UNIVERSITY OF CAPE COAST

NATURAL DISASTERS, FINANCIAL DEVELOPMENT AND INCLUSIVE GROWTH IN SUB-SAHARAN AFRICA: THE ROLE OF STAGE OF DEVELOPMENT

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BY

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DECLARATION

Candidate's Declaration

I hereby declare that this thesis is the result of my own original research and that no part of it has been presented for another degree in this University or elsewhere.

Candidate's Signature: …………………………… Date: …………………

Name: Charles Morrison

Supervisors' Declaration

We hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the University of Cape Coast.

Principal Supervisor's Signature: ……………… ……… Date: ……………..

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Name: Prof. Samuel Kwaku Agyei

ABSTRACT

Natural disasters, an act of God, constitute major socioeconomic threats that require an in-depth understanding, particularly in Sub-Saharan Africa, where their frequency and severity have risen. Hence, this study examines the effects of the most prevalent natural disasters, floods, droughts and storms, on financial development and inclusive growth in SSA. Also, it analyses the moderating of the stage of development on these relationships. The five sets objectives. Firstly, to investigate the effect of natural disasters on financial institutions, financial markets and overall financial development. Secondly, to assess the moderating role of the stage of development on the relationship between natural disasters and financial development. Thirdly, to examine the effects of natural disasters on inclusive growth. Fourthly, assess the moderating role of the stage of development on the relationship between natural disasters and inclusive growth. Fifthly, to explore whether a threshold effect exists between financial development and inclusive growth. Using the Generalized Method of Moment technique, data on 35 countries from 1990-2019 was analyzed. The findings reveal that natural disasters negatively affect financial development and inclusive growth. Also, the stage of development significantly moderates these relationships for most models. Further, no threshold effect was established between financial development and inclusive growth. The study recommends that the financial sector regulators integrate natural disaster risk assessment to boost the resilience of the sector. Also, initiatives to drive inclusive growth should account for natural disaster-related vulnerabilities. Besides, the stage of development should be considered in any policy that aims at mitigating the impacts of natural disasters.

KEYWORDS

Financial institution development

Financial market development

Generalized Method of Moments

Inclusive growth

Natural Disasters

Overall financial development

Stage of development

Sub-Saharan Africa

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DEDICATION

To my Wife and Children

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LIST OF ABBREVIATIONS

2SLS	Two Stage Least Squares
4AID	Advocate for International Development
ACPC	African Climate Policy Centre
ADB	Asian Development Bank
AfDB	African Development Bank
AGI	African Growth Initiative
BCBS	Basel Committee on Banking Supervision
BIS	Bank for International Settlement
CAFOD	Catholic Agency For Overseas Development
CEMAC	Central African Economic and Monetary Community
CRED	Centre for Research on the Epidemiology of Disease
CSMAR	Chinese Stock Market and Accounting Research
EAC	Eastern African Community
ECOWAS	Economic Community for West African States
EIB	European Investment Bank
EM-DAT	Emergency Event Database
EST	Events System Theory
GDP	Gross Domestic Product
GEP	Global Economic Prospect
GMM	Generalized Method of Moments
GNI	Gross National Income
HDI	Human Development Index
IDB	Inter-American Development Bank

IFRC	International Federation of Red Cross and Red Crescent Societies
IFS	International Financial Statistics
IMF	International Monetary Fund
IPCC	Intergovernmental Panel on Climate Change
IPC-IG	International Policy Centre for Inclusive Growth
IV	Instrumental Variable
MCF	Master Card Foundation
NGFS	Network for Greening the Financial System
OAU	Organization of African Unity
ODI	Overseas Development Institute
OECD	Organization for Economic Co-operation and Development
OLS	Ordinary Least Squares
OST	Open System Theory
PCNS	Policy Center for the New South
PMG	Pooled Mean Group
ROA	Return on Assets
SADC	Southern African Development Community
SDGs	Sustainable Development Goals
SSA	Sub-Saharan Africa
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UNDESA	United Nations Department for Social and Economic Affairs

UNDP	United Nations Development Programme
UNDRR	United Nations Office for Disaster Risk Reduction
UNECA	United Nations Economic Commission for Africa
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNISDR	United Nations International Strategy for Disaster Reduction
UNU-WIDER	United Nations University World Institute for Development Economics Research
WDI	World Development Indicators
WID	World Inequality Database
WEF	World Economic Forum
WMO	World Meteorological Organization

CHAPTER ONE

INTRODUCTION

The rise in frequency and intensity of natural disasters poses a significant socioeconomic threat, particularly in Sub-Saharan Africa (SSA), where the different stages of development amplify the region's vulnerability due to different levels of adaptive capacity, it faces increased vulnerability. Natural disasters threaten financial development, hinder inclusive growth and impede the progress towards sustainable development goals. Even though global attention has been drawn to natural disaster risks, empirical studies on its nuanced effects on financial development and inclusive growth in the sub-region is limited. This study fills this gap by investigating the effect of natural disasters on financial development and inclusive growth while assessing the moderating role of a country's stage of development. Unlike earlier studies, this study employs comprehensive indices for inclusive growth and financial development which are unique for SSA. The findings will provide actionable insights to develop policies for a financial system that is disaster-resilient, stimulate inclusive strategies and thus contribute to an in-depth understanding of the relationship between natural disasters, financial development and inclusive growth in SSA.

Background to the study

The increasing rise in the frequency and severity of natural disasters presents one of the most persistent global challenges as a result of climate (United Nations Framework Convention on Climate Change [UNFCCC], 2022). Although their impact is globally felt, Sub-Saharan Africa (SSA) suffers disproportionately and is particularly vulnerable due to its limited adaptive capacity, persistent socioeconomic challenges and feeble infrastructure ((Fomby et al., 2013; the United Nations Department for Social and Economic Affairs [UNDESA], 2019). The World Meteorological Organization (WMO, 2021) reports that over the past five decades, Africa has witnessed 1,700 natural disasters, with droughts, floods and storms being the most predominant. These occurrences have deleterious consequences on the economy, infrastructure and livelihood.

The financial sector, an important sector is not immune to the destructive impact of natural disasters (Covitz et al., 2015). Given the underdeveloped state of the financial sector in SSA, natural disasters magnify the prevailing challenges by exacerbating credit risks, destabilizing institutions and reducing access to credit (Gani, 2020). Besides, natural disasters erode investor confidence, the value of financial assets and disrupt financial market activities and thus threaten financial development (Network for Greening the Financial System, 2020; Seiger, 2019). Further, when natural disasters such as storms and floods destroy assets that have been used as collateral for bank loans, they inhibit borrowers' ability to honour their financial obligations, which leads to worsening credit portfolios which weaken financial institutions (Akter et al., 2023). These destructive effects of natural disasters have long-term ramifications for the financial sector's contributions to the economy.

Similarly, natural disasters undermine inclusive growth which is critical for dealing with the SSA's prevalent inequality and poverty. According to UNEP (2016), inclusive growth ensures that the benefits of economic growth are evenly distributed across all sectors of an economy which reduces unequal access to resources, income and opportunities.

Nonetheless, natural disasters amplify income inequality and often disproportionately affect underdeveloped economies which are resource-deficient to mitigate the impact of natural disasters. Extant studies (Keerthiratne & Tol, 2018; Eco-Business, 2020) emphasize that low-salaried workers in regions affected by natural disasters lose a greater proportion of their incomes in the event of natural disasters than high-income earners, hence widening the income-inequality gap and undermine inclusive growth initiatives. According to the Kwatia et al. (2024), SSA faces high inequality with the top 10% earning more than 30 times the 50% at the bottom. As natural disasters occur, they heighten these challenges through the disruption of livelihoods, rising poverty and limiting access to social services.

Notwithstanding these challenges, current studies on natural disasters in SSA have mostly examined their physical and economic outcomes neglecting their overarching implications for financial development and inclusive growth. For instance, available studies examine the nexus between disasters, climate change, and economic development in SSA (Chhibber & Laajaj 2008), natural disasters and education (Edoun et al. 2015), natural disasters and conflict (Namgoong 2018), natural disasters and economic growth (Adjei-Mantey & Adusah-Poku 2019), natural disasters and technological innovations (Okolo & Wen 2023). There is a gap in understanding how natural disasters affect financial development and inclusive growth, especially in SSA whose financial system is underdeveloped and economic inclusivity is usually limited.

Furthermore, while extant studies (Khan et al., 2023) emphasizes the relevance of the stage of development in assessing natural disasters' impact, it is neglected in current studies. The Event System Theory (EST) posits that the stage of development of a country determines the impact that exogenous shocks such as natural disasters can have on it (Morgeson, Mitchell, & Liu, 2015). SSA countries have been categorized into low-income, lower-middle-income and upper-middle-income countries based on the World Bank's 2022 Gross National Income (GNI) country classification indicating different capacities to mitigate the impact of natural disasters. For example, whereas low-income countries are particularly vulnerable to the impact of natural disasters due to limited adaptive capacity, upper-middle-income countries may possess advanced financial systems and better infrastructure to deal with the impact of natural disasters (Khan et al., 2023; Kahn, 2005). The differences in the stages of development in SSA necessitate a comprehensive investigation of the role they play on the relationship between natural disasters and financial development and inclusive growth.

Moreover, even though the "too much finance" hypothesis (Cecchetti & Kharroubi, 2012) posits that the positive contributions of financial development to growth exist to a certain level beyond which the contributions become negative suggesting a threshold effect, this relationship has been under-investigated. According to Gakusi and Bagazonzya (2022) credit to financial sector depth increased from 33% in 2014 to almost 40% in 2018. Likewise, the Overseas Development Institute (2021) reports an improvement in the financial development index from 0.12% to 0.16% between 2000 and 2018. Despite the significant strides in SSA's financial sector, its relationship with inclusive growth has not been exhaustively explored. There is a need to examine the effect of financial development on inclusive growth in SSA and determine the threshold effect to inform sustainable growth policies.

In light of the existing gap in empirical studies, this study asks the ensuing question: what is the effect of natural disasters on financial development and inclusive growth in SSA? What is the role of the stage of a country's development in moderating these relationships? Does a threshold effect exist between financial development and inclusive growth in SSA? By using composite indicators tailored for the sub-region's unique socioeconomic context, this study offers valuable insights for policymakers who seek to have a natural-resilient financial sector and stimulate fairly distributed economic growth in SSA.

Statement of the Problem

Sub-Saharan Africa, a region known for its vast geographical diversity, cultural richness, and complex socio-economic dynamics, is particularly vulnerable to the impacts of natural disasters (Aleinikoff & Martin, 2022). Over the past few decades, the region has witnessed a significant surge in the frequency and intensity of natural disasters such as floods, drought and storms. The World Meteorological Organization (2021) reports that since the 1970s, the frequency of droughts has increased three times, floods have grown ten times and storms have quadrupled. Such a rise in natural disasters results in significant loss of lives and widespread disruptions to economic activities which negatively the marginalized population who are disadvantaged (Panwar & Sen (2019)

The financial systems of SSA, underdeveloped and characterized by low access to financial services, weak institutions and a lack of financial market depth (Eurostat, 2018), is highly susceptible to the disruptions associated with natural disasters. Natural disasters amplify the pre-existing vulnerabilities of SSA's financial system. Floods, for instance, impact financial institutions' infrastructure, break operations, and lead to a higher rate of loan defaulters, while also contributing to the decline of investors' participation in the financial markets which impedes overall financial development. Likewise, droughts also elevate borrowing default rates in agricultural economies, negatively impact financial institutions and diminish market participation hampering financial development. Similarly, storms wreak damage to infrastructures, impede financial institutions and may cause low investor confidence in financial markets, thus affecting global financial development as a whole (NGFS, 2020; Seiger, 2019; Akter et al., 2023; Federal Reserve, 2021; Gani, 2020). Despite the relevance of the SSA's financial sector to the region, current studies largely neglected to examine how natural disasters affect the two important components of the financial system.

This study's focus on financial development is critical given that it drives growth, poverty reduction, and equality all of which align with AU Agenda 2063 and the SDGs (Tabash, Anagreh & Adeosun, 2022; World Economic Forum, 2015). Financial development composed of financial institutions and financial markets is critical for reducing volatility, stimulating growth and thus ensuring economic stability in SSA (IMF, 2016; Ben Naceur & Zhang, 2016). Nevertheless, natural disaster, an exogenous shock, poses a substantial threat to all components of the financial system (Basel Committee on Banking Supervision, 2010). For instance, natural disasters raise credit costs, impair loans, erode investor confidence, and disrupt financial markets

(Akter et al., 2023; Federal Reserve, 2021; Gani, 2020; Seiger, 2019). This study, therefore, investigates how natural disasters affect the financial system of SSA. This responds to the gap in the literature, as most available literature tends to examine the effects of natural disasters on some macroeconomic variables such as GDP but overlook how these disasters impact the financial sector that is required for long-term growth (Annor et al., 2023).

Moreover, this study also investigates the critical issues regarding inclusive growth. According to existing literature (Ali & Sons, 2007), inclusive growth does not only focus on economic growth but also ensuring that the benefits from economic growth are evenly distributed across all sectors of society, especially among vulnerable and disadvantaged. In SSA, despite its consistent economic growth, the benefits have not been evenly distributed as there still persists high inequality, poverty and unemployment (AfDB, 2013; Brookings Institute, 2012). Consequently, Gyamfi et al. (2019) asserts that while the benefits from economic growth are not discounted, in Africa, inclusive growth has better meaning than just output growth since GDP-based growth has not resulted in poverty reduction and improvement in the economic welfare of citizens (Mlachila et al., 2017). Furthermore, the IMF (2018) notes that although SSA has, over the past twenty years, made significant strides in enhancing its social and economic conditions, such growth has not been adequate to generate continuous, robust and inclusive growth. The prevalence of high inequality and poverty in the presence of high economic growth emphasizes the relevance of inclusive growth as a better measure of the socioeconomic well-being of citizens.

Nevertheless, Yamamura (2015) points out that, natural disasters constitute a major threat in the pursuit of inclusive growth. For instance, the occurrence of natural disasters disrupts economic activities, destroy infrastructure, interrupt supply chains and increase vulnerabilities, undermining the drivers of inclusive growth per endogenous growth theory (UNDP, 2020; UNEP, 2016; World Bank, 2020). This disproportionately affects the already marginalized group and thus worsens the pre-existing inequality and poverty challenge that characterizes SSA. In line with SDG 11.5, which seeks to reduce the impact of natural disasters and thus promote the socioeconomic well-being of citizens, this study investigates how natural disasters hamper efforts toward achieving inclusive growth in SSA to foster resilience.

Furthermore, while some studies have been undertaken to understand the drivers of economic growth, a wide gap exists for the drivers of inclusive growth in SSA. Beck et al. (2007) posits that financial development is essential for achieving inclusive growth. Notwithstanding, Schularick and Taylor (2012) note that even though financial development is critical for inclusive growth, beyond a certain level, further financial development can cause a financial crisis, such as leading to a rise in inequality. Similarly, the Bank for International Settlement (BIS, 2012) reveal that "the level of financial development is good only up to a point, after which it becomes a drag on growth". These arguments suggest that there is a threshold effect between financial development and growth

For SSA, Gakusi and Bagazonzya (2022) notes that credit to financial sector depth, measured as private sector credit to GDP, increased from 33% in 2014 to almost 40% in 2018. Besides, the Overseas Development Institute

(2021) highlights an improvement in the financial development index from 0.12% to 0.16% between 2000 and 2018. Despite the steady progress in SSA's financial sector development, its relationship with inclusive growth has been under-investigated. Presently, empirical studies on the nature of the relationship between financial development and inclusive growth are limited, and this can be attributed to the narrow use of the concepts of financial development (Asongu & Nting, 2021). Employing IMF (2016)'s financial development indicator, which measures the stage and progress of financial institution and financial market development across access, depth and efficiency, and underpinned by the "too-much finance" hypothesis, this study investigates whether is a threshold effect between financial development and inclusive growth in SSA. This is necessary to ascertain the level where the positive contributions of financial development to inclusive growth becomes negative to help develop policies that maximize the positive benefits of the financial sector development while mitigating possible risks.

Further, even though extant (Khan, 2023) emphasizes the relevance of the stage of development in assessing natural disasters' impact, its neglect in current studies, could result in ineffective policies for sustainable financial development and inclusive growth. For instance, whereas developed economies with advanced financial systems and vigorous institutions are equipped to withstand the impact of natural disasters, emerging economies suffer from deleterious impacts of natural disasters due to inadequate financial resources and feeble institutions (Noy, 2009; Skidmore and Toya, 2002). Also, since developed economies are resource-endowed, they can effectively allocate them to mitigate the impact of disasters compared to less-developed economies (Kahn, 2005; Loayza et al., 2012). Further, Hallegatte et al. (2013) highlight that because developed economies possess advanced technologies and resilient infrastructure, they suffer less from the impact of disasters. Conversely, less resourced-endowed economies are mostly vulnerable to the effects of natural disasters because of weak infrastructure and inadequate adaptive capacity (Keefer et al., 2011). Guided by the EST, this study investigates the effects of natural disasters on financial development and inclusive growth in SSA, using composite indicators and focusing on the moderating role of the stage of development.

Despite the increasing awareness of the importance of financial development and inclusive growth and the rising frequency and severity of natural disasters, there exist limited studies that addresses how natural disasters, financial development and inclusive growth interact in SSA. This study seeks to address these gaps by examining the disaggregated impacts of natural disasters on financial institutions, financial markets and overall financial development, investigating the effects of natural disasters on inclusive growth, assessing how the stage of development moderates the relationship between natural disasters and financial development as well as inclusive growth and ascertaining whether a threshold effect exist between financial development and inclusive growth

By filling these gaps, this study seeks to contribute to extant literature and provide pragmatic solutions for government regulators of the financial system in SSA. The findings of this study will provide important insight into strengthening the financial systems and inclusive growth to withstand natural disasters. Moreover, the findings will also offer critical insight for understanding the role of a country's stage of development in mitigating the impact of natural disasters on inclusive growth and financial development to help develop tailored policies. This study ultimately aims to ensure the financial systems in SSA are resilient and that the pursuit of inclusive growth is not undermined by rising natural disasters.

Purpose of the Study

The purpose of this study is to investigate the relationships among natural disasters, financial development and inclusive growth in Sub-Saharan Africa.

Objectives of the Study

In order to achieve the purpose of this study, the under-listed objectives are set:

1. To examine the effect of natural disasters *(floods, droughts, storms, and composite disasters)* on financial development (*institution, market and overall*) in SSA.
2. To assess the moderating effect of the stage of development on the relationship between natural disasters (*floods, droughts, storms and composite)* and financial development (*institution, market and overall*) in SSA.
3. To investigate the effect of natural disasters (*floods, droughts, storms and composite)* on inclusive growth in SSA.
4. To evaluate the moderating effect of the stage of development on the relationship between natural disasters (*floods, droughts, storms and composite)* and inclusive growth in SSA.

5. To ascertain whether there is a threshold effect between financial development (*institution, market and overall*) and inclusive growth in SSA.

Research hypotheses

Based on the objectives of the study, the under-listed hypotheses have been formulated:

$H_{1o:}$ There is no significant effect of natural disasters (*floods, droughts, storms, and composite disasters)* on financial development in SSA.

$H_{1A:}$ Natural disasters (*floods, droughts, storms, and composite disasters)* significantly affect financial development (*institution, market and overall*) in SSA.

$H_{2o:}$ The stage of development of countries does not moderate the relationship between natural disasters (*floods, droughts, storms, and composite disasters*) and financial development (*institution, market and overall*) in SSA.

H_{2A}: The stage of development of countries moderates the relationship between natural disasters (*floods, droughts, storms and composite)* and financial development (*institution, market and overall*) in SSA.

$H_{3o:}$ There is no significant effect of natural disasters (*floods, droughts, storms, and composite disasters)* on inclusive growth in SSA.

H_{3A}: Natural disasters (*floods, droughts, storms and composite)* have a significant effect on inclusive growth in SSA.

$H_{4o:}$ The stage of development of countries does not moderate the relationship between natural disasters (*floods, droughts, storms, and composite disasters*) and inclusive growth in SSA.

H_{4A}: The stage of development moderates the relationship between natural disasters (*floods, droughts, storms and composite)* and inclusive growth in SSA.

H_{5o}: Financial development (*institution, market and overall*) does not have threshold effect on inclusive growth in SSA.

H_{5A}: Financial development (*institution, market and overall*) has a threshold effect on inclusive growth in SSA.

Significance of the Study

Even though extant literature and data from EMDAT reveal that the frequency and intensity of natural disasters in SSA have risen, little attention has been paid to their possible effects on economies. Natural disasters affect financial development, income inequality, poverty alleviation and consequently, inclusive growth of affected regions. Nevertheless, to the researcher’s knowledge, no empirical study has attempted to investigate the effect of natural disasters on financial development and inclusive growth in SSA. This study, therefore, contributes to the discourse on natural disasters, financial development and inclusive growth among emerging economies. It fills the gap in the limited literature on the impact of natural disasters in SSA. This is crucial for preparing for natural disaster events, relief, reconstruction, and enacting policies that may be targeted at building resilience against natural disasters and incorporating natural disaster risks into regulatory frameworks.

Moreover, this study is the first to analyse the effect of natural disasters on SSA's inclusive growth. Achieving inclusive and sustainable growth is fundamental to realising the SDG goals and ultimately improving the social and economic well-being of citizens of the sub-region. SSA faces high inequality and poverty, which tend to trigger major social and economic woes; achieving inclusive growth is essential. These have made inclusive growth a primary objective for most governments in the sub-region. However, as governments become poised to follow this path, it is necessary to be abreast with all the possible hindrances to realising the inclusive growth agenda. This study provides information on how natural disasters threaten inclusive growth in African settings, thus providing the basis for tailor-made policies and practices to reduce their impact in line with SDG 11.5, which entreats all economies to reduce the impact of natural disasters because they threaten inclusive growth. Furthermore, filling this gap will help stakeholders understand how natural disasters affect inclusive growth and possibly threaten Africa’s Agenda 2030 and 2063 so that policies can be implemented to deal with associated challenges in pursuing SDG goals.

Furthermore, the financial sector of SSA has been crucial in promoting growth in the sub-region. As the World Bank in 2016 advised, the sub-region should be cautious of any threat that could threaten its financial sector. This implies that there should be adequate knowledge of all the potential threats to the sector. Even though some bottlenecks are already known, there are empirical investigations on how weather-related shocks could disturb and disrupt the activities of SSA's financial sector. Therefore, this study provides information on how natural disasters affect the two main structures of financial development: financial institution development, financial market, and overall financial development. This is necessary for sector-specific and holistic policies to ensure the continued growth of the sub-region's financial system. This study is relevant because it helps to understand how natural disasters affect the financial system so that natural disaster-related policies can be incorporated into the regulatory frameworks of the regulators of the financial system of Sub-Saharan Africa.

Delimitation of the Study

This study examines the effect of natural disasters on financial development and inclusive growth in Sub-Saharan Africa from 1990-2019. Although there are about 48 countries, the study shall be based on 35 countries due to data availability.

Furthermore, even though EMDAT reports that different types of natural disasters occur in SSA, the studies focus on floods, droughts and storms, the most prevalent and impactful natural disasters in the sub-region.

Prior studies had measured financial development using a single indicator. However, this study employs the Svirydzenka (2016) or the IMF Financial Development Index, which incorporates both two critical components of financial institutions and financial markets into a single index. Although the World Bank (2016) has developed a financial development index, the choice of the IMF index was informed by the availability of data over the period considered for the study.

Also, even though there are various measures of natural disasters in the extant literature, this study uses the Lifeyears Index developed by Noy (2016) as this index incorporates all three critical areas of a natural disaster's impact: number of deaths, total affected and economic losses, into a single index so that the overall impact of natural disasters can be measured. In this case, a holistic understanding of how natural disasters impact an affected region is gained.

Further, although there are various indicators for measuring the economic well-being of citizens, this study aligns with AfDB's measure as it tends to be best suited for SSA. Economic growth has been criticised as a good measure of the economic welfare of citizens because it ignores other important indicators of well-being, such as health, education, gender, inequality, etc. Inclusive growth is, however, a broad measure because it integrates economic growth and other measures of the welfare of citizens.

Limitations of the Study

The main limitation of this study is the availability of data on critical variables for all 48 countries in SSA. Inasmuch, the study would have preferred to examine the effect of natural disasters on financial development and inclusive growth; due to data unavailability, several countries had to be dropped from the empirical analysis. Due to this, the generalisation of the result cannot be made for 48 countries.

Definition of terms

Natural disasters

Natural disasters are the consequences of natural hazards that overwhelm local response capacity and seriously affect an exposed region's social and economic development (United Nations, 2011). According to CRED (2016), a natural disaster is "a situation or event, which overwhelms local capacity, necessitating a request to national or international level for external assistance; an unforeseen and often sudden event that causes great damage, destruction and human suffering."

Financial Development

Eryigit, Eryigit and Dulgeroglu (2015) explain that financial development describes the situation where the financial system performs its functions excellently and thus eliminates distortions in the market. Also, Wait, Tafadzwa and Pierre (2017) highlight that financial development occurs when there is an improvement in the activity, size, stability and efficiency of the financial system of an economy.

