kenya seek to encourage disclosure of climate-related financial risks and promote sustainable finance, implementation remains uneven across the continent.

Nevertheless, climate change presents opportunities for green and sustainable financing. African banks can leverage increasing demand for renewable energy, climate-resilient infrastructure, and sustainable agriculture to align profitability with environmental impact mitigation. Financing climate adaptation projects can also support social development, particularly for marginalized communities, bridging the financing gap for sustainable development initiatives. The integration of Environmental, Social, and Governance (ESG) factors into banking practices is gaining traction, allowing institutions to mitigate climate-related risks while fostering long-term economic and social resilience.

Overall, these stylized facts highlight the dual challenge and opportunity that climate change presents for Africa: it exacerbates social, economic, and financial vulnerabilities, yet also creates avenues for sustainable investment and inclusive development, provided those regulatory frameworks, risk management systems, and green financing initiatives are strengthened.

4. Methodology

We adapt the climate stress test scenarios of Battiston et al (2017) which quantify the exposure of European financial institutions, through the share markets, in five sectors potentially sensitive to climate change risks: oil and gas (fossil fuels), electricity, energy-intensive industry, real estate, and transport. The authors analysed the spread via financial networks of a scenarios of a massive devaluation of shares in the fossil fuel and electricity sectors. The propagation mechanisms considered the deterioration in the balance sheet of financial institutions and of the financial assets that they issue to refinance following losses on share markets.

Received: August 09, 2025

Volume 38 No. 10s, 2025
ISSN: 1311-1728 (printed version); ISSN: 1314-8060 (on-line version)

For Africa, we considered the relative size of country's GDP in relation to the size of the banking industry exposures to Agriculture, Oil and Gas, Transportation and Storage, Energy and Power, and Finance and Insurance sectors, the stress impact on credit exposures to these sectors and key financial indicators. We built plausible but severe case scenarios of climate change risks shocks and phenomenon across physical and transition risks. Annual data were source from central banks' banking industry reports, published balance sheets of banks, IMF database, AfDB reports and database. Missing data were extrapolated using recognised moving average methodology to account for trend and seasonality.

4.1 The Stress Test - Scenarios, Shocks and Results

In view of the above, we considered three multi-factor scenarios and assumptions and assessed the adequacy of the banking industry's capital under mild, moderate, and severe stress scenarios as well as its capacity to continue to provide credit to support economies.

To ensure that the stress results reflect the true financial condition of the banks, we discounted loan forbearances regulators and excluded the insolvent banks, where information are available.

4.2 Satellite Assumptions

i. Macroeconomic conditions and developments apply to the banking industry symmetrically.
ii. Severity and determination of tail risks are generally recursive with significant likelihood.
iii. There are no regulatory interventions nor banks' management actions during the shocks.
iv. Capitalization under stress is first mitigated by net income as follows:
v. $CAR = (\frac{(TQC+Net\ Income)}{RWA}) * 100$

4.3 Climate risk Factors

Physical

Extreme weather conditions resulting in heightened floods, affecting businesses and impacting exposure to agriculture in varying degrees of severity; and general credit exposure in varying degrees of severity.

Transition

Increased cost of fossil energy owing to regional tensions, international sanctions, structural reforms (fuel subsidy removal and increased energy/electricity cost) and adoption/implementation of regulations as well as policies on sustainable principles leading to shift towards eco-friendly sources of energy such as solar power system, electric car, gas powered generators and vehicles. These are expected to impact exposures to downstream oil and gas; transport and storage; finance and insurance; mortgage/real estate; and power and energy sub-sector.

