KENYA BANKERS ASSOCIATION
One Industry. Transforming Kenya.

POLICY BRIEF

PB/03/23

January 2023

THE CENTRE FOR RESEARCH ON FINANCIAL MARKETS AND POLICY®

Climate Change and Banking Sector (In)Stability in Kenya: A Vulnerability Assessment

Executive Summary

Kenya's climate action commitments include abating greenhouse gases (GHG) emissions by 32% by 2030. This is as per the country's updated Nationally Determined Contribution (NDC) 2020-2030, as a signatory to the Paris Agreement. One crucial global debate has been on the impact of climate change on financial institutions and financial system stability. Increasingly, it is widely accepted that climate-related financial risks could have far-reaching ramifications, including on the stability of the banking sector. A vulnerability assessment of the Kenyan banking sector is done to support this brief's breakdown of the sectoral transmission channels (Climate Policy Relevant Sectors - henceforth, CPRSs) for climate risk drivers. We use rainfall and temperature data, identify 5 CPRSs, construct a banking sector stability index, and examine the time-varying linkages between these variables. Three important findings emerge: First, the agriculture sector is the sole channel of physical climate risk transmission. Second, manufacturing and utilities sectors are becoming increasingly critical/significant channels for transmitting transition risks. Third, during the COVID-19 era, all CPRSs have become increasingly linked to banking sector stability, effectively exacerbating the transmission channel of climate risks to the banking sector.

Gillian Kimundi (Deakin Business School) & Reuben Wambui (Geneva Graduate Institute)

The Centre for Research on Financial Markets and Policy®

The Centre was established by the Kenya Bankers Association in 2012 to offer an array of research, commentary, and dialogue regarding critical policy matters that impact on financial markets in Kenya. The Centre sponsors original research, provides thoughtful commentary, and hosts dialogues and conferences involving scholars and practitioners on key financial market issues. Through these activities, the Centre acts as a platform for intellectual engagement and dialogue between financial market experts, the banking sector and the policy makers in Kenya. It therefore contributes to an informed discussion that influences critical financial market debates and policies.

1. Context and Importance

Climate risk drivers are categorized into physical risks and transition risks. Physical risks arise from weather changes, including acute risks (event-driven) e.g., floods and drought, to more severe/ chronic risks (longer-term shifts) e.g., sustained higher temperatures, variability in rainfall patterns. Transition risks arise from action taken to transition the economy from a system that is reliant on fossil fuels to a low-carbon economy e.g., policy changes and low-carbon technologies. Transition risks apply more to climate policy relevant sectors (henceforth CPRSs) – economic activities that could be impacted by a disorderly transition to a low-carbon economy (Battiston, et al., 2017). These risks include introduction or revision of pollution control policies, transition to energy saving, low-carbon, non-fossil fuel technologies and shifts in investor and consumer sentiment.

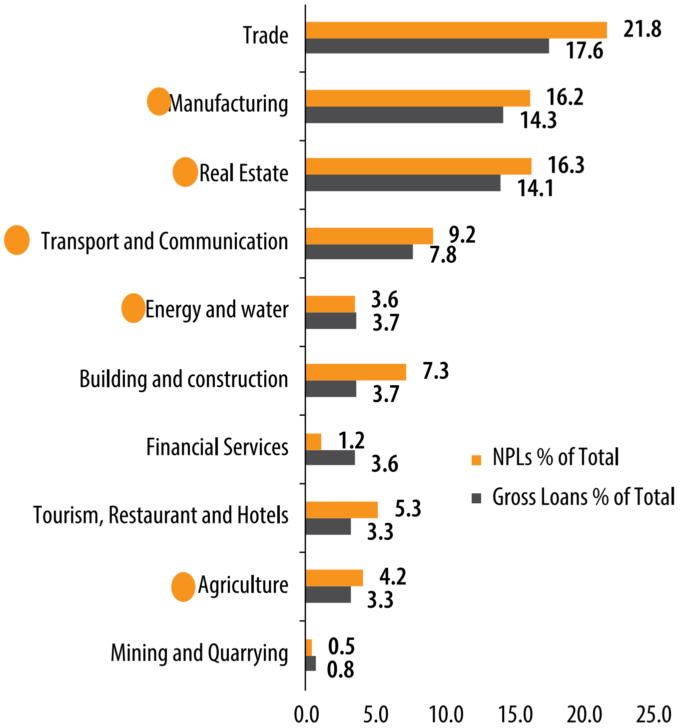
According to the Network for Greening the Financial System (NGFS), a first step in understanding the manifestation of banking sector risks from climate risk drivers would be to understand "specific short-term impacts of climate risk drivers on sectors, geographies and asset classes", and ramifications for macroeconomic and stability indicators (NGFS, 2020). The former are ideally transmission channels through which physical and transition risk drivers impact banks. The microeconomic transmission channels and risk exposures for the banking sector from the two drivers are summarized below:

Table 1: Mapping Banking Sector Risks to Transmission Channels and Climate Risk Drivers

Risk	Channel	Climate Risk Driver
Credit Risk	Declining property/asset values, damaged infrastructure Declining agricultural yields	Physical risks
	Insurance premium increases - coverage and collateral value declines	Physical and transition risks
Market Risk	Decline in value of investments in energy and energy-intensive sectors	Physical and transition risks
	Adjustments to basic energy prices – increased cost of business	Transition risks
Liquidity Risk	Banking sector ability to raise deposits compromised – lower household and business incomes)	Physical and transition risks

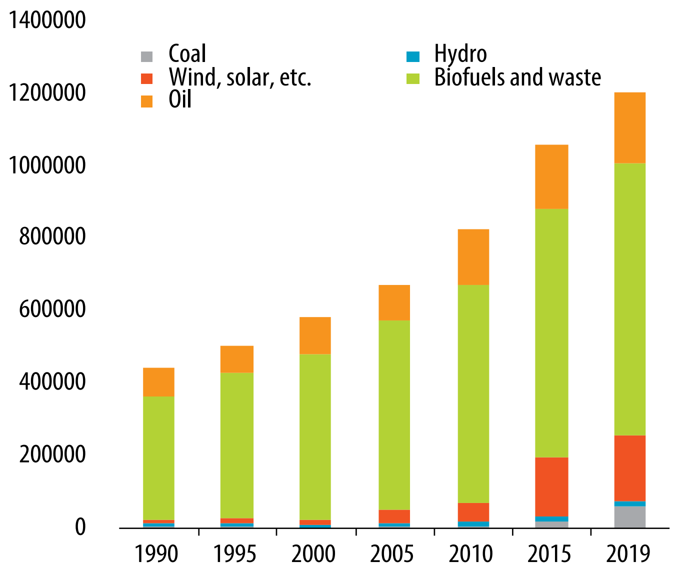
Each of the above channels represents specific sectors and economic activities. These can be mapped into 5 CPRSs [Battiston et al (2017)]: fossil, utilities, transport, energy-intensive and housing/ real estate[1]. **Figure 1** shows sectoral distributions of loans to these CPRSs in Kenya as of December 2021, together with their contribution to total non-performing loans (NPLs) (CBK, 2021). These loan distributions are a good initial proxy to characterize banks' exposure to physical and transition risk, and provide a useful starting point for a vulnerability assessment of climate risk transmission to banks.

Figure 1: Sectoral Loan and NPL Distributions in Kenya, 2021



First, to paint a picture of the economy's exposure to transition risks, we present a few facts and projections about Kenya's energy usage and supply. According to the International Energy Agency (IEA), 67% of the country's energy currently comes from bioenergy. Oil usage remains relatively stable in the past three decades, at an average of 16.7% usage. Projections of primary energy demand[2] in Kenya to 2040 highlight the already declining proportion of biofuel usage in the country is set to worsen and likely narrow down to almost 15% by 2040 due to an increase in energy use from geothermal (other low carbon sources), coal, and oil.

Figure 2: Total Energy Supply (TES) by sources, Kenya 1990 - 2019 (TJ Units)



The Ministry of Energy (2020) also reports energy savings targets of 885,000 MWh/100MW demand or 250m litres heavy fuel oil or 9.0m litres industrial fuel for the combined industrial (includes manufacturing) and agriculture sectors to be achieved by 2025 to improve energy efficiency. The transport sector consumes about 72% of petroleum products imported into Kenya.