Inclusive Growth

African Development Bank (AfDB, 2012) defines inclusive growth as economic growth that leads to broader access to sustainable socio-economic opportunities by more people, regions or countries and protects the vulnerable in the atmosphere of fairness, equal justice, and political plurality. It is economic growth that results in a simultaneous decline in extreme poverty and inequality (AfDB, 2020)

Organisation of the Study

This thesis is organised into eight chapters. Chapter one, the introduction to the study, covers the background, statement of the problem, purpose and objectives of the study, research hypotheses, significance of the study, delimitation, limitations and definition of terms.

Chapter two presents the concepts and the theories that underpin this study. Also, the chapter reviews empirical literature regarding the study's objectives. Further, the chapter presents the gaps identified in the literature and a conceptual framework and ends with a chapter summary.

Chapter three discusses the research methodology employed to empirically analyse the study's objectives. Specifically, it contains the research paradigm, research design, research approach, sources and structure of data, model specification, methods followed to construct the composite index and estimation methods. The chapter concludes with a chapter summary.

Chapter four presents and discusses the results of pre-estimation tests. These included descriptive statistics, correlation matrix and endogeneity tests on the study's critical variables. It also presents and discusses the study's results of objectives one and two. Mainly, the presentation and discussion of the results of the effect of natural disasters on financial development, as well as the moderating role of the stage of development of countries on the relationship between natural disasters and financial development in SSA, is done in this chapter. It concludes with a chapter summary.

Chapter five presents and discusses the results of the effect of natural disasters on inclusive growth as well as the moderating of the stage of development in countries on the relationship between natural disasters and inclusive growth is undertaken in this chapter. It ends with a chapter summary.

Chapter six presents and discusses the findings on the non-monotonic relationship between financial development and inclusive growth in SSA. It ends with a chapter summary.

Chapter seven summarises the study's findings, implications, recommendations, and contributions. Also, the chapter covers suggestions for future research.

CHAPTER TWO

LITERATURE REVIEW

Introduction

This chapter is devoted to discussing the theories and concepts underpinning this study to understand them better and to situate them in the study. Moreover, it highlights empirical studies that have been understanding on natural disasters, financial development, inclusive growth and the moderating role of the stage of development that supports the objectives the study seeks to achieve. The chapter ends with a chapter summary.

Theoretical Framework

This section discusses theories that could explain the relationship among natural disasters, financial development and inclusive growth. Specifically, this section reviews the Event System Theory (EST), Financial fragility theory, Too-much finance hypothesis and Endogenous growth theory, Creative destruction theory, and Efficient Market Hypothesis.

Event System Theory

The Event System Theory (EST) developed by Morgeson, Mitchell and Liu (2015) is an improvement of the Open System Theory (OST) developed by Katz and Kahn (1978). According to the OST, what happens in an entity's environment influences it in several dimensions and thus determines the outcomes that the entity produces. Nonetheless, available literature (Miller & Rice, 2013; Rice, 2013) argued that the primary focus of the OST theory was on recurrent events that result in the creation of a steady state in the entity and thus ensure repetitive functioning with little attention given to non-routine events and how they can change entity's functioning.

Consequently, Morgeson, Mitchell and Liu (2015) resolve this challenge by introducing the EST.

The Event System Theory states that the effect of a single exogenous event can be understood as how that event affects an event system. According to Morgeson, Mitchell and Liu (2015), an event system comprises complex, interrelated components named event strength, event space and event time.

Event strength considers the critical, novelty and disruption of a particular exogenous shock. Criticality is the degree to which a specific event is significant, necessary, or crucial to an individual or organisation. Novelty indicates the extent to which a shock differs from current and previous events in terms of being new or unexpected. Malpass (2021) emphasises that no two disasters are the same; each disaster differs from the preceding one or another. Disruption is the extent to which a shock causes a discontinuation of development in an environment. Existing literature (Li, Sun, Jiang, Yang & Zhang, 2021) posits that these characteristics happen differently depending on the nature of the shock. When these characteristics occur, they affect an entity's performance.

As an exogenous event, natural disasters have exhibited all the characteristics mentioned under the event strength. All major global discussions on climate change consider natural disasters a critical concern (UNDESA, 2019) because of their ability to affect the affected social and economic activities and sometimes extend this effect to unaffected areas (UNFCCC, 2021). Moreover, such attention has become warranted because natural hazards usually generate chain reactions that result in a long chain of technical and societal destructions, bringing about disastrous consequences

(Schweizer & Renn, 2019). This is supported by available data that shows that the number of natural disaster events that occur each year tends to be higher than in previous years. CRED (2020) showed that natural disaster events increased by about 27.4% in 2019, rising from 315 events in 2018 to 396 events in 2019. Again, every time a natural disaster occurred, the impact of the present differed from the previous ones. For instance, between 2007-2016, natural disasters killed 68,302 people, affected 210 million people and caused about US$153 billion in damages globally. Still, in 2017 alone, natural disasters killed 9,503 people, affected 96 million people and caused US$ 314 billion in damages (CRED, 2018). Natural disasters significantly destroy affected economies because major infrastructure such as electricity, water, and other vital infrastructure are destroyed after natural disasters (World Bank, 2020).

Event space, the second component of the EST, is considered when determining the impact of exogenous shocks such as natural disasters (Morgeson, Mitchell & Liu, 2015). According to the theory, the location or the place where a shock occurs is essential in understanding the impact that it can have. This implies that different locations are impacted differently by shocks. For instance, the effect of a shock in a developed economy will not be the same in a developing economy. To this, extant literature (Panwar & Sen, 2019) explains that although destructive natural disasters occur in developed economies, the impact is not the same in emerging economies; developing economies tend to be more sensitive to such exogenous shocks. Furthermore, Noy (2009) highlights that developed economies can deal with natural disasters better because they have higher per capita income, improved institutional frameworks, low illiteracy rates, and more effective ex-ante disaster risk financing instruments.

Again, the United Nations University (2016) reveals that unlike developed economies, which are mostly considered to have very low risk from natural disasters, most developing economies fall under medium-to-extreme high risk from natural hazards. The severity of the impact suffered by developing economies can be attributed to the fact that their economies are more vulnerable to weather-related shocks as a result of the heavy reliance of their agrarian sector on the weather and have less capacity to adapt to climate-related challenges (Fomby, Ikeda & Loayza, 2013; Loayza, Olaberría, Rigolini & Christiaensen, 2012; Mahul et al., 2014; Raddatz, 2009). Additionally, (CRED, 2020) reveal that the cost of natural disasters keeps rising in SSA, and this is attributable to the fact that about 94 per cent of towns in the sub-region were located in areas which are at a high level of risk of death from at least one of the six major types of natural disasters (UNDESA, 2019).

The third component of the EST is event timing. Under this component, the time in which a shock occurs determines the possible effect that it can have. The EST assumes that entities usually go through different stages (Allen & Meyer, 1993) in their development and that a shock may occur at any of these stages. The effect that a shock may have depends on the stage of development that the entity is experiencing. This suggests that the stage of development moderates the relationship between shock and the effect it can have.

The moderating role of stage of development

The event time component of the theory is relevant to SSA because countries in the sub-region are in different stages of development as determined by the World Bank (2022) based on their development levels measured by the respective countries' Gross National Income (GNI) per capita. These categories are low, lower-middle, upper-middle, and high-income. Countries with a GNI per capita below USD 1,085 are classified as low-income countries; countries with a GNI per capita between USD 1086-4255 are considered lower-middle-income countries. Further, whereas countries whose GNI per capita is USD 4,256-13,205 are regarded as upper-middle-income countries, countries with a GNI per capita higher than 13 205 are classified as high-income countries (World Bank, 2022),

Based on the World Bank (2022) country classification, out of the 48 countries in SSA, 24 are classified as low income, 17 as lower middle income, six as upper middle income, and one under high-income countries. Given such groupings, it is anticipated that the effects of natural disasters will be different across the sub-region. This, therefore, sets the basis for investigating how the various stages of development in SSA moderate the effects of natural disasters. Extant literature (Benali & Feki, 2018) supports this argument by emphasising that a country's economic structure and stage of development determine a country’s vulnerability to natural disasters.

Financial Fragility Theory

The financial fragility theory, attributable to Minsky (1992), posits that various factors can make financial systems unstable. Klomp (2014) highlights that natural disasters can cause instability in the financial system as they can wreak havoc, such as the destruction of banks' essential installations, such as information and communications technology systems, that can affect the services offered by the banks. Again, natural disasters can disrupt economic activities and thus result in the loss of financial resources of individuals and businesses that have benefited from loans offered by banks. This, therefore, impairs borrowers' ability to honour their financial obligations, leading to a rise in defaults, which culminates in increased bank vulnerability. As natural disasters bring these deleterious consequences on the banks, they lead to instability in the financial system (Noth & Schuwer, 2018).

Moreover, the impact of natural disasters transcends beyond just the physical destruction of assets to influence the mood of investors (Gani, 2020), the dynamics of financial markets and the prices of financial assets (Seetheram, 2017). These outcomes affect investors' confidence in the market and how they perceive risk in the aftermath of natural disasters and increase the vulnerability of the markets and, hence, financial fragility.

Additionally, in the aftermath of natural disasters, the insurance industry faces increased demand for prompt payments on insurance claims and substantial payouts. This can influence insurance companies' financial stability, possibly leading to a re-evaluation of risk in the broader financial system. Based on how natural disasters cause financial instability, as discussed above, their effect on financial development can be investigated and spelt out objectively.

Too-much finance hypothesis

Following the development of the supply-leading hypothesis by Schumpeter (1911), other literature emerged that contested the argument of the supply-leading theory that a developed financial sector is the engine of growth. Among them was the demand-following hypothesis credited to Robinson (1952). The demand-following argues that economic growth necessitates the need for financial development and contends that as the economy grows, the demand for financial services increases, and the financial sector responds to this by introducing new financial products. Further, the theory states that the expansion in macroeconomic activities due to economic growth necessitates the development of the financial sector (Singh, 1999). Hence, economic growth leads to financial development, and financial development leads to economic growth, as suggested by the finance-led hypothesis.

As a result of the opposing views on the relationship between financial development and growth, another strand of argument, the feedback hypothesis, which sought to integrate both the supply-leading and demand-following hypothesis, was developed by Patrick (1966). The fundamental argument of this hypothesis is that the finance-growth nexus varies based on the stage of development of an economy. This hypothesis, therefore, argues that the finance-led theory holds at the initial stages of development of a country where financial development drives growth through innovation. Still, as the country continues to grow and economic activities expand, the supply-leading hypothesis wanes for the demand following hypothesis in that economic growth facilitates the development of the financial sector. This theory, in essence, advances that there is a reciprocal effect between financial development and economic growth.

Following these divergent views, various empirical studies were undertaken to ascertain the relationship between finance and economic growth empirically. Based on their findings, these studies can be grouped into two (Botev, Égert & Jawadi (2019). The first group of studies (Assefa & Mollick, 2017; Bist, 2018; Ibrahim & Alagidede, 2018; King & Levine, 1993; Ngongang, 2015) established a positive finance-growth relationship. Taiwo (2020) notes that these studies were conducted before the global financial crisis. Conversely, studies (Adeniyi et al., 2015; Allen et al., 2014; Ductor & Grechyna, 2015) established a negative relationship between finance and growth. These studies were undertaken after the global financial crisis (Taiwo, 2021).

The opposing outcomes from the empirical investigation of the relationship between finance and economic growth served as the basis for further studies, leading to the too-much finance hypothesis attributed to Cecchetti and Kharroubi (2012). The too-much finance hypothesis states that the relationship between finance and economic growth is non-monotonic and that there is a threshold beyond which the positive contributions of financial development become negative. According to this hypothesis, even though a well-developed financial sector minimises the cost of transactions and thereby increases investment and enhances optimum capital allocation, which is vital for growth, the relationship can become non-linear because there is a level wherein extra financing, the monetary system ‘becomes a drag on growth’.

Earlier studies (Philippon, 2010), for instance, agreed with the argument of the too-much finance hypothesis as it states that the financial sector is not the only sector in an economy that uses the economy’s scarce resources; hence, as financial development expands, it results in depriving the other importance sectors of the economy of resources that are needed for growth and thus lead to a negative outcome. Similarly, Luca and Spatafora (2012) establish two reasons why the contributions of financial development become a drag on growth: firstly, as the financial sector develops more, there is the high possibility of economic crashes and secondly, the likelihood of misallocation of resources, even in good times. Subsequently, Taiwo (2021) opines that based on the non-monotonic relationship between financial development and economic growth, financial development must be considered jointly with other sectors of an economy as this will assist in stabilising the economy and thus enhance growth.

This theory serves as the basis for analysing whether there is a non-monotonic relationship between financial development and inclusive growth in SSA, as specified in objective five of this study.

Endogenous growth theory

Armstrong and Taylor (2000) note that the endogenous growth theory was developed in the 1990s as a 'new growth theory' for explaining the role of technical progress in the growth process. Neoclassical growth models such as the Solow-Swan model 1956, which were earlier developed, opined that although the technical process was crucial for growth, it was exogenous to development. This position was criticised as there was no role for the government, hence no room for policy (Shaw, 1992). Consequently, Romar (1986) introduced a new growth theory which associated technical progress with the knowledge of research and development of employees of a profit-oriented organisation.

The endogenous growth theory is a theory that explains that economic growth results from factors within an economy and not external to it. The theory assumes that advancing knowledge, innovation and human capital results in increased productivity and brings about positive growth outcomes.

Although endogenous theory primarily focuses on the role of internal factors in fostering economic growth, it can be expanded to emphasise the deleterious consequences of natural disasters on inclusive growth. The theory emphasises that relevant factors such as innovation, human capital accumulation and institutional quality, which can promote inclusive growth, can be negatively affected by natural disasters (Chen et al., 2021; Opper, Park & Husted, 2023; Khurana, Mugabe, & Etienne, 2023). For instance, through interruptions to educational systems, healthcare services (Hassan & Mahmoud, 2021), and the entire community's well-being, natural disasters can impede the development and productivity of the labour force (Martínez et al., 2020). However, inclusive growth depends on improvements in human capital. Consequently, any impediment in improving human capital due to natural disasters can hamper inclusive growth.

Additionally, natural disasters can affect research and development activities and the adoption of technological advancements. Damage to infrastructure, loss of qualified workers, and reallocation of resources to meet urgent recovery needs might limit a region's capacity to innovate. This, in turn, inhibits the possibility of inclusive growth by hindering the creation of fresh opportunities, especially for vulnerable groups (Okolo & Wen, 2022).

Again, interruptions to governance structures and public organisations can affect policy responses, thus worsening the undesirable effect on inclusive growth. Feeble governance may lead to inefficient resource allocation, insufficient social safety nets, and an inability to address the needs of marginalised people following a natural disaster (Mahadevia, 2021).

Conceptual Review

Sub-Saharan Africa

Sub-Saharan Africa is an area of the African continent that lies south of the Sahara Desert whose climate is determined significantly by its distance from the equator and altitude (Bohannan & Curtin, 1998; Reader, 1988; Newman, 1995). There are two types of weather seasons, namely, rainy and dry seasons, which alternate, even though the humid forests experience consistent precipitation. It comprises 42 countries on the mainland and six on islands and is divided into four main divisions: Western Africa, Central Africa, Eastern and Southern Africa (Stockdale 2017). Further, World Bank (2020) reports that the population in SSA is more than 1 billion people, out of which 50% will be under 25 years old by 2050. Moreover, SSA is endowed with diverse natural and human resources that can contribute to achieving inclusive growth and eliminating poverty. Additionally, the region has the potential to create new development paths because it is one of the most significant contributors to free trade and has a broader market of 1.2 billion people. Also, in terms of the stage of development of countries determined by income classification, SSA comprises low, lower-middle, upper-middle, and high-income countries.

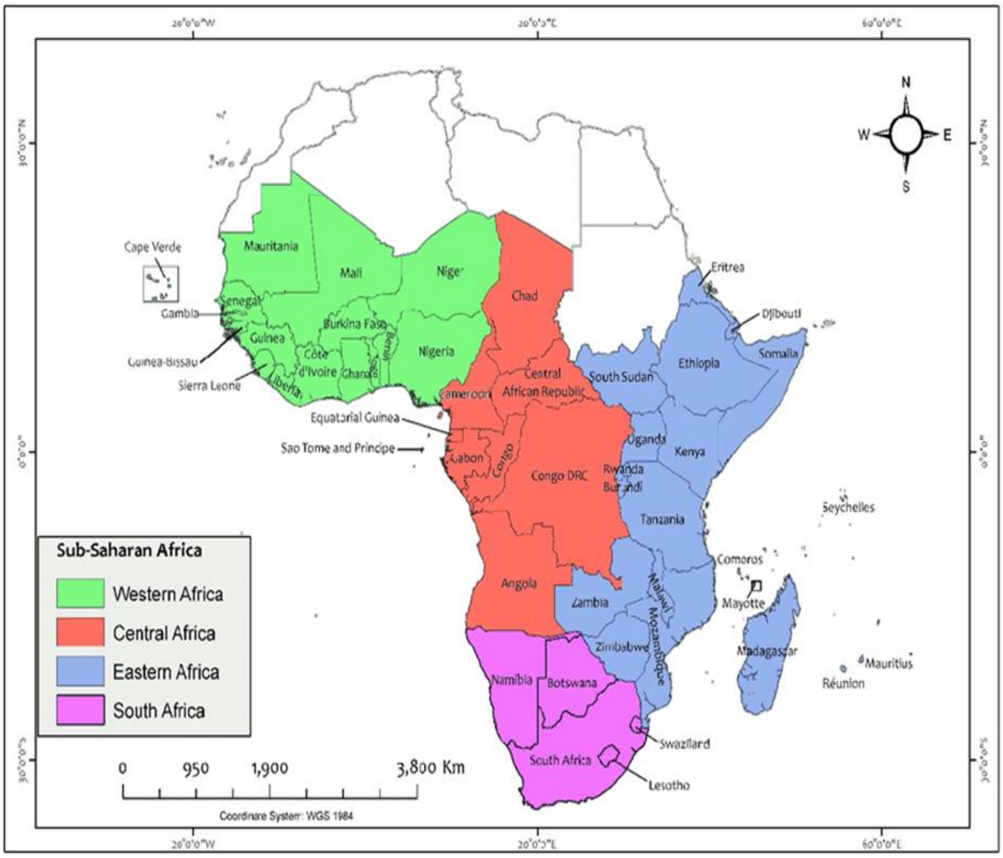

Figure 1: Map of Sub-Saharan Africa showing four main divisions
Source: Fasina and Fasanmi (2020)

Natural Disasters

The concept of natural disasters has been variedly defined and understood based on the field use. According to the United States of America’s Department of Homeland Security (2021), natural disasters are extreme weather that can cause a significant threat to human health and security, property, necessary infrastructure, and homeland security. Correspondingly, OMICS Group International (2021) states that natural disasters are natural processes of the earth, such as floods and earthquakes, that adversely affect a vulnerable population. Also, Lone and Subramani (2016) opine that a natural disaster is a severe hazardous event that affects people, causing destruction, disruption, deaths and injuries and making affected communities incapable of functioning generally without external support.

Again, Noy and duPont IV (2016) intimate that a natural disaster occurs when a natural hazard interacts with a population, causing harm to people and damaging property. Furthermore, the Emergency Event Database (EM-DAT) (1988), as cited in the Centre for Research on the Epidemiology of Disasters (CRED, 2016), states that a natural disaster is "a situation or event, which overwhelms local capacity, necessitating a request to national or international level for external assistance; an unforeseen and often sudden event that causes great damage, destruction and human suffering".

Putting the various approaches to the concept of natural disasters together, natural disasters can be conceptualised as disasters that emanate from nature instead of man or technology that result in the destruction of property and harm to humans either through death, displacement, injuries and beyond the ability of the affected area to handle thus, necessitating the need for external assistance.

Generally, EM-DAT reports the occurrence of natural disasters along three main dimensions: reported disasters, human impact and economic impact. Also, reported disasters give information about the number of disasters that occurred over a certain period. Human impact is divided into two categories: total deaths and total affected. Total deaths refer to the number of people whose lives were lost and the number of people who could not be found after the disaster and were, therefore, considered dead. Total affected is the sum of the number of people who need immediate support or are injured and whose places of residence were destroyed or seriously destroyed and thus required shelter after a natural disaster. Furthermore, EM-DAT categorises all natural disasters into six main groups as below:

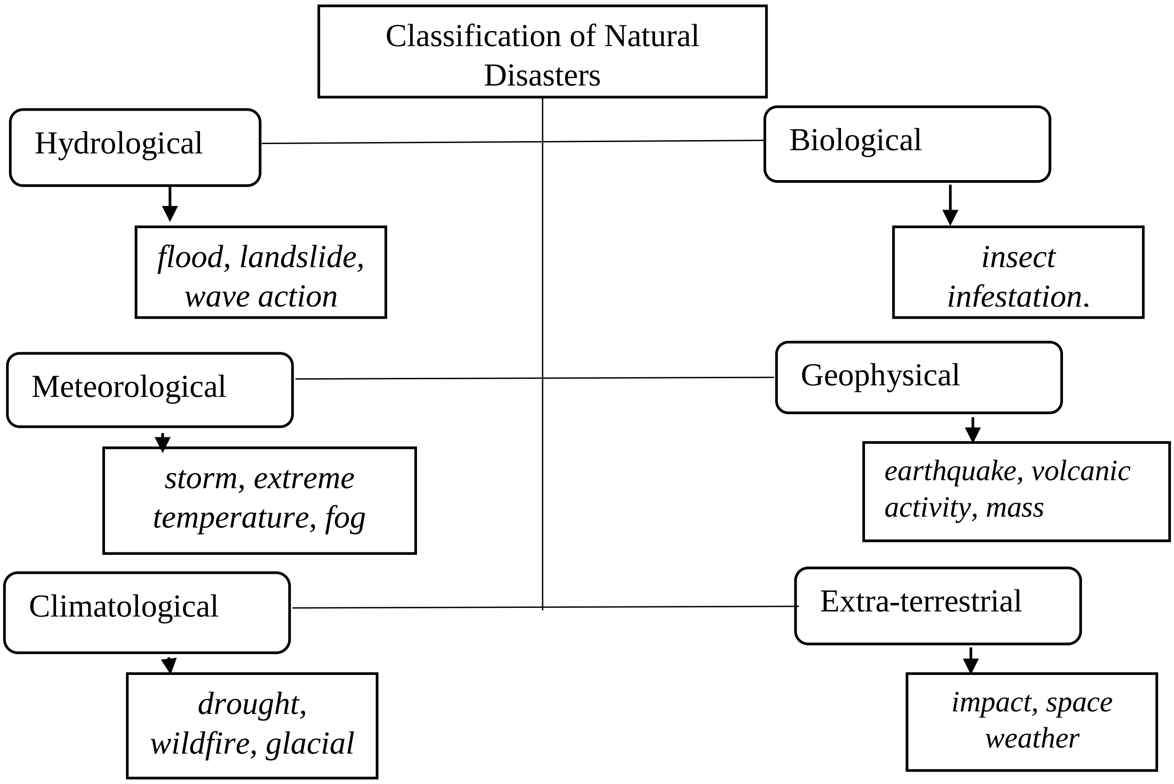

Figure 2: Classifications of natural disasters
Source: Author's construct based on EM-DAT

Most Prevalent Natural Disasters in Africa

It is worth noting that even though there are six main categories of natural disasters, the most predominant and impactful natural disasters in Africa are the hydrological, meteorological and climatological natural disasters (CRED, 2019). Figure 2 below gives an overview of natural disasters distribution or by share in Africa from 2000 to 2019.

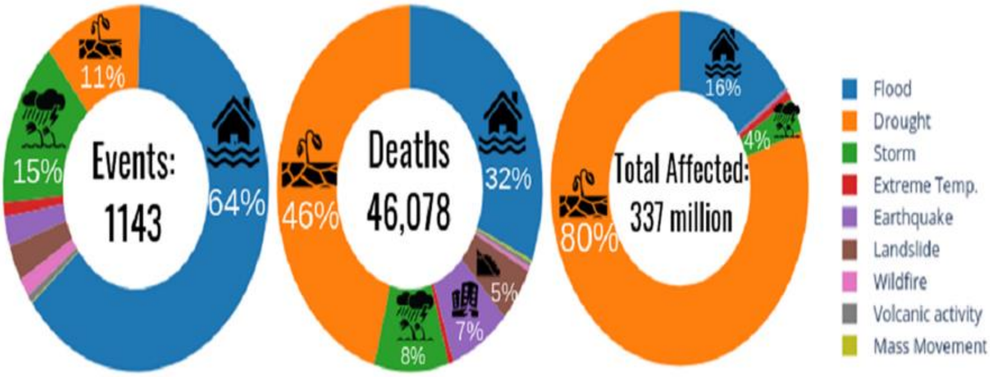

Figure 3: Overview of natural disasters in Africa between 2000 and 2019
Source: CRED (2019)

As can be seen in Figure 3 above, between 2000 and 2019, a total of 1,143 natural disasters occurred in Africa. Of the 1,143 natural disasters, 64% were floods, 15% were storms, and 11% were droughts. The remaining 10% was distributed among the remaining types of natural disasters, implying they were insignificant. Figure 4 also reveals that between 2000-2019, out of 46,078 deaths from natural disasters, droughts killed 46%, 32% died from floods, 8% from storms, 7% from wildfires and 5% from landslides. The remaining 2% were distributed among other types of natural disasters. Further, of the 337 million people affected by natural disasters between 2000 and 2019, 80% were affected by drought, 16% by floods, and 4% by storms. Droughts, floods and storms have been Africa's most frequent and impactful natural disasters.