4.4 Matrix of stress scenarios and shocks

The stress scenarios and shocks are categorized and presented below:

Received: August 09, 2025

Climate Risk Factors	Mild	Moderate	Severe
Impact of Physical Risk Factors on CAR Via Total Credit Exposure	1% Loss in Total Credit Exposure Due to Floods Affecting Businesses in Prone Areas	2.5% Loss in Total Credit Exposure Due to Floods Affecting Businesses in Prone Areas	5% Loss in Total Credit Exposure Due to Floods Affecting Businesses in Prone Areas
Impact of Physical Risk Factors on CAR Via Credit Exposure to Agriculture	10% Loss in Agric Credit Exposure Due to Floods Affecting Businesses in Prone Areas	25% Loss in Agric Credit Exposure Due to Floods Affecting Businesses in Prone Areas	50% Loss in Agric Credit Exposure Due to Floods Affecting Businesses in Prone Areas
Climate Risk: Impact of Transition Risk Factors on CAR Via Downstream Oil & Gas	5% Loss in Exposure to Downstream Subssector due to shift to eco friendly technology	10% Loss in Exposure to Downstream Subssector due to shift to eco friendly technology	15% Loss in Exposure to Downstream Subssector due to shift to eco friendly technology
Impact of Transition Risk Factors on CAR Via Power & Energy	5% Loss in Exposure to Power & Energy Sub-ssector due to shift towards eco friendly technology	10% Loss in Exposure to Power & Energy Sub-ssector due to shift towards eco friendly technology	15% Loss in Exposure to Power & Energy Sub-ssector due to shift towards eco friendly technology

5. Analysis of Results

This chapter presents an in-depth analysis of the results from climate risk stress tests conducted on African banks, focusing on the impact of physical and transition risks associated with climate change on their capital adequacy ratios (CAR). The stress test examines various shock scenarios, ranging from mild to severe, across different sectors exposed to climate risks. The findings highlight how climate-related events and the transition to an eco-friendly economy can significantly impact the financial resilience of banks in Africa.

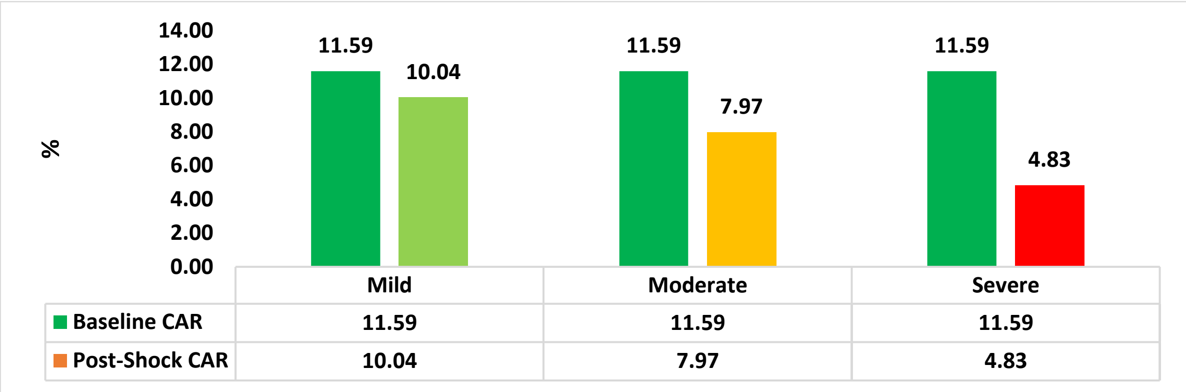
5.1 Overview of Capital Adequacy Ratio (CAR) Impact

The stress test assessed the Capital Adequacy Ratio (CAR) of African banks under both baseline and climate shock scenarios to evaluate the impact of climate risks on their balance sheets. The baseline CAR was 11.58%, comfortably above the regulatory minimum for most African banks. However, when subjected to climate stress scenarios, CAR declines notably, especially under severe shocks.

As shown in Figure 4, multifactor climate shocks lead to a progressive reduction in CAR as the intensity of the shocks increases. Under mild scenarios, CAR falls modestly from 11.58% to 10.03%, leaving a buffer of 2.04 percentage points above the 8% minimum Basel requirement, indicating that the banking sector remains resilient. In contrast, moderate and severe shocks cause CAR to drop to 7.97% and 4.83%, respectively, signaling significant vulnerability. These findings suggest that while African banks can withstand mild climate-related shocks, extreme events could severely erode capital buffers, raising the risk of insolvency or necessitating recapitalization.