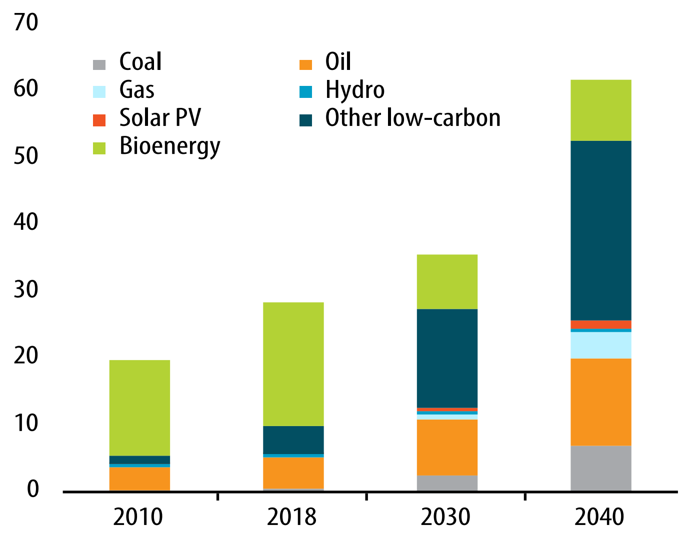
Energy saving targets are set at a reduced average fuel consumption of 6.5 litres per 100 km travelled by 2025, from 7.5 litres in 2019. For utilities, as much as there has been significant strides in the country to sustain renewable electricity production, about 1,200 GWh of electricity production is still reliant on oil, versus 3,200 GWh from hydro and 4,800 GWh from geothermal sources.

The threat of physical risks is clear from a snapshot of changes in quarterly temperature and precipitation levels from 2006 – 2020 in the country. The data is sourced from the World Bank Climate Change Knowledge Portal (CCKP). In **Table 2,** TEMP and PREC are monthly average temperature and average precipitation respectively.

Table 2: Summary Statistics – Temperature and Precipitation (Monthly)

	Mean	Std Dev	Min	Max	Range
	2006 - 2010				
TEMP (°C)	**25.2**	1.2	23.6	27.2	**3.6**
PREC (mm)	**49.1**	25.8	19.6	109.8	**90.2**
	2011 - 2015				
TEMP (°C)	**25.1**	1.0	23.8	26.8	**3.1**
PREC (mm)	**53.6**	27.9	26.9	128.3	**101.4**
	2016 - 2020				
TEMP (°C)	**25.4**	1.1	23.9	28.0	**4.1**
PREC (mm)	**51.6**	30.8	14.4	135.8	**121.4**

Figure : Kenya - Primary energy demand in Africa Case, 2010 - 2040 (million tonnes of oil equivalent)



> **Climate change is increasingly affecting Kenya's economy evidenced by greater incidence of weather and climate shocks resulting in more volatile agricultural output that has resulted in a 3-5 percent socio-economic GDP loss over the past decade.**

An evaluation across three consecutive sub-samples (2006 -2010, 2011-2015, 2016-2020) shows the trend and volatility of temperature and precipitation levels have become in the past two decades, with a 0.3°C average temperature increases in the last five-year window. The maximum temperature has also increased by over a degree in the same time span. Precipitation levels have become more volatile with increasing ranges and standard deviations.

The context provided highlights two issues: Firstly, for CPRSs, a rethinking of energy infrastructure in the country has begun, as reported by the Ministry, and will continue be inevitable in the wake of increasing climate change risks. Hence, in the context of Kenya's banking sector, there is a strong need for the assessment of the transmission of climate risk to the banking industry from the most affected and relevant sectors. Secondly, changes in climate related variables (temperature and precipitation) could present risks from a micro and macroeconomics perspective. This forms part of our primary analysis. It is expected that real estate/ housing and agricultural sector are the most exposed to such physical climate risk drivers, and in an economy where the agricultural sector accounts for 54% of employment and 23% of GDP, banks' balance sheets are more exposed than the 3% loan distribution would suggest.