The WMO (2021) corroborates the above, showing in Figure 5 that between 1970 and 2019, 1,695 natural disasters occurred in Africa. Out of this, floods accounted for 60%, storms 17%, and drought 16%. Landslides accounted for 3%, wildfires 2% and temperatures 2%. WMO (2021) thus confirms that floods, drought and storms have been Africa's most predominant and impactful natural disasters.

Furthermore, figure 4 shows that out of the total economic losses of USD 38.5 billion caused by natural disasters between 1970-2019, 37% were attributable to storms, 34% to floods and 26% to droughts, and only 3% was caused by wildfires. Moreover, out of 731,747 deaths, 95% were attributable to drought, 4% to floods, and 1% to storms. Droughts are causing a severe depletion of the human capital of Africa.

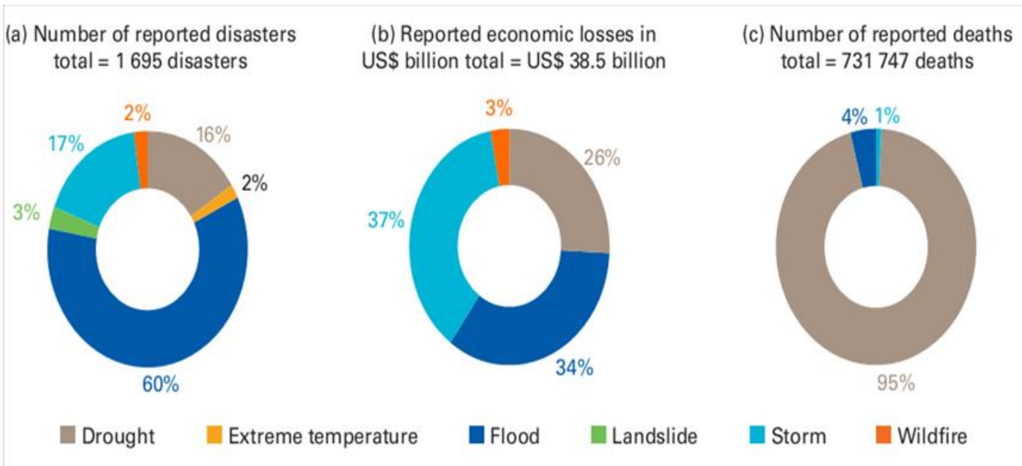

Figure 4: Distribution of reported natural disasters in Africa between 1970-2019
Source: World Meteorological Organization (2021)

Given these statistics, it can be concluded that floods, storms and droughts are the most prevalent and impactful in Africa. This study, therefore, examines the effect of these on financial development and inclusion.

Inclusive Growth

The OECD (2014) highlights that economic growth is not an end; it is needed to address multidimensional challenges. The available literature, however, reports that economic growth needs to address those challenges. For instance, Lanchovichina and Lundström (2009) aver that it has become imperative to focus on inclusive growth because economic growth alone cannot meet the developmental needs of the poor. After all, it does not tackle essential concerns such as unemployment and inequality. Again, Furman (2014) argues that the benefits of economic growth are not fairly distributed. Moreover, growth has not resulted in poverty reduction and improvement in the economic welfare of citizens (Mlachila et al., 2017). Consequently, attention has been shifted to a broader economic well-being and inclusive growth concept. This is because achieving inclusive growth is significantly related to achieving the Sustainable Development Goals (Niekerk 2020). Major international organisations committed to improving human socio-economic welfare have, therefore, been at the forefront of pushing for inclusive growth instead of just economic growth. For instance, the United Nations Development Program (UNDP) in 2004 established a research group known as the International Policy Centre for Inclusive Growth (IPC-IG) to focus on matters relating to inclusive growth. Also, the Asian Development Bank (ADB 2008), in its Strategy 2020, gives prominent attention to inclusive growth, stating that it agrees with most economies' societal values. Furthermore, Khan, Khan, Safdar and Andleeb (2016) assert that most emerging economies have diverted their attention to inclusive growth due to the rising inequality associated with economic growth.

Conceptualising inclusive growth

The concept of inclusive growth is attributable to Kakwani and Pernia (2000), who sought to explain the idea of pro-poor growth. According to them, pro-poor growth is “one that enables the poor to participate in actively and significantly benefit from economic activity”. Ranieri and Ramos (2013) note that since the concept's inception, it has been related to growth that carries various impacts, not just income distribution. Catholic Agency For

Overseas Development (CAFOD, 2014) observes that although there is a universal agreement for countries to pursue inclusive growth, little consensus exists as to what the concept means, even among the key institutions such as the ADB, IPC-IG and the World Bank. In support, Alexander (2015) stresses that no commonly agreed definition exists despite heightened and exigent attention paid to inclusive growth. Subsequently, inclusive growth has been conceptualised differently by different authors.

For example, the World Bank (2009) uses the term inclusive growth to indicate both the pace and pattern of economic growth, “which are interlinked and assessed together”. From this perspective, fast economic growth is essential for reducing total poverty. Notwithstanding, if such growth is sustainable in the long run, it should affect all sectors of an economy. However, the OECD (2014) asserts that the World Bank’s approach to inclusive growth suggests a direct relationship between the macro and micro factors that determine growth. Also, its focus is on productive employment and not just work or redistribution of income in the sense that employment growth only leads to creating new jobs and income. Productivity growth holds the potential to increase the revenues of workers and the returns of the self-employed. Besides, inclusive growth is a long-term perspective concerned with sustained growth that ensures equal opportunity for access to resources and markets and a balanced regulatory atmosphere for individuals and businesses.

Furthermore, the Asian Development Bank (ADB, 2008) highlights that inclusive growth entails more than broad-based growth. Further, it is not just growth that results in fresh economic opportunities but also ensures that all sectors of an economy, especially people experiencing poverty, benefit from the opportunities created. Under this perspective, inclusive has a dual focus: the "process" of growth and the "outcome" of growth. Under the "process" of growth, growth is inclusive if all societal members, particularly the poor and the marginalised, are made to participate. In other words, inclusive growth is growth that is non-discriminatory. Conversely, the 'outcome' of growth emphasises that growth is inclusive if it reduces inequality among citizens of an economy so that there is equal access to economic opportunities such as health, education, social integration, and nutrition. This is known as the "disadvantage-reducing" effect of inclusive growth.

In support, Klasen (2010) emphasises that inclusive growth involves both an outcome and a process. As a process, inclusive growth requires the participation of all members of an economy in the process of growth, both in making decisions and participating in growth itself. As an outcome, the benefits from the growth should be fairly distributed. In this case, inclusive growth suggests the involvement and sharing of benefits by all. In addition, the European Commission (2010) also considers inclusive growth as "empowering people through high levels of employment, investing in skills, fighting poverty and modernising labour markets, training and social protection systems to help people anticipate and manage change, and build a cohesive society". The Commission highlights the necessity for fair distribution of the benefits of economic growth across all sectors to ensure equitable access and opportunities for everyone.

According to the OECD (2014), inclusive growth, although economic growth is necessary for economies, is only beneficial if its associated gains with economic growth are equitably distributed among social groups and individuals in the economy. Moreover, the concept emphasises that it is not just income that improves people's welfare. Still, some non-income factors, such as education and health status, contribute to economic welfare. Inclusive growth, therefore, involves income and non-income dimensions that combine to improve the livelihood of a more significant majority of a social group and individuals.

Moreover, AfDB (2012) explains that inclusive growth leads to broader access to sustainable socio-economic opportunities by more people, regions or countries and protects the vulnerable in an atmosphere of fairness, equal justice, and political plurality. Further, AfDB (2020) views economic growth as inclusive if the outcomes are extensively shared across all sections of a population, leading to a simultaneous decline in extreme poverty and inequality. Ngepah (2017) highlights that AfDB’s approach to inclusive growth hinges on four pillars: social, economic, political and spatial inclusion.

Despite the varied approaches to inclusive growth, CAFOD (2014) emphasises that there needs to be more convergence on the essential elements that should be captured in its conceptualisation.

Firstly, inclusive growth should result in reducing inequality and poverty and bring benefits to the most disadvantaged. It notes that all approaches to inclusive growth argue that reducing poverty and inequality and stimulating economic growth can bring more beneficial outcomes to all members of society.

Secondly, inclusive growth is more than income growth. Available approaches to inclusive growth underscore that growth is only considered inclusive based on how low-income people have benefited equitably. In other words, inclusive growth should cover other indicators of economic well-being and not just a rise in income.

Thirdly, inclusive Growth entails participation, not just the outcomes. CAFOD (2014) points out that all the approaches to inclusive growth agree that as more opportunities are created and made accessible to the majority or specifically disadvantaged, inclusive growth will be engendered. Such opportunities allow for maximum participation when restrictions to accessing them are removed. Nonetheless, improved access to available opportunities should go with a deliberate effort to ensure fair distribution of benefits to all.

Finally, inclusive growth requires sustainable growth. CAFOD (2014) stresses that attaining impactful inclusive growth requires a more significant focus on sustaining the environment because it helps to achieve sustainable development. Any attempt to destroy the environment threatens the achievement of inclusive growth and sustainable development.

Kusumawati et al. (2016) provide a summary of the conceptualisation of the concept by major global organisations in Table 1 below:

Table 1: Summary of the concept of inclusive growth by world organisations

International organisation	Definition of inclusive growth	Key terms
World Bank (2009)	The rapid pace of growth is unquestionably necessary for substantial poverty reduction. Still, for this growth to be sustainable in the long run, it should be broad-based across sectors and inclusive of a large part of a country's labour force.	Economic growth Poverty reduction Employment
ADB (2008)	Growth with equality of opportunity is provided by having highly sustainable development that creates opportunities, broader access for members of society to participate in and benefit from development, and strong social safety nets to avoid deficiency.	Economic growth Equal opportunity Broader access for participate Strengthen social safety nets.
IMF(2011)	Growth that is not associated with an increase in inequality	Economic growth Income distribution of the poor and the rich
UNDP	Growth that provides both equality in income distribution and the opportunity to participate and benefit from growth for society	Economic growth Equality in income distribution Opportunity to participate and benefit from growth
OECD (2014)	The growth that creates opportunity for all segments of the population and distributes the dividends of increased prosperity, both in monetary and non-monetary terms, fairly across society	Economic growth Household Income Health status Jobs

Source: Kusumawati et al. (2016)

The various concepts notwithstanding, this study aligns with the AfDB (2012) definition because it presents a broader expression of inclusive and not only income inequality and reduction of poverty but also other comprehensive measures of economic well-being (Albagoury, 2021). The indicators that underpin AfDB's approach to inclusive growth could be categorised into two main groups: access indicators and distribution indicators. The access indicators measure how opportunities such as infrastructure, education, and health can be accessible to all. The distribution indicators consider a decline in inequality, unemployment, poverty and an improvement in gender equity (Albagoury, 2021).

Inclusive Growth in Africa

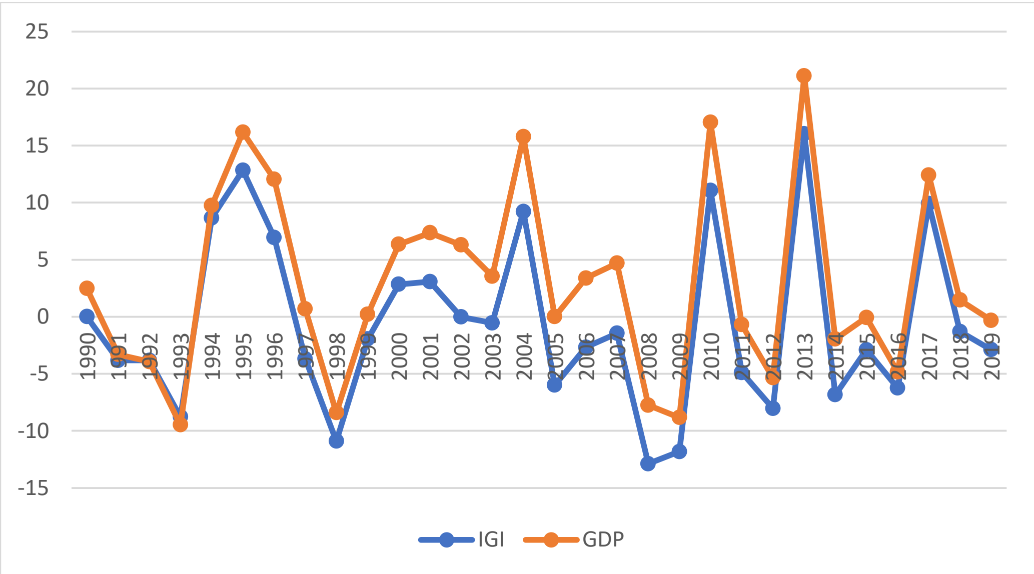

Figure 5: Trend in GDP growth and inclusive growth in SSA
Source: Author based on WDI

Figure 5 shows the GDP growth and inclusive growth rate pattern computed using AfDB's approach over 30 years, from 1990-2019. GDP growth showed an upward trend. It is also worth noting that even though the movement in the growth rate of both GDP and inclusive growth has been similar, it is observed that whenever there was positive growth, GDP was always more significant than that of inclusive growth. On the converse, where there was a decline in both, the drop in inclusive growth was more important than in GDP. Furthermore, from Figure 5, there were times when there was a positive growth rate in GDP, while inclusive growth saw negative growth.

The trend in GDP and inclusive growth in Figure 5 above confirms the observation by AfDB (2020) that although African economies are growing higher than the global average, only 18 out of the 48 of such countries achieved inclusive growth as there has been no significant reduction in inequality and absolute poverty. Similarly, Morsy Balma and Mukasa (2020) opine that even though Africa was among the fastest-growing economies in the world in 2019, more was needed to deal with the two most persistent challenges of absolute poverty and inequality. In support, INCLUDE (2019) reports that the trickle-down effect from traditional economic theories has yet to be applicable in Africa as poverty reduction has been slow despite significant and prolonged economic growth. Also, Valensisi (2020) emphasises that Africa still suffers from absolute poverty even though the poverty level of households in Africa whose income level is below \$1.9 per day declined from 40.2% in 2010 to 34.4 % in 2018 and from 63.2 to 59.1% for households whose consumption was below \$3.2 per day as well as from 82.5 to 80.2% for households whose income was below \$5.5 day over the same period in SSA. AfDB (2012), however, points out that such significant improvement in economic growth has yet to prove adequate for the region.

In support, UNU-WIDER (2013) argues that although Africa has witnessed significant improvement in economic performance since the 1980s, there are still answers. For instance, the rate of poverty and inequality on the continent are high. This is corroborated by the UNECA (2019) and IMF (2022), which report that before the COVID-19 pandemic, many sub-Saharan African economies grew rapidly due to strong global growth rates, high commodity prices, and domestic investments that stimulated private consumption. Nevertheless, such growth has not been inclusive since the SSA has high inequality. This confirms the IMF's observation in 2012 that the use of GDP as an indicator of economic well-being and performance has been contested since the late 1940s when the System of National Accounts was introduced. Also, Sen, Stiglitz and Fitoussi (2009) mention that GDP is neither an indicator of economic welfare nor income. Instead, it is a measure of market activity that is constituted by the summing of the value of market goods and services in an economy.

Given the preceding, AfDB (2012) submits that stimulating inclusive growth in Africa is a matter of urgency as there are many benefits that the continent stands to derive from it. For instance, inclusive growth will reduce the occurrence of political instability that characterises the region as there will be equitable distribution of the benefits of growth and the availability of decent jobs. Besides, UNCTAD (2017) highlights that Africa must focus on achieving inclusive growth, considering Africa's slow-paced progress in attaining Millennium Development Goals. Moreover, UNCTAD (2021) asserts that inclusive growth and sustainable development are Africa's Agendas 2030 and 2063 objectives. However, available evidence shows that Africa's growth has not been inclusive.

According to UNCTAD (2021), African countries have been categorised under three types of inclusive growth: relative inclusive growth, absolute inclusive growth and non-inclusive growth. Relative inclusive growth occurs when there is a simultaneous reduction in poverty and inequality, absolute inclusive growth focuses on reducing only poverty even though inequality may be rising, and non-inclusive growth describes a situation in which economic growth does not result in any decline in poverty and inequality. Figure 6 below shows the areas on the continent that belong to the three types of inclusive growth over 2000-2020.

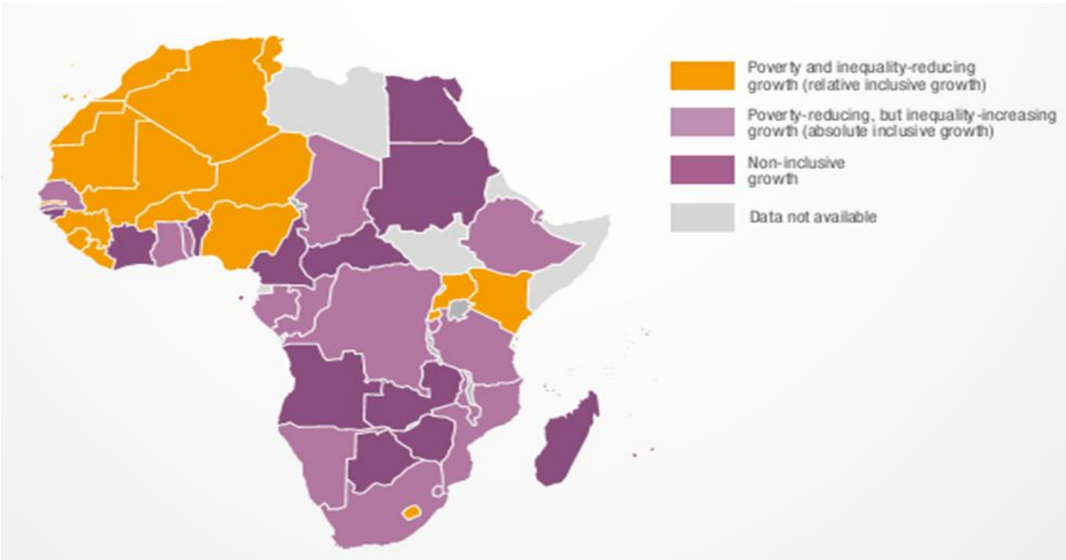

Figure 6: Inclusive growth trend in Africa over the period 2000-2020
Source: UNCTAD (2021)

From Figure 6, it is evident that most countries in SSA fall under absolute inclusive and non-inclusive growth. Only a small number of countries in SSA were grouped under relative inclusive growth. In contrast, it can be seen that most of the economies in the northern part of Africa fall under absolute inclusive growth. Countries in the northern part have been more inclusive in their growth than those in SSA.

Further, apart from categorising inclusive growth under income parameters such as poverty, wealth and income inequality, available literature (INCLUDE 2019; Klasen, 2010; OECD, 2014) notes that inclusive growth has non-income parameters too. Whereas the income dimension of inclusive growth is exclusively based on household consumption or income, the non-income dimension focuses on social, human, environmental and economic development. The non-income dimension of inclusive growth covers areas such as education, gender parity, health, education, corruption, food security, access to basic and social services, citizen participation, environmental sustainability, etc. (INCLUDE, 2019). The OECD (2014) explain that the non-income parameters are also significant because they represent opportunities and choices relevant to citizens' participation in economic life and society. Good health, for instance, contributes to the well-being of people, necessary for active involvement in the labour market and enjoying social relationships. Also, being gainfully employed brings both satisfaction and financial rewards, which ultimately improve the general well-being of citizens. Subsequently, INCLUDE (2019) highlights that the income and non-income dimensions should be considered together and not isolated to achieve sustainable growth. To corroborate, Kanbur and Rauniyar (2010) opine that inclusive growth only occurs when there is an improvement in both the income and non-income parameters.

Nonetheless, available evidence reveals that although Africa has made some progress in the non-income inclusive growth parameters, there is a need to improve. AUC/OECD (2018) reports that economic growth in Africa has yet to create adequate and better-quality jobs. Under such a situation, if nothing is done, the number of vulnerable jobs in Africa will rise to 66% by 2022, a level higher than the target of 41% by 2023. Moreover, in 2019, the employment-to-population ratio in Africa stood at 68%, implying that one in three Africans aged 25 or over was unemployed. However, female participation in the labour market stood at 54%, which was higher than the world average of 47%. This is an improvement in the female participation rate of 33% in 2018 again, even though Africa has made significant progress in improving access to education for females since the year 2000, as in 2016, only 12% of females of working age were in wage-paying jobs (UNCTAD, 2021).

Similarly, the African Union and OECD (2021) report that although life expectancy has improved since 2000, it is lower than the global average. Likewise, the World Health Organization (2021) reports that compared with the global age of 64.4 years, men born in Africa in 2000 have a life expectancy average of 51.1 years. In 2019, however, the average life expectancy of men increased to 63.4 years compared with a global average of 70.9 years. Maternal mortality in Africa, however, slacked behind the expected international ratio of 700 per 100,000 live births by 2030. As of 2017, Africa's maternal mortality ratio was 500 per 100,000 live births. Again, both child and maternal mortality have declined significantly in Africa since 2014 (African Governance Report, 2019).

Similarly, Mastercard Foundation (MCF, 2020) reports that despite significant advancement in admission and completion of primary education over the last twenty years, from 81 million in 1998 to 169 million in 2018 and from 29% to 51% in lower secondary and from 20% to 34% in upper secondary, inequalities persist between the most and marginalised sections of societies. Furthermore, the African Governance Report (2019) notes that since 2014, Africa has experienced a decline of -0.3 points in education. It reveals that most African countries need to catch up when providing an encouraging environment for attaining Agenda 2063 targets. Even more, most countries continent score low regarding access and quality of education, further deteriorating for most countries.

Financial Development

The World Economic Forum (2015) stresses that the development of the financial sector brings essential benefits to all sectors of an economy. The concept of financial development has been defined in various ways by different literature and authors. For instance, Levine (2005) posits that financial development comprises enhancements in functions rendered by the financial systems, such as pooling of savings, allocating capital to productive investments, investments monitoring, risk diversification and trading of goods and services. Similarly, Wait, Tafadzwa and Pierre (2017) highlight that financial development occurs when there is an improvement in the activity, size, stability and efficiency of the financial system of an economy. According to Chami, Fullenkamp, and Sharma (2010), financial development is about the broader use of available financial instruments and the creation and adoption of new financial instruments to facilitate financial intermediation and risk management. Furthermore, Altay and Topcu (2020) submit that financial development involves creating and expanding markets, instruments and institutions to enable growth and investment. Also, Yurtkur (2019) asserts that financial development is about establishing financial markets, financial institutions and financial instruments. Additionally, financial development describes the situation where the financial system performs excellently, thus eliminating market distortions (Eryigit & Eryigit, 2015).

Further, Çetin, Ecevit, Seker and Günaydin (2015) explain financial development as enhancements in producing information regarding capital allocation, potential investments, monitoring of firms, the exercise of corporate governance, trading, management of risk, diversification, mobilising and pooling of savings, and the easing of the exchange of goods and services to facilitate technological innovation, investment and savings to stimulate growth. Still, the World Bank (2016) notes that financial development consists of reducing the costs in the financial system, such as costs of acquiring information, enforcing contracts, and making transactions so that it eventually results in the development of new financial markets, intermediaries and contracts. These diverse perspectives on financial development agree that financial development encompasses the efficient performance of the financial sector, resulting in favourable outcomes for an economy.

The financial sector attracted significant attention from economists and policymakers since the work of Bagehot in 1873. Bagehot (1873) highlighted that the financial system performed a critical function by promoting industrialisation in England through capital mobilisation. Since then, several empirical studies have investigated the financial sector's essential economic roles. For instance, the financial sector channels savings from the surplus unit to the productive sector of an economy (Diamond, 1984; Stiglitz & Weiss, 1983), helps in the optimum allocation of capital due to reduced information cost (Greenwood & Jovanovic, 1990), improves technological advancement as entrepreneurs are rewarded (King & Levine, 1993), helps in hedging, easing good and services transaction, trading, risk amelioration and diversification, (Levine, 1997).

Aside from the empirical studies done earlier, recent studies have also emphasised the relevance of a developed financial sector to an economy. For example, a developed financial sector is a fundamental requirement for the achievement of inclusive and sustainable growth (UNECA, 2015), reduces income inequality and poverty in low-income and middle-income countries (Beck et al., 2007), provides positive support and coping mechanism for the poor who suffer from the uncertainty and risk associated with low and volatile income from the informal sector (Demirgüç-Kunt et al. (2017). Furthermore, Svirydzenka (2016) opines that financial development affects human and physical capital accumulation and total factor productivity and that these three are essential determinants of economic growth. Still, the financial sector supports the provision of avenues for the diversification of risk, making it possible for individuals to have more liquid investments, thus encouraging economic investment.