Figure 4: Climate Risk Stress: Impact on CAR

ISSN: 1311-1728 (printed version); ISSN: 1314-8060 (on-line version)

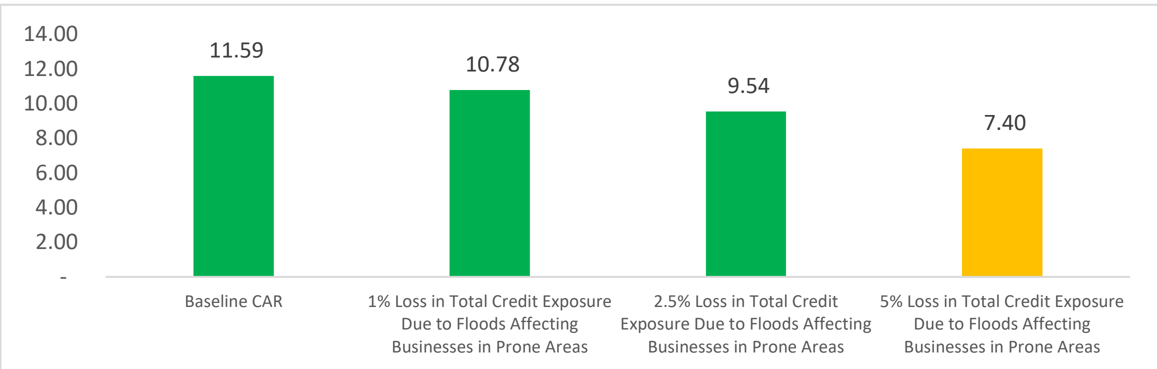


The moderate and severe case scenarios show that African banks are considerably vulnerable climate change risks. A crystallization of these risks are more pronounced in African, due to the susceptibility Africa to climate change risks, which are connected to the heavy reliance on agriculture and nature dependent economic activities such as mining and agriculture, including fishing and other related activities.

5.1.2. Physical Risk Factors and Impact on Credit Exposures

Physical risks—most notably floods affecting businesses in vulnerable areas—were evaluated to determine their impact on banks' total credit exposures across various industries. As illustrated in Figure 5, the stress test simulates losses of 1%, 2.5%, and 5% in total credit exposure due to flooding, each resulting in a corresponding decline in the Capital Adequacy Ratio (CAR). A 1% loss reduces CAR from 11.58% to 10.78%, while a 5% loss pushes it down to 7.40%. These findings highlight the significant vulnerability of African banks to physical climate risks, particularly in flood-prone regions, where even moderate credit losses can meaningfully weaken capital buffers.

Figure 5: Climate Risk: Impact of Physical Risk Factors on CAR via Total Credit Exposure



...s in agriculturally dependent regions—where banks hold substantial loan portfolios—exert a disproportionately large influence on the Capital Adequacy Ratio (CAR). The stress test simulates credit losses of 10%, 25%, and 50% arising from flood-related disruptions. A 10% reduction in agricultural credit exposure results in a slight decline in CAR from 11.58% to