As such, the threat on banking sector stability needs to be analyzed through the lens of key sectors impacted by climate change. The purpose of the study is to examine the time-varying nexus of climate risk drivers, climate policy relevant sectors, and banking sector stability, and discuss key policy implications that arise from the results. We achieve this by first analysing if outputs from sectors that present significant climate risk exposure for banks are granger-caused/ predictable by physical climate risks. Secondly, we gauge the vulnerability of banks to transition risks by examining which sectors significantly lead/predict banking sector stability, and further investigate the response of banking sector stability to sectoral output shocks arising from physical and transition risks. In effect, the paper examines sectoral transmission of climate risks to the banking sector.

2. DATA, METHODS AND RESULTS

Table 3:
Core IMF Financial Soundness Indicators for Depository Institutions

Capital Adequacy	Regulatory Tier 1 capital to risk-weighted assets
	Net Non-Performing Loans (NPLs) as a % of Capital
Asset Quality	Net Non-Performing Loans (NPLs) as a % of total gross loans
Liquidity	Customer Deposits to Total Loans
Earnings	Return on Assets (ROA)
	Return on Equity (ROE)

The study uses quarterly data on climate related variables (average temperature and average precipitation) and gross value-added[3] data from 5 CPRS (agriculture, utilities, manufacturing, transport, and real estate) from March (Q1) 2006 to December (Q4) 2021. To build the banking sector stability index, the study selects 6 Core Indicators from the IMF Financial Soundness Indicators (FSIs) Guide (IMF, 2006) and a similar review of measures of financial stability by the Bank of International Settlements (BIS, 2008). The selected indicators for the index span across core capital-based FSIs, core asset-based FSIs, and income-based FSIs.
Using these three sets of variables, our two-pronged analysis allows us to 1) determine whether climate related variables lead output from the 5 CPRSs (is there a significant predictive relationship from climate related variables to the sectors?) and to what extent this can translate to banking stability 2) determine through which sectors transition risks can be notably or significantly transmitted to the banking sector.

3.1 Physical Risks, Sectoral Output and Banking Sector Stability

From a microeconomics perspective, it is expected that both the agricultural and real estate sector would be the most exposed to physical risks. However, our analysis shows that net output growth patterns from real estate consistently remain unpredicted by variation in temperature and precipitation in the country. However, in more recent years, both temperature (from 2017) and precipitation (from 2019) are becoming increasingly important in predicting the percentage change in net agricultural output. This result identifies with the significantly higher average temperature and higher variability in precipitation levels seen in the 2016 to 2020 sub-period above. We estimate that a 1.1-degree temperature increase is followed by a 2.5 percentage point decline in net agricultural output 2 quarters later, with a short-lived recovery in quarter 4 to 5. A similar negative but milder response to increased precipitation is also observed 2 to 3 quarters later. We also observe that net agricultural output growth affects banking sector stability. A negative shock to agricultural output growth is followed by a negative response from the banking sector stability index 2 to 4 quarters later. This provides evidence of the channeled effect that physical risks have on banking sector stability.

3.2 Transition Risks, Sectoral Output and Banking Sector Stability

Secondly, we analyze how transition risk (especially from a disorderly transition) would affect climate policy relevant sectors and the effect of negative sectoral output shocks on banking stability. We find that net output growth from Manufacturing and Utilities sectors have become increasingly important predictors of banking stability since 2016, but their importance is especially accelerated and magnified in the COVID-19 period. Given that most energy use in electricity production in Kenya is largely low carbon at present (geothermal and hydropower), the transition risk from the utilities sector might be lowered. Nonetheless, as of 2019, data from the IEA shows that there is still about 1,200 GWh produced using oil, presenting an economically significant vulnerability to (expected) low carbon transition policies. Banking sector stability outside of the COVID-19 period is generally not predictable by output growth from the transport and real estate sectors. However, we see a surge in these sectors' predictive capacity during the COVID-period, especially from transport. The pandemic ultimately made each of these sectors stronger transmission channels of transition risk. With further climate related policies coming into effect, this link might be intensified even further.