The above definitions of financial development unravel some level of agreement and disagreement on what the concept is about. For instance, some authors align financial development the efficiency in performing its core functions which include the mobilization of savings, efficient allocation of capital, management of risk, stimulating economic growth, cost reduction and the facilitation of transactions (Çetin et al., 2015; Levine, 2005; Wait, Tafadzwa, & Pierre, 2017; World Bank, 2016). Besides, some authors (Greenwood & Jovanovic, 1990; King & Levine, 1993; Levine, 1997) associate financial development with economic growth through channels as technological advancement, enhanced productivity and reduction in information cost. Further, Beck et al. (2007) and UNECA (2015) link financial development with socioeconomic benefits such as mitigating inequality and poverty reduction.

Aside from the common views on what financial development entails, some divergence exists among some scholars. Whereas some authors (Levine (2005; World Bank, 2016) emphasize the cost reduction and efficiency of the financial sector, others (Beck et al., 2007 & Demirgüç-Kunt et al., 2017) focus on inclusivity with a principal focus on inequality mitigation and poverty reduction. Also, Chami et al., (2010) and Altay and Topcu (2020) highlight the establishment of new instruments and markets and financial innovation, providing a dynamic viewpoint which can be compared with some seminal research like Bagehot (1873), Stiglitz and Weiss (1983) and Diamond (1984) which focused on channelling resource for economic stability and industrialization. Additionally, UNECA (2015) exclusively integrates environmental sustainability into financial development, a perspective that is not emphasized by other authors.

The merits of these definitions are in their thorough examination of the fundamental functions and socioeconomic outcomes of financial development. For example, Levine (2005) and Çetin et al. (2015) provide comprehensive frameworks that integrate capital allocation, savings mobilization, innovation and corporate governance. Correspondingly, Svirydzenka (2016) and the World Bank (2016) offer depth by incorporating productivity enhancement and the reduction of cost. Equally, Beck et al. (2007) and Demirgüç-Kunt et al. (2017) underscore the tangible gains of reduction in poverty and inequality, rendering their viewpoints especially pertinent to emerging areas such as Sub-Saharan Africa (SSA). Historical contributions by Bagehot (1873), Stiglitz and Weiss (1983) and Diamond (1984) also confirm the relevance of the financial sector in fostering industrialization and economic growth.

Despite the above, some weaknesses exist. Levine (2005) and Wait, Tafadzwa, and Pierre (2017) emphasize efficiency, overlooking inclusivity, which is crucial to the sub-region. Likewise, Chami et al. (2010) and Altay and Topcu (2020) overstress market establishment and innovation, ignoring socioeconomic differences and the capacity of institutions. Though UNECA (2015) incorporates sustainability, several authors neglect to address environmental concerns that are becoming increasingly pertinent in the setting of Sub-Saharan Africa.

Based on the above perspectives, this study adopts the IMF Financial Development Index (Svirydzenka, 2016) as financial development. This approach incorporates efficiency, access, and depth across financial markets and institutions, providing a framework that addresses the unique challenges of SSA, such as market inefficiencies, restricted access to financial services, and socioeconomic differences. By employing this thorough framework, the study aligns with the larger goal of driving inclusive financial systems that promote sustainable economic growth in SSA.

Financial System of Africa

Generally, financial systems comprise financial markets and financial institutions, which, although perform different functions, work to improve an economy. In Africa, whereas financial institutions consist of banks, insurance companies, and mutual fund pension funds, financial markets comprise stock and bond markets (Asafo, 2020). It is worth mentioning that banks dominate the financial system of Africa, and this is because banks can function even in environments where there are weak institutions (Allen, Otchere & Senbet, 2011; Agbloyor & Abor, 2018). Again, the European Investment Bank (EIB, 216) asserts that in SSA, even though the financial sector is less developed and small, the banking sector dominates and thus constitutes the primary source of external financing for business because the capital market is underdeveloped. According to Mahonye and Ojah (2014), the dominance of banks in the financial landscape of Africa leads to a financial gap as there are limited sources of long-term financing required to engender economic growth. Tinta (2022) corroborates this, explaining that the financial system in SSA has more financial institutions than financial markets. Nonetheless, a proper combination of capital markets, private equity finance, banks, and contractual savings institutions is essential for having a robust, liquid and diversified financial system (Beck & Cull, 2014). Further, Rateiwa and Aziakpono (2015) point out that financial markets and institutions are required to stimulate growth in Africa.

However, it is essential to mention that Africa's financial system has recently experienced significant changes in its composition. For instance, Andrianaivo and Yartey (2012) opine that African countries that were predominantly bank-dominated until the global financial crisis in 2007/2008 have incorporated capital markets into their financial system. Also, the Africa Development Indicators Report (2013) highlights that these changes were necessitated by the widespread financial system reforms and liberalisation that many African countries embarked on. Such financial sector reforms and liberalisation led to the denationalisation of state-owned businesses, the setting up of new stock exchanges, liberalising foreign exchange regimes, deposit interest rate ceilings and interest rates; divesting ownership of state-owned, establishment of foreign banks, restructuring of regulations to facilitate product innovation and provision of credit to the private sector (Ojah & Kodongo, 2014). Consequently, Africa's financial industry developed to incorporate financial institutions and markets. Yet, Essien (2017) asserts that even though Africa's financial sector has seen improvement, the development in the industry is slower when compared with other regions of the world, thus suggesting a need for further action to harness the benefits associated with a financial system that is balanced and developed.

Countries Classification based on the Stage of Development

Gough and McGregor (2007) argue that maximising present welfare and sustaining it long-term are the fundamental objectives of development as these reflect the human experience of growth. Accordingly, the UNDP (2014) highlights many global voices emphasising the need to comprehend development as an intricate phenomenon influencing many aspects of people's lives. To understand development, the Advocate for International Development (4AID 2022) notes that countries are grouped into different categories to understand their economic and social outcomes properly. According to Internet Geography (2022), a country's development level is determined by the extent to which it has improved the quality of life of its citizens, progressed technologically and grown economically.

Despite the differences in development outcomes among countries, no universally accepted measure for classifying economies exists. However, major international organisations such as IMF, UNDP and the World Bank rank countries based on their unique development taxonomies (4AID, 2022); this study categorises countries based on the World Bank's country classification.

World Bank Country Classification System

The World Bank country classification system categorises countries based on geographic region, income group or operational lending categories. Nonetheless, this study adopts the income classification dimension. This choice is informed by the fact that the GNI has proven to be a suitable and readily available indicator that is closely correlated with other non-monetary indicators that measure the quality of life of citizens, such as school enrolment, children's mortality rate and life expectancy at birth (World Bank, 2022)

Income group classification

Under this category, countries are grouped into four income tiers: low, lower-middle, upper-middle, and high. Here, the Gross National Income (GNI) per capita, denominated in US dollars after conversion from local currency using the World Bank Atlas method, is used as an indicator of income. Countries are reassigned on July 1 of each year based on their GNI per capita estimate for the previous calendar year. Nevertheless, a country's income group remains the same for the entire financial year until July 1 of the year, even if GNI per capita estimates of that economy are reviewed during the year. Table 2 below shows the income groupings of the 48 countries of SSA based on the New World Bank country classifications by income.

Table 2: SSA countries grouped by the World Bank based on the GNI

Income Group	Countries
Low-Income Economies (GNI per capita ≤ $1,085)	Burkina Faso, Central African Republic, Chad, Congo Dem Rep, Eritrea, Ethiopia, The Gambia, Guinea, Guinea Bissau, Liberia, Madagascar, Malawi, Mali, Niger, Rwanda, Sierra Leone, South Sudan, Togo, Uganda, Zambia, Burundi, Somalia, Mozambique
Lower-Middle-Income Economies (GNI per capita $1,086 - $4,255)	Angola, Senegal, Eswatini, Ghana, Kenya, Lesotho, Mauritania, Nigeria, Tanzania, Zimbabwe, Sao Tome and Principe,Djibouti, Cote D'Ivore, Cape Verde, Cameroon, Comoros, Congo Rep., Benin
Upper-Middle-Income Economies (GNI per capita $4,256 - $13,205)	Botswana, Gabon, Mauritius, South Africa, Namibia, Equatorial Guinea
High Income(GNI per capita≥ $13,206	Seychelles

Source: Author's compilation based on World Bank (2022) Income Classification of Countries

Table 2 above reveals that out of the 48 countries in SSA, 22 are classified as low income, 19 as lower-middle income, six as upper-middle income, and one under high-income countries. It is worth mentioning that based on World Bank historical data from 1990-2022, the country's current position averagely reflects countries' long-term trajectory based on the GNI.

Vulnerability and Adaptive Capacity of SSA to Natural Disasters

Available literature (Van Niekerk & Nemakonde, 2017) explains that though the whole continent of Africa is witnessing an upsurge in the frequency of natural disasters, the situation is quite dire in the SSA as almost every country experiences one form of natural disaster or the other. Additionally, Wilhite, Sivakumar and Pulwarty (2014) highlight that while the rise in natural hazards has both social and natural costs, the social dimension is the deciding factor that turns a natural risk into a disaster. The associated cost heightens the vulnerability of SSA to natural disasters. To explain, Blaikie et al. (2014) aver that the risk associated with any natural disaster for any economy is a combination of both the region's exposure, that is, the likelihood of the event occurring at various levels of severity and the extent of vulnerability of the affected region. Consequently, the increase in the frequency of natural disaster and its associated cost magnifies the disaster risks a region faces.

Extant literature (van Niekerk & Coetzee, 2012; World Bank, 2010) pinpoint that the impact of natural disasters in SSA is closely linked with the sub-region's vulnerability and low adaptive capacity. This is corroborated by the African Climate Policy Centre (ACPC, 2013), which notes that Africa has low adaptive capacity because it has weak economies, feeble institutions and inadequately established governance structures. It is also essential to emphasise that generally, in any discussion on adaptive capacity to any disaster, the deliberations are done together with vulnerability and resilience. This is because, usually, low-level adaptive capacity indicates exposure and higher-level adaptive capacity indicates resilience (Daramola, Oni, Ogundele & Adesanya, 2016).

Moreover, Kyere (2018) intimate that in an attempt to enhance the adaptive capacity of a system to withstand any form of external shocks, an assessment of the system's vulnerability is essential. According to the UNDRR (2017), exposure refers to "the characteristics determined by physical, social, economic and environmental factors or processes which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards". Adger et al. (2007) emphasise that the level of adaptive capacity highly influences a system's vulnerability. Also, according to Norris et al. (2008), adaptive capacities are resources with dynamic features such as robustness, redundancy or rapidity, which can interact with stressors like natural disasters to bring about different outcomes for people. Furthermore, adaptive capacity refers to "the ability of systems, institutions, humans, and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences of hazards" (IPCC, 2014).

Earlier research (Moench & Dixit, 2004) revealed that vulnerability and adaptive capacity are influenced by eight main factors named below:

i. The nature of livelihood systems within a region and the ability to diversify.

ii. The ability of people to migrate to obtain access to non-agricultural sources of income.

iii. The ability of information, services and resources to flow into and out of an affected region.

iv. The social infrastructure households access, such as banks, NGOs and social networks.

v. Existing patterns of vulnerability.

vi. The nature of physical infrastructure includes the degree to which it is vulnerable and the extent to which it promotes the maintenance of livelihoods.

vii. The ability of households to obtain secure sources of water.

viii. Natural resource conditions, particularly the degree to which water surface systems have been disrupted

The factors mentioned above notwithstanding, current studies (Lemos et al.,2013; Sharma & Patwardhan, 2008) highlight that adaptive capacity can be grouped under generic and impact-specific dimensions. Whereas the generic adaptive capacities focus on dealing with the challenges faced in meeting fundamental human developmental needs such as education, health, livelihood, mobility, and security, the specific adaptive capacities are concerned with the skills and the tools that are required to anticipate and respond effectively to particular climatic threats. Furthermore, Eakin, Lemos and Nelson (2014) observe that even though these two dimensions of adaptive capacity manifest at different levels of decision-making and are not fairly distributed among countries to some extent, they exist in all economies. Asante, Boakye, Egyir and Jatoe (2012) stress that these two dimensions of adaptive capacity depend on each other and that a robust adaptive capacity requires a combination of both.

Moreover, Cutter, Burton and Emrich (2010) maintain that the factors determining adaptive capacity can be categorised into identified social, economic, institutional, infrastructure and community capital categories. The social category is made up of variables like equal access to education, transportation and age; the Economic category entails employment, housing capital, and single-sector employment dependence; the Institutional category covers municipal services, mitigation and social connectivity; Infrastructure variables include housing type and medical capacity and community capital variables involve political engagement and innovation.

Review of Empirical Literature

Even though studies on the interaction of natural disasters exist, they mainly focus on their direct impact. In recent times, however, academics and policymakers have paid attention to the indirect effect of natural disasters on macroeconomic variables. Even though there are limited studies on how natural disasters affect the financial system and inclusive growth presently, some studies undertaken have served to guide this present one. The essence of this section is to review the empirical literature on financial development, natural disasters and inclusive growth, as well as the relationship among them.

Natural Disasters and Financial Development

Brei, Mohan and Strobl (2019) employ panel data from 2000-2012 to study the impact of natural disasters on the banking sector in the Caribbean. This study measured natural disasters as a hurricane destruction index based on estimated localised wind speeds derived from actual hurricane tracks to which a wind field model was used. Data on the damages caused by natural disasters were sourced from EMDAT. Also, quarterly balance sheets and income statement data from the Eastern Caribbean were aggregated at the country level to access funding sources, lending capacity, funding, and the financial soundness of the entire banking sector. The study found that following natural disasters, there is an increase in customers' withdrawal, which affects their ability to lend to other customers who require loans. The banks react to this by decreasing their lending. This eventually reduces access to credit, a key indicator of financial development. Natural disasters, therefore, affect financial development negatively.

Again, Xu (2020), using panel data consisting of a sample of 2,891 banks, investigated the effect of 187 large-scale natural disasters on the profitability and solvency of banks in the United States of America between 2000-2014. The study measured natural disasters as damage ratios calculated as the ratio of the sum of the damages from natural disasters to GDP with data from EMDAT. Also, the indicator of bank performance was based on three categories: capitalisation, loan write-offs and profitability. The study showed that natural disasters negatively impact the banks' profitability. This has implications for financial development as the reduction in profitability can result in reduced investment in infrastructure and technological innovations and infrastructure which ultimately hinders the competitiveness and efficiency of the financial sector.

Furthermore, Albuquerque and Rajhi (2019) investigated the effects of natural disasters and state fragility on emerging economies' financial, economic and banking systems. The study used 66 emergent countries from 1995 to 2011, and the study measured natural disasters using the Lifeyears Index and banks' Z-scores and distance-to-default as measures for the banks.

Natural disasters were found to momentarily cause a surge in non-performing loans, which tended to increase bank defaults in developing economies. This limits the banks' credit supply and, hence, financial development.

Besides, Noth and Schüwer (2018) explored the effect of natural disasters on the stability of 6,136 banks in America from 1994-2012. The study, which employed a fixed effects OLS regression model, data from the Home Mortgage Disclosure Act (HMDA), SHELDUS, and FDIC revealed that natural disasters reduce z-scores of banks, increase the likelihood of default resulting in a higher non-performing assets ratio, huge foreclosure ratios, decreased return on assets as well as equity ratios in the first two years after the occurrence of a natural disaster. With these adverse outcomes on the banks occasioned by natural disasters, the efficiency of financial institutions gets limited, and hence, they cannot operate as required.

Correspondingly, Nguyen and Wilson (2018) examined the effects of unexpected and sporadic natural disaster lending of banks using data on damages and losses that occurred in the 75 Thai provinces from the Asian Disaster Preparedness Centre and monthly data on cumulative bank loans and deposits provided by the Bank of Thailand between January 1, 2004, to December 24, 2005. Using the difference-in-differences method, the study found that following a natural disaster, there is a reduction in the total supply of credit to affected provinces.

Furthermore, Ozsoy, Rasteh and Yonder (2020) using data from National Center for Environmental Information and (NCEI) and S&P Global Market Intelligence as well as diff-in-diff technique examined the effect of droughts on bank stability and loan performance over the period 2000-2017 for 217 banks in the United States of America. The study found that drought shocks negatively affect the Z-Score, ROA volatility, loan performance, and equity volatility of affected banks compared to unaffected banks. This therefore affects the development of banks in affected regions as they become restrained in their ability to offer financial services.

Further, Berg and Schrader (2012) find that in the aftermath of a natural disaster, the demand for credit from financial institutions markedly increased, signifying the need for an extra source of financing. Even so, most of the credit applications after the occurrence of a volcanic eruption in Ecuador were restricted except for returning clients for whom such restriction was relaxed. The study reports that repeat clients were more likely to have their loan applications approved by financial institutions than new applicants. Also, the study employed the random effects linear probability model with branch fixed effects, data from Banco ProCredit Ecuador and Instituto Geofisico Ecuador from 2002 to 2007 to empirically estimate the impact of natural disasters on credit demand and access to credit.

Again, a study by Born and Viscusi (2006) on the destructive effects of natural disasters on insurance markets using data over the period 1984 to 2004 of firms in the United States of America reveals that natural disasters pose a significant threat to the insurance sector as in the aftermath of every natural disaster both insurance ratio and losses incurred rise. This consequently leads to insurance firms raising their insurance rates so that the loss ratios in the non-catastrophe years following a disaster are lesser than before. This, therefore, increases insurance costs, negatively affecting affordability and financial development.

Besides financial institutions, existing studies also show that natural disasters affect the financial markets. For instance, Pagnottoni, Spelta, Flori, and Pammolli (2022) explored the effect of 6759 natural disasters on 27 global stock markets from 104 economies worldwide from February 8, 2001 to December 31, 2019. The study employs the event study approach, data from the Financial Development Index by the IMF and EM-DAT. It categorises natural disasters into biological, climatological, geophysical, hydrological, and meteorological and investigates their effects. The result of the study showed that the nature of the stock market response depended on the type of natural disaster shock experienced. Biological and climatological disasters significantly impact the market's returns among the various categories of natural disasters.

Also, Pan and Qiu (2022), in their study on the effect of flooding on firm performance and economic growth in China over the period 2003-2019 with data from the Chinese Stock Market and Accounting Research (CSMAR) database, Urban Statistical Yearbooks and Provincial Statistical Yearbooks find that floods impact negatively of the performance of firms listed on the Shenzhen Stock Exchange and Shanghai Stock Exchange. The study measured the performance of listed firms using Tobin's Q (Tobin's Q) and return on assets (ROA) and the impact of the flood as flood ratio measured as the ratio of the flood area of the firm's headquarters city to the city's total area.

Furthermore, Seetharam (2017) investigated the effect of environmental disasters on the stock market performance of 12,449 companies in the United States of America from 1980-2014. The dependent variable for the study was daily returns on the stock of all publicly listed companies in the

United States, for which data was obtained from CRSP COMPUSTAT. Of the 165, the study concentrated on 122 natural disasters: fires, hurricanes, tornadoes, ice storms, floods, freezes and severe weather events. Data on natural disasters was sourced from the Storm Events Database, National Oceanic and Atmospheric Administration. The study reveals that companies exposed to natural disasters face lower market valuations than non-exposed companies. This hampers financial development, and the wealth and capital base of listed financial institutions get reduced, thus limiting their ability to provide credit. Moreover, natural disasters erode investors' confidence and disrupt financial market stability.

Furthermore, in studying the effect of natural disasters on the financing cost of bonds from 2005-2015, Bourdeau-Brien (2017) found that the financing cost of bonds increased following a natural disaster. Data on natural disasters were measured as floods from NCEI, and bonds were measured bonds as all tax-exempt general obligation bonds issued by county governments taken from Bloomberg and the Municipal Securities Rulemaking Board (MSRB) transaction database. When the effect of natural disasters measured as extreme weather events was examined on investors’ risk aversion over 2005-2016, the study found that natural disasters cause a significant increase in relative risk aversion.

Also, Gani (2020) employed cross-country analysis to study the effect of natural disasters on investor sentiment among developing and developed economies using data from 1998 to 2019. The study measured investor sentiment as the volume of stock traded and natural disasters by the number of deaths and economic losses arising from the disasters. At the same time, data on natural disasters was obtained from Statista.com, UNDP.org and Weather. com., data on the volume of stock traded was taken from YahooFinance.com. The study showed a negative relationship between natural disasters and investor sentiment.

Again, Benali and Feki (2017) examined the effect of natural disasters on the profit of insurers using data from OneSource and SHELDUS from 2008 to 2012. The study used a sample made up of 30 property and casualty insurance firms in United States. It was found that natural disasters increase the loss ratio of the insurance firms and hence, their profit. This affects the ability of the insurance companies to invest in financial instruments. Moreover, this has the tendency of causing an increase in the premiums charged by insurances companies in the exposed regions thus, making them unaffordable.

Additionally, Fakhry, Aktan, Masood, Tvaronavičienė, and Celik (2018) studied the effect of natural disasters on Japan's financial market's efficiency in both the short and long run. Unlike earlier studies where the financial market only considered the equity market, this study regarded foreign exchange, sovereign debt and gold markets in addition to the equity. By employing a five-day week filling in the missing data with the last known price, which covers the period 11th March 2011 to 31st December 2022 and using the C-GARCH variant of the variance bound test, the study found evidence that natural disasters affected the efficiency of the market significantly soon after its occurrence than in the long-run. Their study concluded that the financial market in Japan is reactive rather than efficient, implying that market participants' reaction influences the price more than the information.

Likewise, Keerthiratne and Tol (2018) employed a panel fixed effects estimator, panel data from 1979 to 2011 for 147 countries, to explore the impact of natural disasters on financial development. Using data from the Global Financial Database, financial development was measured as a credit to the private sector as a percentage of GDP. Also, natural disaster was measured as the number of people affected by natural disasters in a country year with data from EMDAT. The study's outcome showed that businesses and individuals get deeper into debt following a natural disaster, with the effect being more pronounced in poorer economies than in developed countries. This has implications for their ability to honour their debt obligations with banks and, hence, financial development.

Further, a current study by Chen and Chang (2021) examined the effect of natural disasters on financial markets and institutions, using financial risk as a moderator between natural hazards and the financial system. A panel data on 116 economies from 1996 to 2017 and a panel fixed effect estimator was used. Whereas the financial system was composed of the stock markets, insurance and banking system, natural hazards comprised eight different types of disasters: floods, droughts, storms, earthquakes, volcanic eruptions, epidemics, land-slides and extreme temperatures. The study measured the banking system as domestic credit to the private sector, the insurance system as insurance premium volume and the stock market as capitalisation. Furthermore, natural hazard was measured as the number of deaths from the hazards and the number of persons impaired by the hazard. The study found that even though natural disasters do not directly affect the banking system, they did have a significant negative influence on the banking system through financial risk. Also, the influence of natural hazards on the insurance system is dynamic and has a lasting impact over a period of time. Considering the moderating effect of financial risk on the relationship between natural hazards and the insurance sector, they found that the relationship is negatively impacted. Further, the direct and moderating effects of natural disasters through financial risk on the stock market were significantly adverse. The study finally concluded that the impact of natural hazards on the financial system through financial risk was more significant in low-income countries than in high-income economies. From those mentioned above, it is apparent that natural disasters threaten the financial sector of affected countries.

Even though the studies on the effect of natural disasters are limited, the above review reveals several gaps. Firstly, studies concerning SSA need to be more present. Also, available studies only used sections of financial development rather than financial development as a whole. Therefore, this study seeks to fill thesis gaps, especially concerning SSA.

The above studies on the effects of natural disasters and financial development reveal some strengths as well as weaknesses which are necessary for understanding the impacts of natural disasters on financial development in SSA. With respects to the strengths, the above studies point out that financial systems are vulnerable to natural disasters and thus underscore the need for a disaster-resilient financial system. Nevertheless, the findings of most of the above studies were largely sector-specific or global, with no concentration on SSA which has peculiar challenges. The insights from these studies are important for comprehending how natural disasters impact financial development which directly aligns with the objective of this study that seeks to investigate the effect of natural disasters on financial development in SSA.

Natural disasters and the social and economic well-being of citizens of a country

Khan, Anwar, Sarkodie, Yaseen, and Nadeem (2023) examined the effect of natural disasters on economic growth in 98 countries over the period 1995 to 2019 based on four main income groups, namely, high, upper-middle, lower-middle and low-income groups. Natural disasters included geophysical, hydro-metrological, and biological disasters, measured by the number of people affected and economic growth by GDP per capita. Data on natural disasters was obtained from EMDAT and the Disaster Information Management System, and data on GDP per capita was sourced for the WDI. The results show that natural disasters have a more significant income-reducing effect in low-income economies and mild among high-income and upper-middle-income economies.

Again, Shimada (2022) evaluated the effect of natural disasters on economic growth and agricultural production in Africa from 1961-2011. Natural disaster, which entailed storms, floods and droughts, was measured as the number of people affected. Data on natural disasters was from EMDAT, GDP per capita was from WDI and agricultural production was obtained from the Food and Agriculture Organization Corporate Statistical Database (FAOSTAT). The result of the study revealed that natural disasters negatively affect economic growth and agricultural production in Africa and thus increase poverty. Furthermore, drought was found to be the most impactful among the different disaster types as they affected crop production. This eventually increases the incidence of urban poverty.