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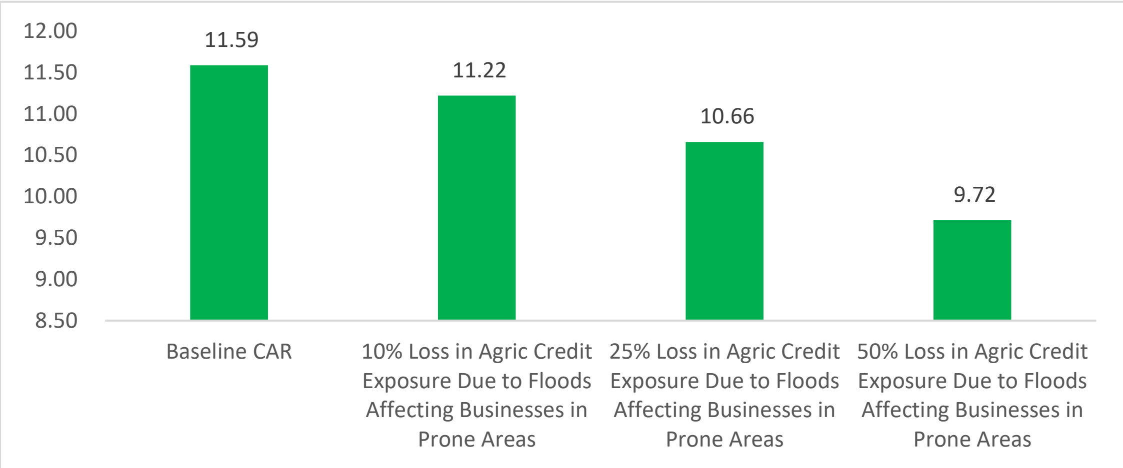
ISSN: 1311-1728 (printed version); ISSN: 1314-8060 (on-line version)

11.21%, but a severe 50% loss causes CAR to fall significantly to 9.71%. Given agriculture's central role in African economies, this decline is notable. The findings underscore that banks with heavy agricultural exposure are particularly vulnerable to acute climate shocks such as flooding, reinforcing the need for stronger climate risk management and mitigation measures.

Figure 6: Climate Risk: Impact of Physical Risk Factors on CAR via Total Credit Exposure to Agriculture



ustries like oil and gas as well as power and energy—were also assessed. The analysis presented in Figure 7 shows how transition-related factors affect the Capital Adequacy Ratio (CAR) through banks' exposure to the downstream oil and gas sector. The results indicate that African banks remain highly vulnerable in this area: a simulated decline of 5%, 10%, and 15% in sectoral exposure, driven by the adoption of eco-friendly technologies, leads to a modest reduction in CAR from 11.35% to 10.89% under the most severe case. While the direct impact appears moderate, the findings highlight that the combined effect of transition risks across multiple sectors could escalate into a broader threat to financial stability.

Figure 7: Climate Risk: Impact of Transition Risk Factors on CAR via Downstream Oil & Gas

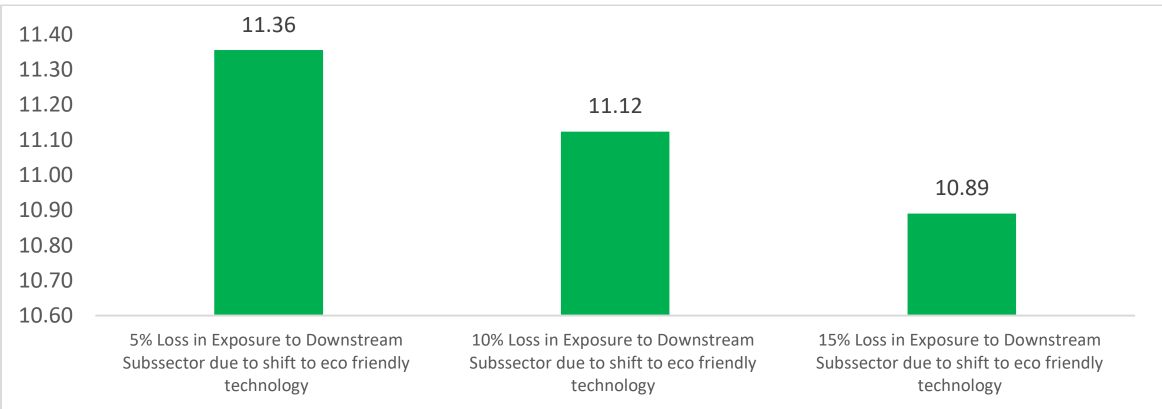


Figure 8 depicting the power and energy sector shows how transition risks affect banks' resilience as economies shift toward renewable energy sources. The stress test models losses of 5%, 10%, and 15% in sectoral exposure linked to this transition, and under the most severe scenario, the Capital Adequacy Ratio (CAR) declines from 11.46% to 11.21%. While the