3. POLICY IMPLICATIONS

The overarching objective of this policy brief and related analysis has been to examine how vulnerable the Kenyan banking sector is to climate risk drivers via a sectoral channel. We see that physical risks manifest through the agricultural sector alone, a key empirical finding that demystifies the primary channel through which physical risks can translate to the banking sector (in Kenya). Climate change and the consequences to the agricultural sector translate to an increased risk profile for banks. As a result, climate related policies that encourage a transition to a low-carbon economy will be critical in reducing the size and frequency of shocks arising from climate risks. As such, instruments such as carbon taxes and renewable subsidies should be considered for use to the extent that they are not market-distorting and are welfare-enhancing. Evidently, a "business as usual" approach to climate change with no relevant climate policies put in place is clearly a detriment to banking sector stability.

Secondly, the climate change conversation has played alongside COVID-19. It is key to note that during this period, all CPRSs have become increasingly linked to the banking sector – output changes from these sectors have stronger predictive capacity on the direction of the banking sector's stability. Consequently, this calls to attention the need for cautious design and implementation of climate related policies and targets, to avoid significantly contracted sectoral performance that amplifies the risk on stability. A disorderly transition to a low-carbon economy not only exacerbates the effects of the pandemic and slows down the recovery, but also amplifies the climate risk transmission channel from climate policy relevant sectors to banking sector stability. There is a place for sector-specific policymakers, central banks, and other financial regulators to facilitate an environment where firms in these sectors are resilient to climate-induced economic shocks given the effect this has on financial system stability. As such, in the interest of maintaining such stability, it is crucial for policymakers (monetary, fiscal, or otherwise) to be proactive and find synergistic approaches to greening of the economy and the financial system, while identifying risks and challenges that come with such a transition.

1. Endnotes

1 Real estate is defined to include both land and buildings (amongst other dwellings)

2 The projections are based on "The Africa Case", an IEA outlook of Africa guided by Agenda 2063. Agenda 2063 is the continentally agreed development blueprint adopted by heads of state and government in 2013.

3 Value added is the measure of output less the intermediate inputs used in production. The sum of value added from all producers is GDP

2. WORKS CITED

1. Bank for International Settlements. (26-27 August 2008). *Measures of financial stability - a review. Proceedings of the IFC Conference on "Measuring financial innovation and its impact",* (pp. 365-380). Basel.
2. Basel Committee on Banking Supervision (Bank for International Settlements). (2021). *Climate-related financial risks - measurement methodologies.* Bank for International Settlements.
3. Basel Committee on Banking Supervision. (April 2021). *Climate-related risk drivers and their transmission channels.* Bank for International Settlements.
4. Battiston, S., Mandel, A., Monasterolo, I., Schuetze, F., & Visentin, G. (2017). *A Climate stress-test of the financial system. Nature Climate Change,* 7, 283-288.
5. Central Bank of Kenya (CBK). (2021). *Bank Supervision Annual Report. Nairobi:* Central Bank of Kenya.
6. European Central Bank. (2019). Climate change and financial stability. *Financial Stability Review.*
7. European Central Bank/European Systemic Risk Board Project Team on climate risk monitoring. (July 2021). *Climate-related risk and financial stability.* European Central Bank.
8. International Energy Agency (IEA). (2019). *Africa Energy Outlook*. International Energy Agency .
9. International Energy Agency. (2022, *Last Updated, September). Energy Statistics Data Browser.* Retrieved from https://www.iea.org/data-and-statistics
10. International Monetary Fund. (2006). *Financial Soundness Indicators Compilation Guide.* Washington, D.C.: *International Monetary Fund, Publication Services.*
11. Ministry of Energy (Kenya). (2020). *Kenya National Energy Efficiency and Conservation Strategy. Nairobi.*
12. Network for Greening the Financial System (NGFS). (June 2020). T*he Macroeconomic and Financial Stability Impacts of Climate Change Research Priorities.* NGFS Secretariat/Banque de France.
13. World Bank. (2021). *The Climate Change Knowledge Portal (CCKP).* Retrieved from https://climateknowledgeportal.worldbank.org/