Moreover, Atsalakis, Bouri, and Pasiouras (2021) studied the effect of natural disasters on economic growth by employing a quantile-on-quantile technique for 108 developed and developing economies between 1979 and 2010. The study used four different measures of natural disasters; “EMDAT all disaster” measured as the summation of all disasters in the EMDAT database, normalised by the land area; “EMDAT Large” involved only large-scale disasters normalised by land area; “GeoMet Disaster Index” which was given as the unweighted totality of physical intensity measures of disasters that happened in a specific country and “GeoMet Disaster Index weighted” which comprised the physical intensity measures of different disaster types which have been weighted with their inverse sample standard deviations. Economic growth was measured as GDP per capita. The study found that natural disasters generally hurt economic growth.

Also, Foreman (2020) studied the effect of dust storms on the economic development of citizens living in the semi-arid environments of West Africa from 1980 to 2020 with data from satellite-based observations or reanalyses, the WDI, Maddison Project Database and the Penn World Tables. Using the OLS and first-stage regression approach, the study found that agricultural yield and economic growth in West Africa declined by margins of 3% and 2%, respectively, due to natural disasters.

Again, Adu-Mantey and Adusah-Poku (2019) investigated the effect of natural disasters on the economic growth of 50 African countries from 1980 to 2015. Natural disaster, which included floods and droughts, was measured using four indicators, namely disaster occurrence, which was a dummy variable indicating whether a disaster occurred or not, the number of deaths arising from the disasters, the number of people affected by the disaster and disaster intensity measured as the total of people affected and left homeless to the population of a country with data from EMDAT. Also, the study had four dependent variables, including economic growth measured as GDP per capita and growth in services, agriculture, and industry in Africa. Data on the dependent variables were obtained from the WDI. The result of the study revealed that natural disasters hurt economic growth in Africa. Similarly, natural disasters hurt agriculture and industry value-added. However, the relationship between natural disasters and service value-added was statistically insignificant. Furthermore, the study found that the measure of natural disasters employed significantly influences the effect of natural disasters on economic growth.

Correspondingly, Panwar and Sen (2019) examined the effect of natural disasters on the economy as a whole using panel data involving 102 countries, 29 of which were developed economies and 73 from emerging countries from 1981 to 2015. The study employed three dependent variables, namely, per capita, real GDP growth rates, gross agricultural value-added and gross non-agricultural value-added, with floods, storms, droughts and earthquakes as the independent variables. Data on the dependent variables was from the WDI, and that of the independent variable was from EMDAT. In this study, natural disaster was measured as the number of people killed and impaired by disasters over the previous year's population. Employing a system GMM estimator, the study found that the effect of natural disasters on the macroeconomy depends on the sector of the economy and the type of natural disaster. Normal floods positively affected growth in the agricultural industry and other sectors of the economy, with such impact being more significant in emergent economies. Severe floods negatively affected growth. Droughts negatively affected the growth of the agricultural industry but had no significant effect on the other sectors of the economy. Severe drought also negatively affected the economic growth. Storms negatively affected both GDP growth and the agricultural sectors of developing economies. Severe storms had comparable results, but the effects were comparatively stronger than moderate storms. Both severe and moderate earthquakes negatively influenced growth in the non-agricultural sector of developing economies. Nevertheless, the earthquake positively affected the non-agricultural industry for the total sample of economies used for the study. The study concluded that although the direct damages associated with natural disasters are more significant for advanced economies, the negative macroeconomic consequences were more substantial among developing countries.

Further, Di Pietro (2018) studied the effect of natural disasters on the educational outcomes of students from Universities in Central Italy with data on three cohorts of students: 2001, 2004 and 2007. Earthquakes were used as indicators of natural disasters. The study revealed that natural disasters reduced the probability of students graduating on time and increased the likelihood of dropping out. This has implications for human capital development, which is crucial to inclusive growth. Nonetheless, the study could have expanded the study period to elicit the most current outcome.

Rosales-Rueda (2018) used rainfall data from 244 weather stations across Ecuador to construct the Standardized Precipitation Index and household data from the Living Standards Measurement Study to investigate the effect of El Niño floods on human capital formation from 1997-1998. The study reported that natural disasters affected children's physical and cognitive development in the exposed region. Also, the study found that natural disasters reduced total consumption, income and food consumption. The study period could have been extended to investigate if there were any lingering effects of the floods on employment and poverty reduction.

Additionally, Wang and Zhao (2023) examined the effect of natural disasters on household income and expenditure inequality in China with a panel dataset from six waves of the Chinese Household Income Project (CHIP) over the period 1988-2018. Using the fixed effect models, the study found that natural disasters increased income and expenditure inequality and income losses for the marginalised. Natural disasters, therefore, worsen the socioeconomic conditions in the regions where they occur.

Moreover, Barattieri et al. (2023) investigated the short-run, dynamic employment effect of natural disasters in Puerto Rico between 1995 and 2019. Using satellite data from the National Oceanic and Atmospheric Administration (NOAA) Tropical Prediction Center and employment data from the Quarterly Census of Employment and Wages (QCEW), the study found that natural disasters result in an average decline in employment by 0.5%. The loss of jobs meant employees lost the source of their income, which has adverse rippling effects as it can affect their dependents' education, healthcare and other socioeconomic well-being.

Similarly, Adeagbo et al. (2016) investigated how natural disasters affect the socio-economic well-being of the people of Nigeria from 2009-2013. Using descriptive analysis, the study found that a more significant proportion of respondents experienced a 47% reduction in their residential units, 41% destruction of household assets and a 45% reduction in children's schooling. Further, the study found that while some experienced severe health-related challenges, others experienced a disruption in the supply of utilities, such as water and electricity.

Furthermore, Ilham et al. (2023) investigated the effect of natural disasters on regional economic growth, poverty, unemployment, and human development index in 30 provinces in Indonesia between 2013-2016. Natural disasters used in the study consisted of whirlwinds, floods, and landslides, measured as the number of mortalities, the number of affected houses, and the number of affected public facilities. Employing panel data and the Partial Least Squares method, the study found that natural disasters cause a decline in regional economic growth and increased unemployment but have no significant effect on the human capital index.

Moreover, Loayza and Olaberria (2012) examined the effect of natural disasters on growth based on disaster type and economic sector from 1961 to 2005. Three economic sectors, namely industry, agriculture and services sectors, and four types of natural disasters: floods, storms, drought and earthquakes, were considered for study. Also, the dependent variable in the study was measured as real per capita GDP as well as the growth rate of real per capita value added in the selected economic sectors. Natural disaster was calculated as the ratio of impaired people to the total population for each disaster type. The study found that droughts adversely affect agricultural growth and industry in emerging economies. Also, storms cause a decline in agricultural growth in developing economies but stimulate growth in the industrial sector. Likewise, earthquakes were found to boost growth industry growth among emerging economies. Nonetheless, moderate floods positively influenced agricultural growth and growth in the other sectors of the economy. Besides, Loayza and Olaberria (2012) conclude that growth in emerging economies significantly responds to natural disasters mainly because natural disasters significantly impact more economic sectors of developing economies.

The literature reviewed highlighted the deleterious impact of natural disasters on socioeconomic outcomes, especially in emerging economies However, these studies did not adopt a holistic measure of inclusive growth but focused on a few narrow dimensions while ignoring other crucial socioeconomic indicators. Moreover, many available studies do not focus on SSA and thus limit their generalizability to the region. This study therefore investigates the wider impact of natural disasters on inclusive growth in SSA, focusing on their detrimental effect on equity and access to basic services. This aligns with the study's objectives to evaluate the broader socioeconomic impacts of natural disasters, especially within the context of Sub-Saharan Africa.

Financial Development and socioeconomic well-being of citizens of a country

Nguyen, Le, Ho, Nguyen and Vo (2022) investigated whether financial development is relevant for economic growth using panel data on 22 emerging markets from 1980-2020. The study measured financial development based on the broad-based financial development index of the IMF and economic growth as GDP per capita with data from the WDI. The study found a linear long-run relationship between financial development and economic growth. Moreover, financial development positively affected economic growth in emerging countries.

Also, Wen, Mahmood, Khalid and Zakaria (2022) analysed the effect of financial development on some macroeconomic indicators such as economic growth, employment and inflation for 120 economies from 1997 to 2017. Financial development in this study was measured using four different proxies: money and quasi-money, private sector credit, bank credit and liquid liabilities. Economic growth was measured as real per capita GDP, employment as the growth rate of persons employed and inflation as the consumer price index. Data for variables used in this study was obtained from the WDI, ICRG and the International Financial Statistics (IFS). The study's outcome was that whereas financial development negatively affects economic growth, it influences employment and inflation positively.

Similarly, Kassie (2021) examined the effect of financial development on economic growth and the role institutions play in the relationship of 35 African economies from 1985 to 2018. Economic growth measured GDP per capita and financial development as IMF’s financial development index. Data on economic growth was obtained from WDI, financial development from IMF, and institutional quality from the International Country Risk Guide (ICRG), which reveals that financial development does not affect economic growth. Nonetheless, when financial development interacts with institutional quality, the relationship is positive, suggesting that financial development's positive impact on economic growth relies on the institution's quality.

Shen and He (2022) employed a panel threshold model of 30 provinces, municipalities, and autonomous regions in China from 2005 to 2018 to determine if there is a threshold effect between financial systems and high-quality economic development. Green total factor productivity was used as a proxy for high-quality economic development. The financial system was measured as an index of the macroeconomy, micro-financial institutions and markets, and macro-financial institutions and markets. The study found that the relationship between financial development and high-quality economic development was not linear as other studies had found but an inverted U-shape. This suggests a threshold effect between financial development and high-quality economic development in China. For instance, the optimum financial system plays a more significant role in capital allocation between the initial threshold of 0.1355 and the subsequent threshold of 0.1377. It has a supplementary apparent positive effect on economic growth. Further, the study found that using economic development as a threshold variable, the impact of the financial system on high-quality economic development reveals a weakening marginal tendency. At a threshold value of below 0.01409 for economic development, the financial system significantly stimulates high-quality economic development. Notwithstanding, at a value higher than the threshold value, the contributions of the financial system lessen.

Similarly, Donou-Adonsou and Sylwester (2016) investigated the role of financial development in reducing poverty in 71 developing economies from 2002 to 2011. In their study, whereas poverty was measured as poverty gap, headcount ratio and the square of poverty gap, financial development, on the other hand, was measured as private credit as a percentage of GDP and the ratio of asset to GDP of both banks and microfinance institutions. Data on microfinance institutions was taken from Microfinance Information Exchange (MIX) reports and Microfinance Profiles, and data on poverty was taken from the Poverty and Equity database and PovcalNet, both maintained by the World Bank. Additionally, bank data was taken from Beck et al. (2013). Employing the fixed-effect 2SLS estimation technique, the study found that bank credit reduces the prevalence of poverty when poverty is measured as poverty gap and headcounts. Still, no reducing effect of bank credit was found on poverty when measured as a squared poverty gap. Regarding the development of microfinance institutions in reducing the impact of poverty, no evidence was established regarding all the measures of poverty.

Additionally, Naceur and Zhang (2016), in their study on financial development, inequality and poverty in 143 developed and emerging economies over the period 1961 to 2011 based on data from the World Bank's poverty and inequality database, the Global Financial Development Database (GFDD) found that four out of the five dimensions of financial development namely, access, depth, efficiency and stability, contribute significantly to the reduction of poverty and inequality. Conversely, financial liberation heightened poverty and inequality among selected countries. Moreover, the development of the banking sector contributed significantly to the development of the stock market. The study employed both Instrumental Variable (IV) and OLS methods.

Also, Shahabzi and Saeidpour (2013) find a non-linear relationship between financial development and economic growth in D-8 countries. The study, which measured financial development as domestic credit to the private sector, spanned over the period 1980-2011 and employed a Panel Smooth Transition Regression (PSTR) model that reports that at the initial level of growth, financial development contributed negatively to economic growth. Nonetheless, beyond a threshold value of 26.55, even though the effect of financial development was positive, the magnitude of the impact was relatively low, indicating that financial development's contribution to the D-8 economies is insignificant.

Moreover, Nizam, Karim, Rahman and Sarmidi (2020) explored the relationship between financial inclusiveness and economic growth in 63 developing and emergent economies from 2014 to 2017. Economic growth in this study was measured as real GDP per capita with data taken from the WDI. Similarly, an index composed of four indicators, namely, availability of banking services, banking penetration, digital financial technology and the use of financial services with data drawn from the Financial Access Database of IMF and Global Findex Database, was employed to capture financial development. The study reports a threshold effect between financial development and economic growth. Also, financial inclusiveness positively influences economic growth with a magnitude more significant impact in economies with lesser growth than in economies with higher growth.

Still, Arcand, Berkes and Panizza (2012), using data from 1970-2010, examined the relationship between financial development and economic growth to see if there is a threshold level beyond which the contributions of financial development to economic growth decline or become negative. Employing different empirical methods, the study finds a threshold effect between financial development and economic growth, thus confirming the too much finance hypothesis. Specifically, the study found that the contributions of finance to growth become negative when credit to the private sector reaches 100% of GDP.

Similarly, Nguyen et al. (2022) studied the effect of financial development on the economic growth of 22 developing countries over the period of 1980-2020 using an advanced dynamic joint correlated estimator (DCCE) and a panel Granger-causality test. While economic growth was measured as GDP per capita, financial development in this study was measured using the financial development index developed by the IMF (Svirydzenka, 2016) with data from the WDI and IMF, respectively. The study found a positive linear relationship between financial development and economic growth in emerging economies. Moreover, the study found a strong, solid bi-directional Granger causality between financial development and economic growth for all proxies of financial development.

Besides, Samargandi, Fidrmuc and Ghosh (2015) employed the Pooled Mean Group (PMG) estimation technique to evaluate the relationship between financial development and economic growth for 23 upper and 29 lower-middle-income countries using panel data from 1980-2008. Economic growth in this study was measured as real GDP growth rate. Financial development, on the other hand, is calculated as a composite indicator made up of the ratio of liquid liabilities (or M3) to nominal GDP, the ratio of commercial bank assets to the sum of commercial bank assets and central bank assets and the percentage of bank credit to the private sector to GDP. Imposing linearity on the relationship between financial development and economic growth, the study found that financial development negatively influences economic growth. The study further examined whether there is a non-monotonic relationship between financial development and economic growth. The results show that the relationship between financial development and economic growth is inverted U-shaped, indicating a non-monotonic relationship between financial development and economic growth. Further, the study noted that the effect of financial development varied across the sample economies due to the heterogeneity in their quality of institutions, financial markets and economic structure.

Moreover, Ayyagari, Juarros, Peria, and Singh (2016) explored the influence of access to finance on employment growth in 50,000 organisations across 70 emerging economies with data from cross-country World Bank Enterprise Surveys and cross-country World Bank Enterprise Surveys between 2002 and 2014. Based on the fixed-effects estimations and a difference-in-difference technique, the study finds that financial access stimulates employment growth, especially among small, micro and medium organisations.

Similarly, Borisov, Ellul and Sevilir (2021), in their study on access to public capital markets and employment growth, examined the impact of going public on firm-level employment of 7953 Initial Public Offerings (IPO) of US firms for the period 1990 to 2010 with data from Thomson Reuters' Global New Issues (GNI) database and NETS database. The study first employed OLS estimation followed by a two-stage IV estimation method to establish causality. It was found that when firms go public, their employment increases considerably. Nonetheless, the rise in employment is noticeable in industries which require highly skilled labour and rely on external financing.

Ntow-Gyamfi et al. (2022) investigated the effect of financial development on inclusive growth and the moderating role of institutional quality on the relationship between financial development and inclusive growth using panel data on 48 countries across Africa from 1990 to 2016. The study measured inclusive growth as an index based on the ADB's approach. Financial development was measured as domestic credit to the private sector. All data for the study was sourced from the World Bank's WDI. Employing system GMM, the study found a non-linear relationship between financial development and inclusive growth showing that at the early stages of development, financial development influences economic growth negatively. However, after a certain threshold, the contributions of financial development become significant. Moreover, the study reported that financial development positively affected inclusive growth at the early stages. However, there is a need for quality institutions to regularise the activities of financial market participants.

Also, Asongu and Nting (2021) explored the role of finance in inclusive human development in 38 African countries over the period 1996 to 2008 using data from the United Nations Development Program (UNDP), African Development Indicators (ADI) and World Bank databases. Whereas the inequality-adjusted human development index was used as the dependent variable, the independent variable comprised all financial development and structure dimensions. Employing several estimation techniques such as 2SLS, GMM, Tobit regression and the fixed-effect estimation technique, the study mainly found that the size, activity and depth of the financial sector facilitate inclusive human development. However, the failure of banks to transform deposits mobilised into loans to be accessed by the deficit unit negatively impacts inclusive human development.

Cuesta-González, Ruza and Rodríguez-Fernández (2020) studied the nexus between financial development and income inequality among nine OECD countries between 2000-2015. The study measured income inequality using net Gini and financial development using two proxies: credit provided to the private sector as a share of GDP and stock market capitalisation as a percentage of GDP. Using different estimation methods such as generalised least squares in two stages (G2SLS), OLS and GMM, the study confirmed the "too much finance hypothesis" for the size of stock markets and credit provision. Nonetheless, the study concludes that the financial system's resilience assists in alleviating prevailing income inequality.

Most of the above studies show the positive contribution of financial development in improving the socioeconomic well-being of citizens, particularly among emerging countries. Notwithstanding, they are deficient when it comes to understanding whether there is a threshold effect between financial development and inclusive growth as they most focused on economic growth instead. The findings from these studies therefore reveal a gap in the literature which requires attention, especially in SSA whose financial sector has been growing steadily.

Furthermore, the review of the interactions among natural disasters, financial development, and inclusive growth shows that most of the studies employed robust methodologies. Nonetheless, the failure to focus on the uniqueness of SSA exposes a significant gap that requires investigating to understand regional dynamics. Giving research attention to SSA, bridges the gap to tailored analysis, employing robust methodology to assess the impact of natural disasters on financial development and inclusive growth in SSA.

Gaps identified in current literature on Africa

Although studies on the indirect effect of natural disasters have been nascent, a review of empirical literature exposes some gaps that must be filled to understand natural disasters holistically and develop the relevant policies to mitigate their impact.

Extant studies (Noy, 2016), for instance, note that generally, natural disasters are measured across three dimensions: the number of deaths, the total number of people affected and total economic losses arising from the event. Consequently, to ascertain the overall impact of a natural disaster on an affected area, a comprehensive analysis must be done that incorporates all three dimensions above. However, most empirical studies either chose a single measure or combined two. In this case, the total effect of the natural disasters on the affected region is not determined. This study, notwithstanding, employs the Lifeyear Index, which incorporates all three measures of natural disaster, developed by Noy (2016) to investigate the effect of natural disasters on financial development and inclusive growth in Sub-Saharan Africa.

Furthermore, available studies on natural disasters concentrate more on developed than developing economies. Since very destructive disasters occur in developed countries due to their high adaptive capacity, the indirect cost tends to be negligible. The developing economies, on the other hand, tend to suffer more from the indirect cost of natural disasters because they do not have adequate systems in place to deal with the consequences and are more exposed to the challenges of climate shocks (Fomby, Ikeda & Loayza, 2013; Loayza, Olaberría, Rigolini & Christiaensen, 2012; Raddatz, 2009). Even though recent attention has been shifted to developing economies, such studies do not consider the peculiarity of particular regions in developing economies. Thus, they lump all developing economies together, assuming their shared similarity. Extant studies show that SSA requires special attention among developing economies (AGI, 2019; IMF, 2020) as natural disaster frequency rises globally. Yet empirical studies on sub-regions are relatively scanty or limited. Table 3 below shows the current studies on natural disasters in Africa.

Table 3: Current Studies on Natural Disasters in Africa

Author	Title
Chhibber and Laajaj (2008)	Disasters, Climate Change and Economic Development in Sub-Saharan Africa: Lessons and Directions
Lukamba (2010)	Natural disasters in African countries: what can we learn about them?
Conteh (2015)	The Impact of Floods on Primary School Education in Zambia
Edoun, Balgah and Mbohwa (2015)	The impact of effective management of natural disasters on Africa’s development
Ngoran, Baninla, Ngoran and Xue (2015)	Circumscribing the Nexus between Natural Disaster, Water Resources and Poverty in Sub-Saharan Africa
Li, Chai, Yang and Li (2016)	Spatio-temporal distribution of flood disasters and analysis of influencing factors in Africa
Ghomian and Yousefian (2017)	Natural Disasters in the Middle East and North Africa with a Focus on Iran: 1900 to 2015
Bettin and Zazzaro (2017)	The Impact of Natural Disasters on Remittances to Low- and Middle-Income Countries
Namgoong (2018)	The Long-Term Effect of Natural Disasters on Conflict Onset in Sub-Saharan African Nations: How One Variable Can Create Two Conflicting Consequences
Adjei-Mantey and Adusah-Poku (2019)	Natural disasters and economic growth in Africa
Shimada (2022)	The Impact of Climate-Change-Related Disasters on Africa’s Economic Growth, Agriculture, and Conflicts: Can Humanitarian Aid and Food Assistance Offset the Damage?

Source: Author’s compilation

From the table above, it is seen that a gap exists regarding the impact of natural disasters on the financial sector and inclusive growth. Moreover, even though some have investigated the effect of natural disasters on growth, their measure, economic growth, has been criticised as needing to be a proper indicator of the level of economic well-being. Considering the relevance of financial development to every economy, a failure in that sector affects almost all other sectors of a region. Though natural disasters have been considered a threat to the financial system of affected economies and the frequency and impact of natural disasters in SSA have been rising, no study has been undertaken to explore the effect of natural disasters on financial development. This study, therefore, fills this gap by examining the impact of natural disasters on financial development in SSA.

Furthermore, given the global attention on the need to measure growth inclusively, especially when inclusive growth is linked with the realisation of the SDGs, it is imperative to understand how natural disasters mitigate against SSA where there has been significant GDP growth but has not reflected in other important aspect of citizens lives.

Conceptual framework

The establishment of the link between natural disasters and financial development and the relationship between natural disasters and inclusive growth was based on existing international reports.

The relationship between natural disasters and inclusive growth is informed by SDG 11.5, which notes that inclusive growth is vital for improving the livelihood of all people and that all efforts should be made to reduce the impact of natural disasters as they threaten the achievement of inclusive growth.

Furthermore, aside from literature, theory informs the relationship between natural disasters, financial development and inclusive growth. The main theory enabling the study of exogenous shocks is the event system theory, which argues that a single exogenous shock can be understood as the effect of an event system composed of event strength, space, and time. Apart from the main theory, the relationship between the critical variables of the study is also established based on theory.

Firstly, the financial fragility hypothesis underpins the relationship between natural disasters and financial development.

The endogenous growth and creative destruction theories support the relationship between natural disasters and inclusive growth.

Thirdly, the too-much finance hypothesis supports the relationship between financial development and inclusive growth.

Fourthly, the time component of the EST gives the basis for examining the moderating role of the stage of development on the relationship between natural disasters and financial growth, as well as natural disasters and financial development, given that the countries in SSA have different stages of development.

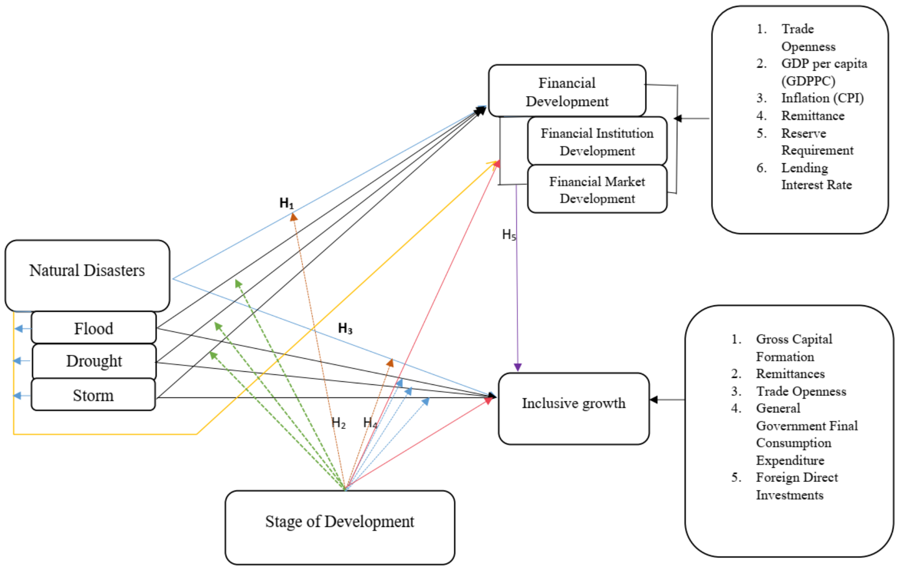

Figure 7: Conceptual Framework
Source: Researcher (2022)

From Figure 7 above, it is observed that even though there are different natural disasters in SSA, only flood, drought and storms have been captured in this study, and this is because available data from EMDAT show that these are the most impactful and frequent disasters in the sub-region (CRED, 2020). Such an approach is supported by Loayza et al. (2012), who highlight that different natural disasters have other impacts and that in assessing the effect of natural disasters, separate analysis should be done for each disaster. If that is not done, the result will be misleading. Consequently, this study analyses how natural disasters influence Africa's financial development and inclusive growth.