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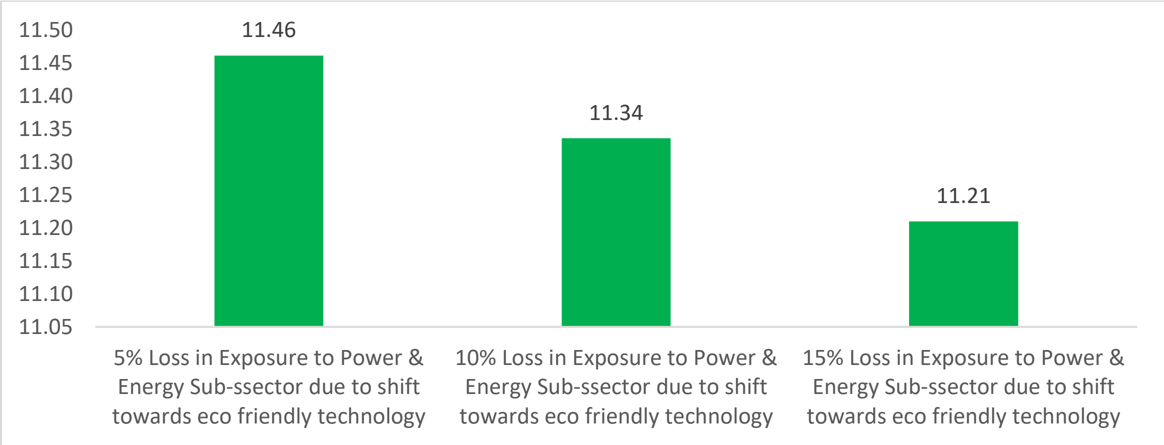
immediate impact appears moderate, the findings suggest that the long-term consequences of moving away from fossil fuel–based energy could intensify as renewable technologies increasingly displace traditional energy systems.

Figure 8: Climate Risk: Impact of Transition Risk Factors on CAR via Power & Energy Sector



5.2 Summary and discussion of result

The stress test results indicate that African banks' capital adequacy is highly sensitive to both physical and transition climate risks, aligning with the growing body of literature on climate-related financial vulnerabilities. Under baseline conditions, the Capital Adequacy Ratio (CAR) stands at 11.58%, above the regulatory minimum, reflecting a resilient banking sector. However, exposure to climate shocks results in notable declines in CAR, particularly under moderate and severe scenarios, where CAR falls to 7.97% and 4.83%, respectively. These outcomes are consistent with studies demonstrating that climate shocks can materially affect banking-sector stability, potentially eroding capital buffers and increasing the risk of insolvency or recapitalization (Campiglio et al., 2017; Battiston, Mandel, & Monasterolo, 2017; Cerutti & Claessens, 2018).

Physical risks, most prominently floods, emerge as the most immediate threat. Banks with significant exposure to agriculture and flood-prone regions are especially vulnerable. Simulations show that losses of 1%, 2.5%, and 5% in total credit exposure due to flooding reduce CAR from 11.58% to as low as 7.40%, while flood-related reductions in agricultural lending can lower CAR from 11.58% to 9.71% under a severe 50% loss scenario. These findings mirror empirical evidence linking climate shocks to disruptions in economic activities and financial performance, particularly in nature-dependent sectors such as agriculture, mining, and fishing (Deryugina & Hsiang, 2014; Stern, 2007; Cerutti & Claessens, 2018). The disproportionate effect of floods in agriculture-heavy regions highlights the systemic nature of physical climate risks and their potential to propagate through financial institutions (Battiston, Mandel, & Monasterolo, 2017; Campiglio et al., 2017).