Furthermore, the financial system of SSA is made up of financial institutions and financial markets. However, performing different functions complement each other to have a better financial sector in the sub-region. This study, therefore, as shown in Figure 8, seeks to investigate the effect of natural disasters on financial institution development and financial market development as separate structures of the financial system and then also the effect on the development of the financial system as a composite whole in Africa.

Chapter Summary

This chapter explained essential concepts as they relate to the main variables that the study uses. Specifically, it discussed the concept of natural disasters, the classifications of natural disasters, and the most prevalent natural disasters; also, the chapter discussed the concept of financial development and the financial system of Africa. Moreover, inclusive growth was discussed in detail, considering how the concept has evolved and the current of SSA about achieving inclusive growth.

Additionally, the chapter discussed various theories employed to link the differences between the studies so that empirical analysis would be justified. Also, the chapter reviewed the empirical studies that have been understood earlier on the nexus between natural disasters, financial development and inclusive growth. Moreover, the chapter discussed gaps that empirical literature still needs to address, which the researcher seeks to fill. Lastly, the chapter ended with a conceptual framework that showed the links between the variables of the study.

CHAPTER THREE

RESEARCH METHOD

Introduction

This section discusses the systematic practical approach to achieve the study's objectives. This study fundamentally seeks to investigate the effect of natural disasters on financial development and inclusive growth in Sub-Saharan Africa. Specifically, this chapter discusses the research paradigm, research approach, research design, source of data, measurement of variables, theoretical and empirical models, data processing, and analysis methods. This chapter finally ends with a chapter summary.

Research Paradigm

This study adopts the positivist paradigm to study the relationships among natural disasters, financial development and inclusive growth in SSA. This philosophy employs the scientific method, which requires a researcher to state hypotheses that can be proven or disproven using quantitative procedures (Aliaga & Gunderson, 2006). Additionally, positivists believe that human beings are a phenomenon that can be studied using scientific methods and that through observation and reasoning, a researcher comes to understand human behaviour. Positivists assume that there is only one reality (Fard, 2012; Shah & Al-Bargi, 2013). Moreover, this paradigm assumes that the researcher and phenomenon being investigated are different units, and neither influences the other (Fard, 2012).

This study aligns with the positivist because it adheres strictly to the scientific process. The researcher's role in achieving the study's objective relates only to data gathering, analysis and interpretation to confirm or disapprove the stated hypothesis.

Research Design

Research design constitutes the framework that specifies the methods, processes and procedures followed in conducting an empirical investigation. It is a plan or a strategy that guides the research process. Specifically, the research design is a framework that informs the approaches and procedures for collecting, analysing, and interpreting data (Kothari, 2004; McCombes, 2019).

This study employs an explanatory research design. The explanatory research design, also known as causal research, explains how one variable influences another and is concerned with investigating a specific issue to understand the patterns of interactions among variables. (Zikmund, Babin, Carr & Griffin, 2012). According to Sue and Ritters (2011), explanatory research seeks primarily to clarify why events occur and to forecast impending occurrences. Explanatory studies use research hypotheses that show the nature and direction of the relationships between or among variables investigated and mostly require quantitative data and statistical analysis to determine the strength of relationships. Additionally, Saunder et al. (2012) explain that the explanatory research design focuses on investigating a situation to justify the correlations between variables. Since the primary purpose of this study is to examine how natural disasters affect financial development and inclusive growth, the explanatory research design is best suited.

Research Approach

Extant literature (Muijs 2010) emphasises that the choice of a research approach is informed by a philosophical assumption that underpins it. The research approach that goes with positivism is the quantitative research approach. The quantitative research approach uses objective measurements, gathering and analysing statistical data to explain a phenomenon. Moreover, this approach entails using statistical techniques to analyse collected data (Babbie, 2010).

This study adopts the quantitative research approach because numerical data with a broader scope shall be collected from reliable sources, analysed using statistical analytical tools and interpreted such that no biases of the researcher shall interfere with the process. Further, this study chooses the quantitative research approach because it can put a social phenomenon into a causality structure, thereby limiting the researcher's influence through statistical analysis methods (Asafo, 2020). Moreover, this approach is best for the chosen research paradigm.

Econometric Data

Wooldridge (2013) states that four types of data, namely, time series, cross-sectional, pooled cross-section, and panel data, are generally employed in applied econometric analysis. Time series data comprises observations on a variable or several variables over time. They are arranged in time sequence, usually uniformly spaced. Conversely, cross-sectional data entails a sample of comments taken at the same point in time. Under this data type, no particular focus is given to the time element. Pooled cross-section data, however, combines some of the features of cross-sectional and time-series data. Finally, panel data, or longitudinal data, consists of a time series for each cross-sectional member in the data set.

Despite the different data structures applicable to applied econometric analysis, this study prefers to employ the panel data structure in investigating the effect of natural disasters on financial development and inclusive growth in SSA due to the associated benefits. Eric (2019) notes that panel data comprises more variability and efficiency than pure cross-sectional or time series data. Also, panel data can reduce estimation biases from aggregating cross-sections into a single time series. Furthermore, panel data can identify and measure statistical effects that cannot be detected by typical time series or cross-sectional data and has a greater capacity to capture complexities and heterogeneity in cross-section behaviour. Considering that this study uses 35 countries in SSA over the period 1990-2019, the panel data structure is best suited.

Types of panel data models

Available literature (Gujarati,2011; Majumder, 2020) explained that the main panel data model estimators are pooled Ordinary Lease Squares (OLS) estimator, Fixed Effect (FE) estimator, Random Effect (RE) estimator and the Instrumental Variable (IV) estimator. The pooled OLS, FE and RE estimators are collectively known as static panel data estimators. The IV estimators, on the other hand, are known as dynamic panel data estimators.

Framework for static panel data models

The baseline model for the static panel data estimators is specified as below:

$$Y_{it} = \alpha + \beta_i X_{it} + \delta Z_i + \varepsilon_{it} \tag{1}$$

Where, α is a constant, Y_{it} is the dependent variable, X_{it} is the independent variable without a constant, δZ_i represents the heterogeneity of individual cross-sections, and ε_{it} is the error term.

Mikulíková (2023) posits that the choice of the best panel data model under this estimation method is fundamentally determined by the assumption about the heterogeneity term. For instance, if the heterogeneity assumption is met, the pooled OLS estimator is most suited, resulting in an efficient and consistent outcome. However, in a condition where the heterogeneity term is unobserved and uncorrelated with X_{it}, the RE model is the best estimator to employ. When the random effect model is used, the heterogeneity term $\delta_i Z$ can be modified to $\mu_i + \alpha$, where μ_i is a random heterogeneity of specific cross-sections and α is a constant. Lastly, the fixed effects (FE) assumption is that the heterogeneity term is unobserved and correlated with the independent variables. Therefore, for the result of the FE to be reliable, the errors must be serially uncorrelated with the explanatory variable and homoskedastic.

Sihombing and Arsani (2021) submit that the dynamic panel data model delivers better results than the static panel data estimation models. In support, extant literature (Asteriou & Hall, 2011; Gujarati & Porter, 2009) note that the pooled OLS is usually an extremely restrictive model because of its imposition and assumption of homogenous intercept and slope parameters for all cross-sections concerning individual heterogeneity and thereby permitting the error term to correlate with some explanatory variables. Also, the fixed effect estimation approach must be revised because of the loss of degrees of freedom. Furthermore, Arellano (2003) posits that random effects estimators are time-invariant, implying that at any time, the error term exhibits strict exogeneity and does not correlate with the previous, current and impending series.

Framework for dynamic panel models

Majumder (2020) assert that dynamic panel estimators have recently become more preferred in econometric analysis. This is because sometimes, the present value of the outcome variable is influenced by the past level, resulting in a dynamic panel model. It is, therefore, imperative that if there is adequate theoretical justification that the past values influence the present values of the dependent variable, the lagged dependent variable must be incorporated into the specification of the empirical model to allow for the dynamic adjustment process (Abeka, 2023). The general equation of the dynamic panel model is given below:

$$Y_{it} = \lambda + \alpha Y_{it-1} + \beta_i X_{it} + \delta Z_i + \epsilon_{it} \quad (2)$$

Where Y_{it} is the dependent variable, Y_{it-1} is the lag of the dependent variable, X_{it} is independent variables without a constant, δZ_i represents the heterogeneity of individual cross-sections, λ is the constant term, and ε_{it} is the error term

This study adopts the dynamic panel model approach because considering that both financial development and inclusive growth constitute a process where the previous levels have a significant association with the present level, the likelihood of endogeneity is very high (Abeka 2018; Ntow-Gyamfi et al., 2019; Wang, 2020). Likewise, Panwar and Sen (2019) note that using data from EM-DAT, the data source for natural disasters, could result in an endogeneity problem in that estimating the effect of natural disasters on growth requires several omitted factors, which could vary from one economy to another. Therefore, it is imperative to consider the endogeneity issue when using EM-DAT to have a robust result.

Further, Chen and Chang (2021) highlight that models that employ the dynamic effects of natural disasters yield better analysis than static models.

Model Specification

Following Panwar and Sen (2019), this study employs a model that uses the dynamic effect where a lag of the dependent variable is part of the independent variables. The modification of the general form of the dynamic panel model results in the given model below:

$$Y_{it} = \beta + \alpha_1 Y_{it-1} + \alpha_2 ND_{it} + \alpha_3 X_{it} + \delta_1 + \varphi_t + \varepsilon_{it} \quad (3)$$

Where β represents the intercept, the subscripts i and t indicate country and year, α_i represents the regression coefficients of the various explanatory variables, Y_{it} is the respective dependent variables, Y_{it-1} denotes the lag of the dependent variable, ND_{it} means natural disasters, X_{it} is a set of independent control variables, δ_i captures unobserved country-specific effects, φ_t indicates time-specific effects term and ε_{it} is the error term. Based on the general model specified in Equation 3 above, five empirical models are set in line with the objectives of this study.

Model 1: Examining the effect of different types of natural disasters on financial development in SSA

Model 1, which is specified to examine the effect of different natural disasters on financial development in SSA, was adopted from Chen and Chang (2021), which sought to investigate the impact of natural hazards on the financial system. The dependent variable of their study was the financial system, which was measured as stock market capitalisation, banking, and insurance systems. The independent variable was natural hazards, measured as the number of deaths and persons affected by natural hazards. The study employed the following control variables: economic development, trade level, inflation rate, exchange rate and bank deposit to GDP.

This study, however, adapts the baseline model of Chen and Chang (2021) to empirically investigate the effect of natural disasters on financial development in SSA. To achieve this, three indices, the overall financial development index, the financial institution development index and the financial markets development index, are employed to examine the effect of natural disasters on financial development in SSA. Earlier studies (Shahbaz, M., Shahzad, Ahmad & Alam, 2016; Topcu & Payne, 2017) support using the separate components of financial development in empirical analysis.

Moreover, instead of using the number of deaths and total affected as an independent variable measuring natural disasters, this study adds the total value of economic losses caused by the disaster to develop an index that measures the overall effect of natural disasters. The choice of control variables in model 1 is informed by Takyi and Obeng (2013). Moreover, the lag of the dependent variable has been added to allow for the partial adjustment of financial development to its long-run equilibrium value. Such inclusion is warranted because financial development entails a process where the past levels of financial development influence current levels. Model 1 is therefore specified as below:

$$FD_{it} = \beta + \lambda_1 FD_{it-1} + \lambda_2 ND_{it} + \lambda_3 DEV_{it} + \lambda_4 Z_{it} + \mu_{it} \qquad (4)$$

Where FD_{it} is the financial development index, FD_{it-1} is the lag of the financial development index, ND_{it} denotes natural disasters, DEV_{it} represent stage of development of a country, Z_{it} means all control variables, β represents the intercept, λ signifies the coefficients of the regressions, μ_{it} indicates the error term and $\mu_{it} = \delta_1 + \varphi_t + \varepsilon_{it}$. The composite error term, μ_{it} is broken into three parts: country-specific effect δ1, time effect φt and the white noise εit assumed to be identically and independently distributed.

It is worth mentioning that based on the three different indicators of financial development employed in this study, Model 1 shall be subdivided into three models: Model 1a, Model 1b and Model 1c. Model 1a shall measure the effect of natural disasters on overall financial development, Model 1b shall measure the effect of natural disasters on financial institution development and Model 1c shall measure the impact of natural disasters on financial market development in SSA.

Model 2: The moderating role of the stage of development in the relationship between financial development and natural disasters in SSA

Objective two of this study investigates whether the stage of development of an economy moderates the relationship between financial development and natural disasters. To achieve this, natural disasters and stage of development are interacted and the interacted term entered into Model 4 as a distinct independent variable. Accordingly, model 2 is specified in the equation below:

$$FD_{it} = \beta + \lambda_1 FD_{it-1} + \lambda_2 ND_{it} + \lambda_3 SD_{it} + \lambda_4 \left(ND * DEV\right)_{it} + \lambda_5 Z_{it} + \mu_{it} \qquad (5)$$

Where FD_{it} is the financial development index, FD_{it-1} is the lag of the financial development index, ND_{it} is a presentation of natural disasters, DEV_{it} represent a stage of development of a country, $(ND*DEV)_{it}$ is the interaction term for natural disasters and stage of development, Z_{it} denotes all control variables, α represents the intercept, δ denotes the coefficients of the regression, μ_{it} indicates the error term and $\mu_{it} = \delta_1 + \varphi_t + \varepsilon_{it}$

Stage of development will moderate the relationship between financial development and natural disasters if the coefficient of the interacted term is statistically significant and positive. As with Model 1, Model 2 has been divided into three sub-models, Model 2a, Model 2b and Model 2c, to reflect the effect of natural disasters on overall financial development, financial institutions and financial markets, respectively.

Model 3: Investigating different natural disasters' effects on SSA's inclusive growth

Model 3, which is in line with objective two of this study, seeks to examine the effect of different natural disasters on inclusive growth and is adapted from the econometric model of Kyere (2018), where the dependent variable was inclusive growth and the independent variable, climate change measured as change in temperature anomalies for meteorological a year and carbon dioxide emissions metric ton per capita. Further, Kyere (2018) employed foreign direct investment, trade openness, gross capital formation, adaptive capacity and population as control variables. In this study, however, the dependent variable is inclusive growth; natural disasters are employed as the independent variable instead of climate change. Furthermore, this study modifies some of the control variables Kyere (2018) used, including financial development, gross capital formation, remittances, trade openness, general government final consumption expenditure and foreign direct investments. Consequently, the model is specified in the equation below:

$$IGI_{it} = \alpha + \delta_1 IGI_{it-1} + \delta_2 ND_{it} + \delta_3 DEV_{it} + \delta_4 Z_{it} + \mu_{it} \tag{6}$$

Where IGI_{it} is the inclusive growth index, IGI_{it-1} is the lag of financial development index, ND_{it} is a presentation of natural disasters, DEV_{it} represents the stage of development of a country, Z_{it} denotes all control variables, α represents the intercept, δ denotes the coefficients of the regression, μ_{it} indicates the error term and $\mu_{it} = \delta_1 + \varphi_t + \varepsilon_{it}$. The composite error term, μ_{it} is broken into three parts: country-specific effect δ1, time effect φt and the white noise εit assumed to be identically and independently distributed.

Model 4: The moderating role of the stage of development in the relationship between inclusive growth and natural disasters in SSA

To determine the effect of stage of development on relationship between natural disasters and inclusive growth, which is the objective four of this studies, natural disasters are interacted with the stage of development of a country and entered into a model as unique independent variable. Model 4, which empirically investigates objective four, is shown in the equation below:

$$IGI_{it} = \alpha + \delta_1 IGI_{it-1} + \delta_2 ND_{it} + \delta_3 SD_{it} + \delta_4 \left(ND * DEV\right)_{it} + \delta_5 Z_{it} + \mu_{it} \quad (7)$$

Where IGI_{it} is the inclusive growth index, IGI_{it-1} is the inclusive growth index, ND_{it} is a representation of natural disasters, DEV_{it} represents a stage of development of a country $(ND*DEV)_{it}$ is the interaction term for natural disasters and stage of development, Z_{it} denotes all control variables, α represents the intercept, δ denotes the coefficients of the regression, μ_{it} indicates the error term.

If the interaction term is statistically significant and positive, it implies that the stage of development influences the relationship between natural disasters and inclusive growth.

Model 5: The threshold effect between financial development and inclusive growth in SSA

To ascertain whether there is a non-monotonic relationship between financial development and inclusive growth in SSA, this study specifies Model 5. Earlier literature (Samargandi, Idrmuc & Ghosh, 2015) contends that the growth effect of financial development exists only to a certain threshold. Furthermore, Arcand, Berkes and Panizza (2012) accentuate that when investigating a non-linear relationship between financial development and growth, a model that does not allow for non-monotonicity will result in a downward bias in the estimated effect of financial development on growth. Subsequently, this study, in investigating such threshold effect of financial development SSA, study adapts the baseline model of Nguyen (2022) where a quadratic term of financial development is added to their model, which had economic growth as the dependent variable, financial development as the independent variable and government expenditure, human capital and inflation are control variables.

However, the model specified for this objective employs inclusive growth as the dependent variable instead of economic growth and financial development as the independent variable. The control variables include gross capital formation, remittance, trade openness, government expenditure and foreign direct investment. Model 5 is therefore specified as below:

$$IGI_{it} = \theta + \omega_1 IGI_{it-1} + \omega_2 FD_{it} + \omega_3 FD^2{}_{it} + \omega_4 Z_{it} + \mu_{it} \quad (8)$$

Where IGI_{it} is inclusive growth, IGI_{it-1} is the lag of inclusive growth, FD_{it} is a representation of financial development, $FD^2{}_{it}$ is the quadratic form of financial development, Z_{it} denotes all control variables, θ represents the intercept, ω denotes the coefficients of the regression, μ_{it} indicates the error term. For a non-monotonic relationship between financial development and inclusive growth to be established, the coefficients ω2 and ω3 are expected to be statistically significant, but whereas ω_2 is expected to be positive to indicate the positive effect of financial development on inclusive, ω_3 is anticipated to be negative.

Measurement of variables

Natural Disasters

Guo et al. (2015) assert that a comprehensive evaluation of disasters is essential in determining their impact. Nevertheless, Guha-Sapir and Hoyois (2012) highlight that the usual way of measuring the effects of disasters, such as the number of injuries, fatalities and financial havoc, dates back to the 1970s. Extant studies have employed several approaches to evaluate the effect of disasters. For instance, whereas some existing studies (Kim, 2010; Skidmore & Toya, 2002; Melecky & Raddatz, 2015) employed disaster frequency, that is, the number of disasters happening to evaluate natural disaster impact, others (Strobl, 2012) measure the disaster impact, using disaster index based on maximum sustained wind velocity for hurricanes, mortality, that is, the numbers of deaths as a share of the total population, total number affected that includes number of fatalities as well as number of affected persons (Klomp, 2015; Loayza et al., 2012). Yet still, others (Noy & Nualsri, 2007) used loss rate measured as losses associated with a disaster as a share of GDP.

Despite the numerous ways of measuring the impact of natural disasters, the United Nations (2015) emphasise that “Part of the reason why disaster losses have not created the same political or economic imperative to address the risks of disease or financial risks may be how they are measured. In reality, disasters affect households, communities, and countries due to the combined impact of mortality, morbidity, and damaged or destroyed housing, infrastructure, and agriculture. Separate measurements of mortality and economic loss fail to capture the full dimensions of disaster". Moreover, Noy (2016) emphasise that when the impact of disasters is measured separately using either mortality, morbidity or financial losses, it is realised that there is a glaring disparity between the trends reported by each of these indicators. This presents a difficulty when describing trends in the impact and, more essentially, when those trends are needed to reason into the future.

Based on the above, there is a need to have a measure that combines mortality, morbidity and the economic losses associated with natural disasters. Noy (2016), therefore, developed a method, the Lifeyears Index, that combines the impact of disasters, that is, mortality, morbidity and economic losses, as well as overcoming some of the methodological challenges that present themselves in any attempt to generalise from the separate measures.

The Lifeyears Index primarily focuses on how natural disasters affect human lives. Noy (2016) intimates that human beings have the potential to lead healthy and long lives, which disasters can threaten. Therefore, the effect of disasters must be accounted for. For instance, the destruction of infrastructure affects the likelihood that human lives can achieve this potential just as psychological injuries do, and they must be accounted for. The Lifeyears Index aggregates the number of fatalities, injuries, or people otherwise affected and the financial damage into a total number of human lifeyears lost to disasters.

Development of the Natural Disaster Index

A fundamental assumption of this index is that the value of human life should be considered equal universally, while the value of financial damages is not. This method converts all indicators that measure the impact of natural disasters, such as morbidity, mortality and other effects on lives and infrastructure destroyed, into lifeyears lost instead of currency/monetary units. For this measure, economic losses attributed to natural disasters are equally converted to 'lifeyears' units using a measure of per capita income.

The measurement of the lifeyears impact of natural disasters, as given by Noy (2016), is as below;

$$Lifeyears\ Index\ =\ L\left(M, A^{death},\ A^{exp}\right)\ +\ I\left(N\right)\ +\ DAM\ \left(Y,\ P\right) \qquad (9)$$

Where M is the number of people killed, A^{death} age at the time of death, A^{exp} is the expected lifespan, and $L\ (M,\ A^{death},\ A^{exp}\ )$ is the number of years lost due to event mortality, calculated as the difference between the age at death and life expectancy, $I(N)$ is the cost function associated with the people who were injured or otherwise affected by the disaster, $DAM\ (Y,\ P)$ accounts for the number of human years lost as a result of the damage to capital assets and infrastructure, Y is the amount of financial damages, and P is the monetary amount obtained in a full year of human effort.

$L\ \left(M,\ A^{death},\ A^{exp}\right)$ requires information on the number of deaths, their age profile, and the expected life expectancy for that age/gender group. Since EM-DAT does not provide that information, the index uses the median age (A^{med}) instead of A^{death}. According to UNECA (2022) and AfDB (2022), the median age in SSA is 19.7 years. To estimate the A^{exp}, the model follows the WHO's method of measuring DALYs, where 92 years at birth is used as life expectancy. Therefore, A^{exp} = 92. The choice of 92 years at birth as the life expectancy originates from the forecast of the United Nations concerning the possible average life expectancy at birth in the year 2050 (World Health Organization, [WHO], 2013). The reason for using a high life expectancy value, unvarying across countries, is that the number represents a viable estimate of the possible frontier of human longevity in the foreseeable future. Consequently, number of lifeyears lost due to disaster mortality can be estimated in equation 2 below:

$$L\left(M,\, A^{med},\, A^{exp}\right) \;=\; M * \left(A^{exp} - A^{med}\right) \tag{10}$$

$$L\left(M,\, A^{med},\, A^{exp}\right) \;=\; M * \left(92 - 19.7\right) \tag{11}$$

The second component of the index is I(N). I(N) in equation (9) above is information about the number of persons affected by a disaster, not the nature of each impact. It, therefore, includes a wide range of syndromes and effects. In capturing the I(N), it is assumed that impacted people were affected similarly or the effect of the disaster quantified describes the average effect experienced. As in the WHO approach of calculating DALYs, the impact function is defined in equation (3) below:

$$I\left(N\right) \;=\; eTN^{EMDAT} \tag{12}$$

Where e is the 'welfare-reduction weight' associated with disaster exposure and is denoted as $e = 0.054$, T is the time it takes for the impact of the disaster to diminish. The lifeyears index assumes a 3-year horizon for return to normality (T= 3), N^{EMDAT} is the number of affected people as available in the

EMDAT database. The total effect of a disaster can, therefore, be computed as below:

$$I(N) = 0.054 * 3 * N^{EMDAT} \tag{13}$$

The third component of the index, DAM (Y, P), as seen in Equation 9 above, measures the number of human years lost because of the destruction of infrastructure and capital assets.

Where Y denotes the economic value of the total infrastructure or capital destroyed by the disaster. This represents only the total value of infrastructure destroyed by disaster and the cost of replacing them.

P is the financial amount obtained in a full year of human effort. It is estimated as income per capita (PCGDP), a measure of the cost of human effort, but discounted by 75% (c) to account for time not spent on job-related activities. DAM (Y, P) can be estimated as the equation (10) below:

$$DAM = \frac{(1-c)Y}{PCGDP} \tag{14}$$

Given the above assumptions, the lifeyears index can be estimated in equation (15) below:

$$Lifeyears = M * \left(A^{exp} - A^{med} \right) + eTN^{EMDAT} + \frac{(1-c)Y}{PCGDP} \tag{15}$$

This index therefore uses all the measures of impact of disaster in EM-DAT and thus gives a comprehensive impact of a disaster.

Furthermore, to eliminate the challenge of simultaneity effect, the calculated index is adjusted using recent studies that employed the lifeyears index (Albuquerque & Rajhi, 2019; Sen &Panwar, 2020). This results in the equation below:

$$\frac{Number\ of\ lifeyears\ lost\ to\ a\ natual\ disaster}{Previous\ year's\ population\ figure} * 100{,}000 \tag{16}$$

Following Albuquerque & Rajhi (2019), results obtained from equation 16 above are rescaled between 0 and 1

Financial Development Index

World Bank (2016) emphasises that an appropriate measure of financial development is critical for assessing the improvement of the financial sector and comprehending the impact it can have. Nonetheless, studies that examined the effect of natural disasters on financial development mostly measured financial development as either the ratio of private credit to GDP (Keerthiratne & Tol, 2017) or the ratio of stock market capitalisation (Seetharam, 2017).

This study, however, uses the most comprehensive measure of financial development (Tyson & Beck (2018), known as the IMF (2016) or the Svirydzenka Index of financial development. This index measures the stage and progress of the development of financial institutions and the financial market in terms of access, depth and efficiency. Table 4 below shows the indicators of financial development that the IMF used in developing its financial development index.

Table 4: Components of the Financial Development by IMF

Category	Indicator
	Financial Institutions
Depth	Private-sector credit to GDP Pension fund assets to GDP Mutual fund assets to GDP Insurance premiums, life and non-life to GDP
Access	Bank branches per 100,000 adults ATMs per 100, 000 adults Net interest margin
Efficiency	Lending-deposits spread Non-interest income to total income Overhead costs to total assets Return on assets Return on equity
	Financial Markets
Depth	Stock market capitalisation to GDP The stock traded to GDP International debts securities of government to GDP Total debt securities of financial corporations to GDP Total debt securities of non-financial corporations to GDP
Access	Percent of market capitalisation outside of the top 10 largest companies Total number of issuers of debt (domestic and external, non-financial and financial corporations
Efficiency	Stock market turnover ratio (stock traded to capitalisation)

Source: IMF (2016)

In developing this index, the IMF followed the standard three-step method, which entailed normalising variables, aggregating the normalised variables into the sub-indices representing a particular functional dimension and aggregating the sub-indices into the final index (Svirydzenka, 2016). The dataset of this index contains nine indices that summarise how financial institutions and financial markets have developed in terms of their depth, access, and efficiency. These indices are aggregated into an overall financial development index, covering over 180 countries annually from 1980 onwards.

Inclusive Growth

This study followed AfDB's approach to developing a composite index for inclusive growth for 35 countries in SSA based on the ability of data to capture a wider spectrum of progress and challenges, allowing an analysis of the potential risk natural disasters pose to attaining inclusive growth across diverse contexts.

According to Anyanwu, Kayizzi-Mugerwa and John (2013), AfDB's strategy for inclusive growth is built on four pillars: political, economic, spatial and social. Based on these pillars, an inclusive growth index was developed, considering inequality in economic growth using an inequality-adjusted GDP per capita (Ngepah, 2017). To measure and monitor inclusive growth, the four pillars of inclusive growth were broken down into eight broad components with 14 sub-indicators, as shown in Table 5 below:

Table 5: Indicators for Inclusive Growth Index by AfDB

Component	Indicator
Growth	Real per capita GDP Growth
Labour Force	Wage & Salaried (% of total employment)
&	Employment-to-Population Ratios (% of 15+)
Employment	Employment-to-Population Ratios (% of 15-24)
Health &	Life Expectancy at Birth
Demographics	Mortality Rate Under 5 (per 1,000)
	Public Health Expenditure (% GDP)
Education	Ratio of Female to Male Secondary Enrolment (%)
	Public Spending on Education (% of total)
Gender	Gender Inequality Index (GII)
Environment	Environmental Performance Index (EPI)
Inequality &	Gini Index
Poverty	Poverty Gap at $2 a day
Governance	Corruption Perception Index (CPI)

Source: AfDB (2016)

Construction of Inclusive Growth Index

In the development of a composite index, weights must be assigned to each of the indicators. The weight applied to each index's components can significantly affect future rankings, which must be noticed. Also, assigning weights to the variation of composite indicator scores is essential (Becker, Saisana, Paruolo, & Vandecasteele, 2017). AfDB uses the arithmetic mean approach to compute the total inclusive score by averaging the sum of the normalised values of each indicator S_j for country *i*, with each component and each indicator within that component being equally weighted (AfDB, 2016) because it is more intuitive. Furthermore, Pollesch and Dale (2015) aver that the continuity feature of the weighted arithmetic mean indicates that the limit for an index can be defined precisely if the respective measurement error of a set of components of the index is already known. This characteristic can be employed for sensitivity analysis and uncertainty quantification, both essential.

Given a composite indicator, IGI_i, the most common aggregation scheme under this approach is the weighted arithmetic average given in equation 17 below:

$$IGI_i = \sum_{i=1}^{d} w_i.x_{ji} \qquad j=1,2\ldots,n \tag{17}$$

Where X_{ji} = the normalised score of each country based on the value of X_{ji} of the *i*th raw variable $i=1\ldots,d$, W_i = the nominal weight assigned to the *i*th variable such summation and $w_i > 0$

Under this approach, a weighting scheme and a scoring system are based on value judgment (Idan 2019). Consequently, a weighted average score from 0-100 is set to construct a composite index for inclusive growth based on the performance of each of the relevant indicators. The closer the score of an indicator is to 100, the higher its inclusiveness. Under this approach, equal weight is assigned to all components of the index. And where a component has more than one indicator, the assigned weight is distributed evenly among each of the indicators of a component, In this study, even though the inclusive growth index of AfDB (2016) has eight components and 14 indicators, due to the non-availability of data for some of the indicators over the period this study covers, it uses five of the components and 11 indicators as shown in Table 6 to construct a composite index to measure inclusive growth.

Table 6: Description of components of selected inclusive growth variables and data source

Component	Indicators	Source of Data
Growth	Real per capita GDP Growth	WDI, 1990-2019
Labour Force and Employment	Wages and Salaries (% of total employment)	WDI, 1990-2019
	Employment-to- Population Ratios (% of 15+)	WDI, 1990-2019
	Employment-to- Population Ratios (% of 15-24)	WDI, 1990-2019
Health and Demographics	Life Expectancy at Birth	WDI, 1990-2019
	Mortality Rate Under-5 (per 1,000)	WDI, 1990-2019
	Public Health Expenditure (% GDP)	WDI, 1990-2019
Education	Ratio of Female to Male Secondary Enrolment (%)	WDI, 1990-2019
	Public Spending on Education (% of total)	WDI, 1990-2019
Inequality and Poverty	Poverty Gap at $2 a day	WDI, 1990-2019
	Gini Index	WID, 1990-2019

Source: Author (2022)

The index is calculated by assigning equal weight among all the components and then fairly distributed among each indicator within a particular component. From Table 9 above, there are five components to inclusive growth; equal weight among the components is determined as below:

$$W_i = \frac{1}{5} = 0.2 = 20\%(W_i * 100) \qquad (18)$$

Therefore, each of the five components is assigned a weight of 20%. From Table 9 above, only 'Growth' has an indicator and thus can be given the weight of 20%. The other components have more than one indicator. To determine the weight for components with more than one indicator, the equation 19 below applies:

$$W_i = \frac{1}{5 * k} \qquad (19)$$

Where k is the number of indicators under the respective components, each of the three indicators under Labour Force and Employment and Health and Demographics will have a weight of $\frac{1}{5*3}$ = 6.67%. Likewise, each of the two indicators under Education and Poverty and Inequality will have equal weight of $\frac{1}{5*2}$ =10%.

Table 7 below shows the aggregation method on the weight of different indicators.

Table 7: Aggregation Method on the Weight of Different Indicators of inclusive growth

Component	Indicator(s)	Weight (%)
Growth	Real per capita GDP Growth	20.00
Labour Force and Employment	Wages and Salaries (% of total employment)	6.67
	Employment-to- Population Ratios (% of 15+)	6.67
	Employment-to- Population Ratios (% of 15-24)	6.67
Health and Demographics	Life Expectancy at Birth	6.67
	Mortality Rate Under-5 (per 1,000)	6.67
	Public Health Expenditure (% GDP)	6.67
Education	Ratio of Female to Male Secondary Enrolment (%)	10.00
	Public Spending on Education (% of total)	10.00
Inequality and Poverty	Gini Index	10.00
	Poverty Gap at $2 a day	10.00
Total		100

Source: Author’s construct

Stage of Development

The stage of development of countries in SSA is measured using a dummy variable. In this study, countries in SSA have been grouped into three main categories: low-income, lower-middle income and upper-middle income based on World Bank income classification. This classification system groups countries into different stages of development based on their Gross National Income (GNI). The World Bank's 2022 criteria for classifying countries into each of the categories is given as below:

- Low income: \$1,085 or
- Lower middle income: \$1086 to \$ 4,255
- Upper middle income: \$4,256 to \$13,205

The number of dummy variables to create is equal to k-1 where k is the number of categorical variables (Zach, 2021). Given that three categories represent the stage of development for countries selected for this study, the number of dummy variables to create is given below:

$$k - 1 = 3\text{-}1 = 2 \qquad (20)$$

For empirical estimation, different combinations of the stages of development shall be paired in the regression model to facilitate comparison of their respective moderation effect. For instance, in the first estimation, the low-income (LOW) group shall be used as the reference to facilitate the comparison of the moderation effect between lower-middle-income (LOWR) and upper-middle-income groups (UPPR). Similarly, in subsequent analysis, the lower middle-income group shall be used as a reference to compare the moderation effect between low-income and upper-middle-income groups. Again, upper-middle income shall be used to compare the moderation effect between low and lower-middle-income groups in SSA.

Control Variables

This study employs several control variables to examine the interactions among natural disasters, financial development and inclusive growth selected based on existing literature. The ensuing sections provide the selected control variables for estimating the relationship between natural disasters, financial development and inclusive growth, and financial development and inclusive growth.

Control variables for examining the effect of natural disasters on financial development

Several variables determine financial development. Following extant literature (Akowuah, 2011; Arshad et al., 2021; Azizi, 2020; Faheem et al., 2019; Keerthiratne & Tol, 2018; Mikulíková, 2023; Takyi & Obeng, 2013; Saydaliyev et al., 2020), financial development-specific control variables were used for the estimation of the regression equations. The control variables used in this study included GDP per capita, remittance, inflation, lending interest rate, reserve requirement, trade openness and stage of development (measured as dummy variables for lower-middle-income and upper-middle-income countries).

Control Variable for studying the effect of natural disasters on inclusive growth

On the effect of natural disasters on inclusive growth in SSA, some macroeconomic variables that empirical literature (Kyere, 2018; Meyer & Shera, 2016; Ntow-Gyamfi et al., 2019; Sherriffdeen & Olorunfemi, 2016) has identified to influence the economic well-being of citizens of a country were selected. These included remittances, trade openness, gross capital formation, government final consumption expenditure, financial development and stage of development (measured as dummy variables for lower-middle-income and upper-middle income countries).

Control Variable for studying the effect of financial development on inclusive growth

The macroeconomic variables that were used as control variables of the relationship between financial development and inclusive growth were informed by previous literature (Ntow-Gyamfi et al., 2019; Rajapaksa, Islam & Managi, 2017; Idan, 2019; Fall, Sawadogo & Kanaza, 2021; Zungu, Greyling & Kaseeram, 2022). The control variables included remittance, trade openness, gross capital formation, government financial consumption expenditure and foreign direct investment.

Table 8: Description of control variable measurement and data sources

Variable	Indicator	Source of Data
Trade Openness	The sum of Exports and Imports (% GDP)	WDI
GDP per capita	GDP per capita (constant 2015 US$)	WDI
Inflation	Consumer price index (2010 = 100)	WDI
Reserve Requirement	Bank liquid reserves to bank assets ratio (%)	WDI
Interest rate	Lending interest rate (%)	WDI
Gross Capital Formation	Gross capital formation (% of GDP)	WDI
Government Final Consumption Expenditure	General government final consumption expenditure (% of GDP)	WDI
Foreign Direct Investment	Foreign direct investment, net inflows (% of GDP)	WDI
Remittances	Personal remittances received (% of GDP)	WDI

Source: Field Survey (2023)

Data Collection Procedures

Secondary data was sourced from credible global organisations as a source of data for this study.

Firstly, data on natural disasters was obtained EMDAT maintained y CRED. CRED provides free access to the full Emergency Events Database (EM-DAT) for non-commercial purposes. Users on behalf of academic organisations, universities, non-profit organisations and international public organisations (UN agencies, multi-lateral banks, other multi-lateral institutions and national governments) are granted free access to EMDAT after acceptance of the present conditions of use. EMDAT contains vital data on the frequency and magnitude of over 22,000 g disasters from 1900 to the present. The database is collected from various sources such as UN agencies, insurance companies, non-governmental organisations, press agencies and research institutes. For an event to be recorded in the database, it has to meet at least one of the under listed criteria:

- ten or more people died
- 100 or more people affected/injured/homeless.
- the country declares a state of emergency
- international assistance is sought

Even though the EMDAT database is confronted with issues such as missing values which can affect the robustness of any empirical analysis, to avoid introducing subjective biases that could significantly affect the results results, this study did not impute values for the missing figures This approach was adopted to ensure that results obtained are based on the impact of natural disasters as reported by EMDAT and to provide a true picture of the patterns and trends in data on natural disaster in SSA.

Secondly, data on the financial development index was sourced from the financial development dataset maintained by the International Monetary Fund (IMF).

Data for constructing the inclusive growth composite index were sourced from the World Development Indicator (WDI) and World Inequality Database (WDI). Except for inequality, whose data was sourced from the World Inequality Database (WID), all other data on the selected components of the index was obtained from the World Development Indicator (WDI) of the World Bank.

Test for Endogeneity

Ullah, Akhtar and Zaefarian (2018) note that a fundamental concern when determining a regression's coefficients is the problem of endogeneity, a situation where one endogenous variable correlates with the error term. This could result in unreliable estimation, incorrect interpretation, wrong theoretical analyses and misleading conclusions. Furthermore, Ketokivi and McIntosh (2017) point out that the correct sign of coefficients may not be obtained in the presence of endogeneity bias. Therefore, in estimating a regression, it is essential to ensure that the independent variables do not correlate with the error term. Consequently, there is a need to perform the test of endogeneity to check before estimating the primary regression.

This study acknowledges that although natural disasters are exogenous events caused by environmental factors and are unlikely to cause reverse causation directly, endogeneity issues may still persist because of simultaneity, omitted variables, and feedback mechanisms such as governance and institutional quality that influence their impact on inclusive growth and financial development.

To test for endogeneity, this study follows Drichoutis, Lazaridis and Nayga (2009) to determine the exogeneity or endogeneity of key variable (2). The procedure entails:

i. estimating instrumental-variable 2-Stage Least Squares (2SLS) regression (when there is only one endogenous variable) or instrumental-variable GMM (when there are two or more variables).

ii. performing the first stage regression to determine the relevance of the excluded exogenous variables. The reported test statistic is determined by the number of endogenous variables in the model estimated in step (i). If the model contains one endogenous regressor, then the first-stage R-squared, adjusted R-squared, partial R-squared, and F statistics should be reported. However, if the model has multiple endogenous regressors, then Shea's partial R-squared and adjusted partial R-squared should be reported instead.

iii. estimating tests of over-identifying restrictions. If the 2SLS estimator is used, Sargan's (1958) and Basmann's (1960) chi-squared tests should be reported. Nevertheless, if the GMM estimator was used, Hansen's (1982) J statistic chi-squared test is reported. As a rule of thumb, a statistically significant test statistic always indicates that the instruments may not be valid.

iv. performing endogenous tests to determine whether endogenous regressors in the model are exogenous. For 2SLS estimation, report the statistics of Durbin (1954) and Wu-Hausman (Wu 1974; Hausman 1978). If the test statistic of the Durbin-Wu-Hausman test is statistically significant, it implies that the variable is endogenous and that it is correlated with the error term. Also, for GMM estimation, the C (difference-in-Sargan) statistic is reported. If the test statistic is significant, then the variables being tested must be treated as endogenous. In other words, when the p-value of Chi2 obtained from the analysis is less than 0.05, it is rejected and thus indicates endogeneity bias in the model.

Empirical Estimation Method

In the presence of endogeneity bias, the instrumental variable method may be the best option to address the challenge (Abeka, 2022). Available literature (Drichoutis, Lazaridis & Nayga, 2009) notes that the commonly employed instrumental variable techniques used in dealing with endogeneity bias are the two-stage least squares technique (2sls) and the generalised method of moments (GMM). The 2sls approach performs the regression output in two stages. The first stage entails calculating the estimated values of the endogenous regressors through instrumental variables. The second stage uses the estimated values to perform a linear regression model of the dependent variable (Abeka, 2022). Notwithstanding, Antonakis et al. (2014) posit that finding instrumental variables for several constructs is not a simple task, if not impossible. Also, Majumder (2020) asserts that even though the 2sls may yield consistent estimates, such estimates are likely inadequate because they may only include some of the possible orthogonality conditions.

Even though there are numerous approaches for empirically estimating dynamic panel models such as the Mean Group (MG) estimator developed by Pesaran and Smith (1995), Dynamic Fixed Effects (DFE) estimator and the

Pooled Mean Group (PMG) estimator by Pesaran et al. (1999), this study employs the system General Method of Moments (GMM) panel estimator developed by Arellano and Bond (1991) and Blundell and Bond (1998) as it is best suited for dynamic panel models.

The GMM estimator, according to Wintoki, Linck, and Netter (2012), is primarily used for panel data as it provides reliable results when endogeneity is detected in a variable. In support, Abeka (2018) explains that the GMM estimator addresses the potential endogeneity problem between the dependent and independent variables by extracting the exogenous components of the endogenous explanatory variables and using them as instruments to signify the independent variables. Through the internal transformation of data where the previous values of the variable are deducted from the current values (Roodman, 2009), the number of observations is reduced. It thus enhances the efficiency of the GMM model (Wooldridge, 2012).

There are two main types of GMM estimators: difference and system GMM estimators. Miletkov and Wintoki (2012) note that the initial GMM panel estimator, traditionally known as a difference GMM estimator, was developed by Arellano and Bond (1991). The difference GMM proposes that equations be transformed into the first difference to eliminate country-specific effects, and the lagged levels of their regressors be employed as instruments to remove simultaneity bias (Law & Azman-Saini, 2012). Moreover, the difference GMM uses data transformation into its first difference to address the concern of heterogeneity and utilises the lagged value of the endogenous variable to eliminate the endogeneity problem (Kassie, 2021). Even so, extant literature (Arellano & Bover 1995) emphasises that this estimation approach may result in incorrect conclusions if the independent variables persist. Again, Kassie (2021) posits that even though the difference GMM estimator deals with the challenges of both fixed effect and pooled OLS estimations, the lagged value of the variables constitutes weak instruments. Furthermore, Agbloyor, Abor, Adjasi and Yawson (2016) highlight that the limitation associated with difference GMM worsens when the independent variables persist over time.

As a result of the limitation associated with the difference GMM, Arellano and Bover (1995) and Blundell and Bond (1998) proposed the use of system GMM which combines both the level and difference equations. The lagged differences of the regressors are then used as additional instruments for a level equation. Besides, system GMM specifies one system of equations combining the regression equations in differences and levels. Further, system GMM uses lagged values of independent variables as instruments for difference estimators and the lagged differences of the independent variables are used for equations in levels (Panwar & Sen, 2019). Also, Kassie (2021) asserts that using the lagged variable of the endogenous variable enhances the estimator's efficiency. Also, available literature (Soto, 2009) reveals that the system GMM estimator has better efficiency than the differenced GMM in that it is less biased given that there is some persistence in the series. Likewise, Nyarko (2018) asserts that system GMM is more beneficial in producing efficient results when the units of panel units are large and the periods are relatively small.

Although Roodman (2009) posits that both the difference GMM and system GMM are well suited for panel analysis, this study prefers systems

GMM to difference GMM since it better resolves the issues of endogeneity, which tend to characterise the fundamental variables of this study. Also, Law and Azman-Saini (2012) note that even though there are two types of the system GMM, namely, the one-step-estimator and the two-step-estimator, the 2-step GMM estimator has been theoretically proven to be more efficient than the one-step-estimator because uses optimum weighting matrices. This study, therefore, employs the 2-step GMM estimator. Furthermore, the system GMM is particularly relevant to this study because it excludes unobservable, individual fixed effects by differencing, thereby eliminating the bias owing to the exclusion of country-specific technical efficiency. Besides, it addresses the problem of potential endogeneity by using instruments. Lastly, system GMM reduces bias due to mismeasurement by employing instrumental variables.

Also, the choice of the system GMM for the analysis in this study is informed by extant empirical studies such as Panwar and Sen (2019), Khan et al. (2023), Nguyen et al. (2023), Mikulíková (2023).

Diagnostic Test for GMM Estimation

Law and Azman-Saini (2012) emphasise that model adequacy of the GMM estimator relies on two specification tests, the Hansen/Sargan test of over-identifying restrictions and a serial correlation test in the disturbances (Arellano and Bond 1991). Corroboratively, Ullah, Akhtar and Zaefarian (2018) posit two post-estimation tests to determine an appropriate GMM output: the Sargan and the Arellano-Bond tests for first-order and second-order correlation.

Sargan test

This test seeks to test the validity of instruments and the identification of restrictions. The test's null hypothesis states that all instrumental variables are strong or valid, and the alternate hypothesis states that some instrumental variables are poor or invalid. This study seeks a null hypothesis that instruments do not correlate with the residual term, which will prove that the instruments are valid. Rejecting the null hypothesis will indicate that the instruments are invalid. A low p-value of less than 0.05 for a statistically significant Sargan test demonstrates that the instruments may be weak.

Arellano-Bond test for no auto-correlation

The Arellano-Bond test is necessary to investigate whether there is a serial correlation in a specified model. The null hypothesis of this test states that no autocorrelation exists, and it is applied to residuals that have been differenced. Autocorrelation of the first order is expected by the model construction with the lagged structure, while the second-order autocorrelation is not desirable for the instruments' validity. Thus, if the AR (2) null hypothesis is not rejected, the model is suitable (Mikulíková, 2023).

Chapter Summary

This chapter was dedicated to discussing the methods and procedures that would be followed to empirically analyse the effect of natural disasters on financial development and inclusive growth in SSA. The chapter discussed the research philosophy, the research approach, the research design, the model specification and the estimation method. The chapter justified every research technique that was employed in the study. Also, the source of data and the various indices the study used were discussed in the chapter.

CHAPTER FOUR

RESULTS AND DISCUSSION

Introduction

The primary purpose of this study is to investigate the effect of natural disasters on financial development and inclusive growth in Sub-Saharan Africa. This chapter presents and discusses the results of summary statistics the test of endogeneity for the critical variables of the study and the result on the analysis of the effect of natural disasters on financial development and the moderating role of the stage of development in Sub-Saharan Africa.

Descriptive statistics

The descriptive statistics of all variables used for the study on SSA are presented in Table 9. Nonetheless, the discussion is made on the main variables on which the study is undertaken. Specifically, a discussion is made on the number of observations, the mean, the standard deviation, and minimum and maximum values for each variable.

Table 9: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
FINDEVDEX	1050	0.131	0.105	0	0.643
FINSTDEX	1050	0.202	0.oter four	0	0.731
FMKTDEX	1050	.056	0.097	0	0.535
GROWTHDEX	1050	49.104	9.533	21.969	125.83
FLOOD	1050	0.066	0.207	0	1
DROUGHT	1050	0.049	0.187	0	1
STORM	1050	0.042	0.363	0	10.58
NDA	1050	0.067	0.206	0	1
CPI	1050	85.297	69.708	0	1344.193
GDPPC	1050	1321.898	1700.259	102.598	11208.344
RESERV	1050	19.535	14.928	1.756	125.716
RATE	900	20.194	24.18	.217	217.875
GCF	1050	22.282	9.306	-2.424	79.401
GFCE	1050	14.367	6.445	.911	43.484
OPN	1050	64.63	32.76	1.219	175.798
FDI	1050	2.974	4.947	-11.199	46.275
REM	1050	3.96	12.27	0	167.432
DEV	1050	0.371	0.595	0	2

Note: FINDEVDEX represents an index for overall financial development, FINSTDEX is an index for financial institution development, and FMKTDEX denotes an index for financial market development. GROWTHDEX is an index for inclusive growth. NDA represents the overall natural disaster index of flood, drought and storm. FLOOD is a lifeyears index of flood, DROUGHT is a lifeyears index drought, STORM a lifeyears index. CPI is consumer price index, GDPPC is real GDP per capita, RESERV requirement, RATE is lending rate, GCF is gross capital formation, GFCE is general government final consumption expenditures. OPN represents trade openness, FDI stands for foreign direct investment, and DEV is an indicator of the stage of development.

Source: Field data (2023)

From Table 9 above, the average overall financial development (FINDEVDEX) is 0.131, with a minimum of 0.00 and a maximum of 0.643. This indicates that although financial development is steadily progressing in SSA, it is still low. Similarly, the mean of financial institution development (FINSTDEX) was 0.202, between 0.00 and 0.731. Although the mean of financial institution development tends to be higher than that of overall financial development in SSA, it is still low to bring about significant changes in the sub-region. Also, the average financial market development (FMKTDEX) in SSA was 0.056, with a minimum of over 0.00 and a maximum of 0.535, which is also relatively weak. These low averages for the indicators of financial development in the sub-region confirm the observation of IMF (2016) that both financial institutions and financial markets in SSA are less developed than other developing regions in the world. Furthermore, even though SSA’s financial system comprises both financial institutions and financial markets, it observed that financial institutions tend to contribute more to the development of the financial sector than the financial market. This is in line with Tinta (2022), who reported that the high dominance of banks and other financial institutions characterises the financial system of SSA.