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Transition risks associated with the global shift toward low-carbon technologies in high-emission sectors such as oil and gas, power, and energy exert a more moderate, yet non-negligible, effect on CAR. Stress tests simulating losses of 5%, 10%, and 15% in downstream oil and gas exposure reduce CAR from 11.35% to 10.89%, while similar losses in the power and energy sector lower CAR from 11.46% to 11.21%. Although the immediate impact appears limited, these findings align with studies showing that the adoption of green technologies and evolving regulatory frameworks can gradually introduce financial risks, particularly for institutions heavily exposed to traditional energy sectors (Hong, Li, & Xu, 2019; Campiglio et al., 2017; Andersson et al., 2016). The results underscore that cumulative transition risks could evolve into broader systemic threats if multiple sectors simultaneously adjust to low-carbon pathways, as also highlighted in research on climate-risk propagation and scenario analysis in banking (Allen & Saunders, 2019; De Bruin, 2017).

Overall, the study reinforces the empirical understanding that African banks are considerably vulnerable to climate-related financial risks. Physical shocks, particularly floods, present immediate and severe threats to capital buffers, while transition risks may gradually escalate as economies move toward sustainable energy systems. These insights support the literature advocating for strengthened climate risk governance, diversified sectoral exposure, and robust mitigation strategies to safeguard financial stability (Carney, 2015; TCFD, 2017; Batten, Sowerbutts, & Tanaka, 2020; Bank of England, 2018). By integrating forward-looking stress testing and scenario analysis into prudential supervision, African banks can better anticipate potential capital erosion, enhance resilience, and contribute to a stable financial system amid rising climate risks (Allen & Saunders, 2019; Lamperti, Bosetti, & Tavoni, 2019).

6. Conclusion, Policy Implications and Recommendations

The study concludes that African banks' capital adequacy is highly vulnerable to climate-related financial risks, with physical shocks—particularly floods—posing the most immediate and severe threats to capital buffers. Transition risks associated with the shift toward low-carbon technologies in high-emission sectors currently exert a moderate effect but have the potential to escalate into systemic threats over time. The stress test results indicate that while African banks can withstand mild climate-related shocks, moderate to severe scenarios could significantly erode capital, exposing banks to heightened risk of insolvency or the need for recapitalization. Overall, the findings underscore that climate-related risks are material and require urgent attention in the context of African banking stability.

The results highlight the need for regulatory authorities and banking institutions to integrate climate risk considerations into prudential supervision and risk management frameworks. Policymakers should promote robust climate-risk governance, including mandatory stress testing, forward-looking scenario analysis, and sectoral exposure monitoring, particularly in agriculture, oil and gas, and power sectors. Strengthening regulatory frameworks aligned with global standards, such as the TCFD recommendations and NGFS guidelines, can ensure that banks adequately prepare for both physical and transition risks. Moreover, the study

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ISSN: 1311-1728 (printed version); ISSN: 1314-8060 (on-line version)

underscores the systemic nature of climate risks, suggesting that failure to address them could have broader implications for financial stability and economic development in Africa.

Based on the findings, African banks should implement comprehensive climate risk management strategies that include diversification of loan portfolios, particularly away from sectors highly exposed to climate shocks. Banks should enhance monitoring and early-warning systems for climate-induced risks, such as floods and extreme weather events, and incorporate forward-looking stress testing into regular capital planning. Policymakers and regulators should incentivize the adoption of sustainable financing practices, green lending, and investment in low-carbon technologies to mitigate transition risks. Additionally, capacity-building initiatives and knowledge-sharing programs should be promoted to strengthen banks' ability to assess, manage, and disclose climate-related financial risks, thereby safeguarding financial stability and supporting long-term resilience in the African banking sector.

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International Journal of Applied Mathematics
Volume 38 No. 10s, 2025
ISSN: 1311-1728 (printed version); ISSN: 1314-8060 (on-line version)

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Received: August 09, 2025