Moreover, the mean of GROWTHDEX, a composite indicator of inclusive growth based on selected variables from AfDB, was 49.104, within the range of 21.969 and 125.83. This reveals that the level of inclusive growth in Sub-Saharan Africa is low. This finding reflects the report of UNCTAD (2021) that inclusive growth in Africa is very low and that less than half of African economies have achieved inclusive growth.

Furthermore, the mean of overall natural disasters (NDA) consisting of flood, drought and storm was 0.067. The averages of the individual natural disasters, namely flood, drought, and storm, were 0.066, 0.049 and 0.042, respectively. It is observed that given the most prevalent and impactful natural disasters in SSA, floods tend to be the most prevalent, followed by drought and then storms. This confirms the reports of the CRED (2021) and WMO (2021).

Table 10: Correlation Matrix

Variables	FINDEVDEX	FINSTDEX	FMKTDEX	FLOOD	DROUGHT	STORM	NDA	lnGDPPC)	Lncpi	lnfindevdex	lngrowthdex	lnreserv	lnrate	lnopn	lnrem	lngcf	lngfce	lnfdi
FINDEVDEX	1.																	
FINSTDEX	0.943*	1.																
FMKTDEX	0.904*	0.709*	1															
FLOOD	0.042	0.047	0.029	1.														
DROUGHT	-0.007	0.020	-0.040	0.017	1													
STORM	-0.001	0.004	-0.009	-0.023	0.011	1												
NDA	-0.013	-0.002	-0.026	0.617*	0.441*	0.180*	1											
lnGDPPC	0.681*	0.652*	0.603*	0.038	-0.027	-0.014	0.024	1										
lncpi	0.139*	0.186*	0.056	0.044	0.009	0.032	0.046	0.214*	1									
lnfindevdex	0.870*	0.847*	0.753*	0.034	0.021	0.007	0.010	0.605*	0.211*	1								
lngrowthdex	-0.020	-0.089*	0.073*	-0.009	0.006	0.045	-0.027	-0.143*	-0.014	0.012	1							
lnreserv	-0.460*	-0.526*	-0.297*	-0.044	-0.020	0.050	-0.017	-0.113*	-0.024	-0.432*	0.015	1						
lnrate	-0.113*	-0.159*	-0.037	-0.093*	-0.019	0.044	-0.051	-0.148*	-0.284*	-0.155*	0.197*	0.281*	1					
lnopn	0.241*	0.246*	0.193*	0.015	0.015	0.027	0.056	0.357*	-0.051	0.253*	-0.137*	-0.180*	0.068*	1				
lnrem	-0.207*	-0.172*	-0.217*	-0.013	0.038	0.023	0.051	-0.111*	0.077*	-0.140*	0.066*	0.006	-0.243*	0.042	1			
lngcf	0.117*	0.109*	0.107*	0.045	0.045	0.020	0.059	0.248*	0.101*	0.195*	0.027	0.145*	-0.007	0.263*	0.011	1		
lngfce	0.264*	0.379*	0.070*	-0.007	0.078*	0.027	0.037	0.226*	0.101*	0.265*	-0.189*	-0.232*	-0.137*	0.313*	0.040	0.048	1	
lnfdi	0.056	0.048	0.057	0.076*	0.025	0.044	0.078*	0.239*	0.104*	0.082*	0.107*	0.056	0.118*	0.337*	0.121*	0.383*	-0.013	1

Note: FINDEVDEX represents the overall financial development index, FINSTDEX is the financial institution development index, and FKMTDEX is the financial market development index. FLOOD represents lifeyears index of flood, DROUGHT is lifeyears index for drought, STORM denotes lifeyears index for storm, NDA is aggregate lifeyears index for all flood, drought and storm. InGDPPC represents the log of real GDP per capita, Incpi represents the log of inflation, Infindevdex represents the log of financial development, and Ingrowthdex is the log of inclusive growth. Inreserv presents the log of reserve requirements. Inrate represents the log of lending rate, and Inopn denotes the log of trade openness. Inrem represents the log of remittances, Ingcf is the log of gross capital formation, Ingfce represents general government final consumption expenditure, and Infdi presents the log of foreign direct investment. * represents 10% level of significance.

Source: Field data (2023)

Table 10 above shows the pairwise correlation matrix of the variables employed in this study. As can be seen from Table 10, the overall financial development index (FINDEVDEX) shares a high pairwise correlation with the financial institution development index (FINSTDEX) and financial market development index (FMKTDEX). This does not indicate a multicollinearity problem, as these variables are not used in the same model as the overall financial development index. Adams (2015) explains that if the correlation coefficients of variables in a study are not greater than 0.90, there is no multicollinearity problem. As shown in the result of the pairwise correlation matrix in Table 10, there is no problem with the correlation matrix since the other variables employed in the study do not have a correlation coefficient of greater than 0.90.

Test of endogeneity of natural disasters

Drichoutis, Lazaridis and Nayga (2009) highlight that the endogeneity of variables should not be assumed but tested. To test for the endogeneity of natural disasters, it was treated as an endogenous variable in the selected models to ascertain whether their reporting is affected by unobserved factors to ensure that any possible biases in empirical estimations have been properly addressed. The determination of the endogeneity of the natural disasters as a variable begins with estimating the 2sls instrumental variable regression, shown in Table 19 below.

Table 11: 2sls Instrumental Variable Regression: Natural Disaster

Lnfindevdex	
Lnnda	-0.255***
	(0.0584)
Lngrowthdex	-0.131
	(0.215)
LnGDPPC	0.318***
	(0.0777)
Lncpi	-0.0278
	(0.0485)
Lnrate	-0.145**
	(0.0666)
Lnrem	0.0236
	(0.0247)
Lnopn	0.433***
	(0.156)
LOWR	0.133
	(0.147)
UPPR	0.232
	(0.291)
Constant	-6.376***
	(1.050)
Observations	483

Note: Infindevdex represents the log of overall financial development index, lnnda represents the log of aggregate lifeyears index for all flood, drought and storm. Ingrowthdex is the log of inclusive growth index, InGDPPC represents the log of real GDP per capita, Incpi represents the log of inflation. Inrate represents the log of lending rate, and Inopn denotes the log of trade openness. Inrem represents the log of remittances, LOWR and UPPR are dummy variables for lower-middle income and upper-middle income countries, respectively, *** represents a 1% significance level, and ** denotes a 5% significance level.

Source: Field data (2023)

As shown in Table 11, the log of natural disasters is truly endogenous to the model at a 10% significance level. Having established that natural disasters are endogenous to financial development; it is imperative to move to the next stage of investigating endogeneity bias by estimating the first-stage regression that reveals whether the instruments used were weak or relevant. The first stage regression is shown in Table 12 below.

Table 12: First-stage regression summary statistics: Natural Disasters

Variable	R-sq.	Adjusted R-sq.	Partial R-sq.	F(8,466)	Prob > F
Lnnda	0.1397	0.1102	0.0451	2.74937	0.0057

Note: lnnda represents the log of aggregate lifeyears index for all flood, drought and storm

Source: Field data (2023)

From Table 12 above, the p-value of the F-statistics is statistically significant at a 5% significance level. This implies that the null hypothesis that the instruments used are weak can be rejected. Hence, the instruments are relevant.

The estimation of the first stage regression is followed by the test of over-identifying restrictions, which seeks to investigate whether the instruments chosen were valid. The null hypothesis of this test is that the instruments are valid. Table13 below show displays the result of the test of over-identifying restrictions.

Table 13: Test of over-identifying restrictions: Natural Disasters

Sargan (score) chi2(7)	=	1.25958	(p=0.9895))
Basmann chi2(7)	=	1.21843	(p= 0.9905)

Source: Field data (2023)

As seen from Table 13 above, the probability values of the Sargan and Basmann tests were more significant than the 5% significance level. The null hypothesis of this test cannot, therefore, be rejected. Consequently, the instruments are valid.

The final stage in determining the endogeneity bias of variables is to perform the endogeneity test, whose null hypothesis is that the variables on which the test is carried are exogenous. Table 14 displays the result of the endogeneity test.

Table 14: Test of endogeneity: Natural Disasters

Durbin (score) chi2(1)	=	79.3334	(p=0.0000)
Wu-Hausman F(1,472)	=	92.763	(p=0.0000)

Source: Field data (2023)

The probability values of both the Durbin and Wu-Hausman tests are statistically significant at a 5% per cent significance level. Therefore, the null hypothesis of the test, the endogeneity, which states that natural disasters are exogenous, can be rejected. Natural disaster, therefore, suffers from endogeneity bias.

Effect of Natural Disasters on Financial Institution, Market and Overall Financial Development in SSA

This section is devoted to presenting and discussing results on the effect of natural disasters on financial development in SSA. The measures of financial development used are financial institution development, financial market development, and overall financial development. The section first discusses the test of endogeneity of financial development then results on the effects of floods, droughts, storms, and the aggregate of the three. Again, it presents results and discusses how the stage of development of countries moderates the relationship between natural disasters and financial institution development, financial market development, and overall financial development in SSA.

Furthermore, it is worth highlighting that the strength of this study rests on the use of the lifeyears index, a multidimensional measure that captures the effects of natural disasters and the use of the comprehensive measure of financial sector development, proving an in-depth understanding of the impact of natural disasters when compared with earlier studies that often employed narrower indicators, leading to this study's result being actionable and reliable.

Endogeneity test for financial development

The result of the 2SLS instrumental variable regression for determining whether financial development is an endogenous variable is shown in Table 15 below:

Table 15: 2SLS Instrumental Variable Regression: Financial Development Index

	(1) NDA
FINDEVDEX	-1.312* (0.680)
lnGDPPC	0.0319 (0.0277)
Lngcf	0.0148 (0.0165)
Lngfce	0.0253 (0.0205)
Lnrem	0.000874 (0.00539)
Lnopn	0.00952 (0.0146)
LOWR	0.0661** (0.0291)
UPPR	0.339* (0.175)
Lngrowthdex	0.0442 (0.0583)
Constant	-0.327 (0.341)
Observations	930

Note: FINDEVDEX represents overall financial development index, NDA is aggregate lifeyears index for all flood, drought and storm. InGDPPC represents the log of real GDP per capita, Inopn denotes the log of trade openness. Inrem represents the log of remittances, Ingcf is the log of gross capital formation, Ingfce represents general government final consumption expenditure, lngrowthdex represents log of inclusive growth index. LOWR and UPPR are dummy variables for lower-middle-income and upper-middle-income countries, respectively ***represents a 1% significance level, **represents a 5% significance level, *represents a 10% significance level.

Source: **Field data (2023)**

The 2sls instrumental variable regression result in Table 15 above shows that financial development is an endogenous regressor in the model at a 10% significance level. The next step after determining whether the independent variable is endogenous is to perform the first stage of instrumental variable regression to determine whether the choice of instruments for the 2SLS regression is relevant or otherwise. The null hypothesis of the first stage IV regression is that the instrument is weak. The outcome of the first stage IV regression is shown in Table 16 below:

Table 16: First-stage regression summary statistics: FINDEVDEX

Variable	R-sq.	Adjusted R-sq.	Partial R-sq.	F(5,916)	Prob > F
FINDEVDEX	0.7156	0.7116	0.0314	5.94544	0.0000

Note: FINDEVDEX represents the overall financial development index
Source: Field data (2023)

From Table 16, the probability value of the F-statistic shows is less than 5%, thus implying that the F-statistic is statistically significant at a 5% level of significance. Given this, the null hypothesis that instruments chosen for the 2sls estimation can be rejected. Hence, the instruments employed in the analysis are relevant and not weak

Further, it is required that the test for over-identifying restrictions is performed. The null hypothesis of this test is that the instruments are valid and uncorrelated with the error term. The result of this test is shown in Table 17 below:

Table 17: Test for over-identifying restrictions: FINDEVDEX

Sargan (score) chi2(4)	=	1.43061	(p=0.8389)
Basmann chi2(4)	=	1.41279	(p= 0.8420)

Source: Field data (2023)

It can be observed from Table 18 that the p-values of the Sargan and Basmann test are more significant than the 5% level of significance. This implies that the null hypothesis cannot be rejected. Therefore, the instruments are valid.

Moreover, a test of endogeneity is performed to determine whether financial development suffers from endogeneity bias. The null hypothesis is that the variables are exogenous. Table 18 below shows the result of the endogeneity test.

Table 18: Test of endogeneity: FINDEVDEX

Durbin (score) chi2(1)	=	5.13445	(p=0.0235)
Wu-Hausman F (1,920)	=	5.10744	(p=0.0241)

Source: Field data (2023)

The null hypothesis is rejected since the p-values of the Durbin and Wu-Hausman tests are less than the 5% significance level in Table 18. Thus, financial development is faced with endogeneity bias.

Regression results

According to Ullah, Akhtar, and Zaefarian (2018), for a GMM model to be suitable for interpretation, two post-estimation tests are needed: the Sargan test and the Arellano-Bond test for first-order and second-order correlation. The result of the Sargan test evaluates the validity and over-identification of instruments. It is expected that the null hypothesis, which states that the instruments are strong and valid, is not rejected at a 5% level of significance. The auto-correlation test with the null hypothesis that no autocorrelation is used to determine the suitability of an estimated model. Whereas it is expected that the first-order autocorrelation test [(AR (1)] should be statistically significant, the second-order autocorrelation test [AR (2)] should not be statistically significant at a 5% level of significance.

Effect of natural disasters on financial institutions, markets and overall financial development in SSA

The following sections will be devoted to the presentation and discussion of the result on the effect of natural disasters on financial institution development, first, financial market development, and then overall financial development.

Effect of natural disasters on financial institution development

Table 19 below presents the effect of natural disasters on financial institution development. There are four models in Table 19, namely, models 1b1, 1b2, 1b3, and 1b4, which capture the effects of flood, drought, storm, and aggregate natural disasters on financial institution development in SSA. The p-values for the Sargan test in all four models are more significant than 0.05, indicating that the null hypothesis cannot be rejected. Furthermore, the p-values in all models for the AR(1) test are less than 0.05, and those for the AR(2) test are greater than 0.05. These meet the expected requirement to conclude that there is no issue with autocorrelation in all four models. The models are, therefore, suitable and adequate for interpretation.

Table 19: Effect of natural disasters on financial institutions in SSA
Dependent Variable: Financial Institution Development

	Model 1b1	Model 1b2	Model 1b3	Model 1b4
L.FINSTDEX	0.861***	0.697***	0.961***	0.924***
	(0.027)	(0.048)	(0.033)	(0.042)
FLOOD	-0.020*			
	(0.011)			
DROUGHT		-0.087***		
		(0.018)		
STORM			-0.015***	
			(0.004)	
NDA				-0.038*
				(0.019)
Control				
lnGDPPC	0.018**	0.013**	-0.004	-0.008**
	(0.008)	(0.005)	(0.004)	(0.003)
Lnrem	-0.000	-0.003***	0.003***	0.006***
	(0.001)	(0.001)	(0.001)	(0.001)
Lnrate	0.006**	0.003	0.003	0.010
	(0.002)	(0.003)	(0.003)	(0.006)
Lnopn	0.001	0.007	0.013**	0.024*
	(0.008)	(0.006)	(0.006)	(0.014)
Lncpi	0.000	0.002***	0.000	0.001*
	(0.001)	(0.000)	(0.000)	(0.000)
Lnreserv	-0.020***	-0.012**	0.011**	-0.011
	(0.004)	(0.005)	(0.005)	(0.009)
LOWR	-0.025*	-0.002	0.011	0.015***
	(0.014)	(0.006)	(0.006)	(0.006)
UPPR	-0.021	0.048***	0.020**	0.051***
	(0.019)	(0.012)	(0.010)	(0.012)
Diagnostic				
Wald Chi2	873470.10	13322.76	10667.91	29455.66
P(Wald)	0.000	0.000	0.000	0.000
AR(1):z	-3.177	-3.827	-3.025	-3.106
P-values	0.001	0.000	0.002	0.002
AR(2)	0.866	-0.553	0.918	0.407
P-values	0.387	0.580	0.359	0.684
Sargan Chi2	13.147	14.742	12.227	20.584
Prob(Sargan)	0.591	0.544	0.662	0.195
No. of grps	30	30	30	30
No. of Inst	26	27	26	27
No. of Obs	865	865	865	865

Note: Standard errors are in parentheses. *, **, and *** represent 10%, 5%, and 1% significance levels, respectively. L.FINDEVDEX lag of overall financial development index, NDA is an indicator of aggregate natural disasters, FLOOD, DROUGHT, STORM denote flood, drought, storm as a sub-component of aggregate natural disasters. InGDPPC represents the log of real GDP per capita, Inrem represents the log of remittances, Inrate represents the log of lending rate, and Inopn denotes the log of trade openness. Incpi represents the log of inflation. Inreserv presents the log of reserve requirements. LOWR and UPPR are dummy variables for lower- and upper-middle-income countries.

Source: Field data (2023)

Model 1b1 indicates that a one-unit increase in life years lost due to floods results in a 0.020-unit decrease in financial institution development in SSA at a 10% level of statistical significance. This suggests that an increase in flooding frequency adversely impacts the effective functioning of financial institutions in Sub-Saharan Africa. The lifeyears index highlights not only the immediate impact of floods but also the long-term economic outcomes like displacement, mortality and a reduction in productivity which could undermine the proper functioning of SSA's financial sector (Kousky, 2014). Floods hamper access to financial services through the destruction of infrastructure belonging to financial institutions as there would be disruption in offering vital financial services to businesses and individuals. Moreover, the depth of financial institutions is also affected when floods occur as they limit the ability of their availability of a broad range of financial products. Also, the destructions associated with floods disrupt the operations of financial institutions and lead to a decline in their efficiency. Even though this finding is consistent with Brei et al. (2019) and Skidmore and Toya (2002), it extends their studies not just examining the contemporaneous effect of floods on financial institutions but also those that involve long-term effects like displacement, mortality, and economic loss, hence providing a comprehensive understanding of how environmental shocks bear upon financial development and resilience in a region beset with many challenges. Further, this finding aligns with the financial fragility theory which associates external shocks with the fragilities in the financial system.

Model 1 b2 reveals that a one-unit rise in lifeyears lost as a result of droughts results in a 0.087-unit decline in financial institution development at 1% level of statistical significance. This indicates the long-term economic droughts that cause, having implications of reduced agricultural productivity, and heightened food insecurity which result in widespread economic instability. Subsequently, financial institutions experience heightened default risks, particularly in agriculture-dependent countries, and may reduce credit availability or limit exposure to drought-prone areas. Further, droughts affect financial institutions by affecting household incomes, reducing investments and savings which ultimately, results in fewer bank deposits. This reflects the financial fragility theory as the occurrence of droughts exacerbates the vulnerabilities in the financial sector which impairs its ability to stimulate recovery. Eventually, droughts reduce incomes and productivity, subsequently limiting access to financial services and reducing the depth of the financial markets through a lower number of active clients; efficiency is lowered as financial institutions increasingly face higher default risks and the adoption of tighter lending practices. Although this finding corroborates of Özsoy, Rasteh, and Yonder (2020), this study offers a nuanced perspective investigating the effect of droughts on financial institutions in SSA employing a broader measure of financial development indicators, access, depth, and efficiency, instead of just bank performance. Moreover, it offers a more in-depth regional perspective, to facilitate a comprehensive understanding of how droughts affect financial institutions in diverse contexts.

Furthermore, model 1b3 shows that a one-unit surge in lifeyears lost as a result of storms leads to a 0.015-unit decline in financial institution development at a 1% level of significance. This is because storms can interrupt the operations of financial institutions through the destruction of vital assets and installations. These destructions negatively affect the operational capacity of the financial institutions. Further, the need to fix the damages can hurt their profits which could support their expansionary activities. Additionally, storms disrupt the operations of financial institutions in Sub-Saharan Africa through the destruction of physical infrastructure, which limits access to banking services and reduces the depth of financial involvement due to lower activity by customers, while efficiency decreases due to higher operational costs and a greater risk of defaults. This aligns with Xu (2020) and Born and Viscusi (2006) which examining storms impact the operations of financial institutions and the insurance sector, respectively, by investigating destruction to assets and increased insurance premiums. This however, employs an extensive approach examining the broader effect of storms on financial institutions, measured as access, depth, and efficiency, hence offering a more holistic insight into of storms impact financial institution development in SSA study. The findings reflect the financial fragility theory that storms exacerbate the fragilities in the financial sector.

Aside from the separate effect of floods, droughts, and storms on financial institution development, Model 1b4 reveals a similar trend where a unit increase in life lost to aggregate natural disasters causes a decline of 0.038 units in financial institution development, at a 10% significance level. This indicates an upsurge in natural disasters adversely financial institution development in SSA. This indicates a cumulative effect, which suggests that aggregate disasters adversely affect financial institutions' development in SSA.

Effect of natural disasters on financial market development in SSA

This section presents and discusses the effects of natural disasters on financial market development in SSA. It begins with discussing the model diagnostics and then the effect of floods, droughts, storms, and their composite on financial market development. As shown in Table 20, four models, 1c1, 1c2, 1c3, and 1c4, capture the respective effects of floods, droughts, storms, and aggregate natural disasters on financial market development. All the models pass the model diagnostic tests and are suitable for interpretation.

Table 20: Effect of natural disasters on the financial market in SSA
Dependent Variable: Financial Market Development

	Model 1c1	Model 1c2	Model 1c3	Model 1c4
L.FMKTDEX	1.027***	0.998***	1.030***	1.112***
	(0.022)	(0.024)	(0.015)	(0.027)
FLOOD	-0.022**			
	(0.008)			
DROUGHT		-0.039***		
		(0.011)		
STORM			-0.016***	
			(0.004)	
NDA				-0.030***
				(0.009)
Control				
lnGDPPC	-0.002	-0.007***	-0.000	-0.008***
	(0.002)	(0.003)	(0.002)	(0.002)
Lnrem	-0.003***	0.001	-0.004***	-0.001
	(0.000)	(0.001)	(0.000)	(0.001)
Lnrate	0.011**	0.007***	0.005**	-0.007***
	(0.005)	(0.002)	(0.002)	(0.002)
Lnreserv	-0.020***	-0.011***	-0.000	-0.006
	(0.002)	(0.004)	(0.002)	(0.004)
Lnopn	-0.007**	0.005	0.013***	0.002
	(0.003)	(0.006)	(0.003)	(0.005)
Lncpi	0.003***	0.002**	0.001*	0.001
	(0.001)	(0.001)	(0.000)	(0.001)
LOWR	0.008**	0.014***	0.007**	0.017***
	(0.004)	(0.005)	(0.003)	(0.004)
UPPR	-0.010	0.022**	-0.016***	-0.012
	(0.008)	(0.009)	(0.004)	(0.011)
Diagnostic				
Wald Chi2	39899.71	3599.41	26162.73	34589.18
P(Wald)	0.000	0.000	0.000	0.000
AR(1):z	-2.086	-2.139	-2.075	-2.122
P-values	0.037	0.032	0.038	0.034
AR(2)	1.623	1.605	1.580	1.630
P-values	0.105	0.109	0.114	0.103
Sargan Chi2	19.516	17.630	16.951	13.949
Prob(Sargan)	0.243	0.283	0.389	0.529
No of Grps	30	30	30	30
No. of Insts	27	26	27	26
No. of Obs	865	865	865	865

Note: Standard errors are in parentheses. *, **, and *** represent 10%, 5%, and 1% significance levels, respectively. L.FINDEVDEX lag of overall financial development index, NDA is an indicator of aggregate natural disasters, FLOOD, DROUGHT, STORM denote flood, drought, storm as a sub-component of aggregate natural disasters. InGDPPC represents the log of real GDP per capita, Inrem represents the log of remittances, Inrate represents the log of lending rate, and Inopn denotes the log of trade openness. Incpi represents the log of inflation. Inreserv presents the log of reserve requirements. LOWR and UPPR are dummy variables for lower-middle-income and upper-middle-income countries, respectively

Source: Field data (2023)

Model 1c1 depicts that a one-unit rise in lifeyears lost to flood leads to a decline of 0.022 units in financial market development in SSA at a 5% significance level. This decline in financial market development can be attributed to the rise in operational disruptions, widespread destruction of assets and the rise in operational cost that listed firms incur in the event of flooding which weakens their corporate performances, leading to a reduction in profit while heightening uncertainty. Floods impede financial market access through a decrease in investor participation because of heightened risk perception, dampen market depth by limiting the availability of investable financial assets, and reduce market efficiency through heightened operational disruptions and uncertainty, eventually inhibiting market capitalization and slower market growth. These results are consistent with Pan and Qiu's (2022) observations, which emphasize how natural disasters increase market risks and undermine investor trust, which results in lower market participation and slower market growth. Nonetheless, this study focuses on the components of financial market development, access, depth, and efficiency, in SSA with a composite index that provides a more detailed analysis of how floods influence these dimensions of market performance rather than generally looking at market risks and investor behavior.

Further, model 1c2 reveals that a one-unit rise in lifeyears lost to drought leads to a decline of 0.089 units in financial market development. Droughts have a negative impact on access, depth, and efficiency in SSA's financial markets by disrupting agricultural productivity, which in turn reduces income and investments, decreases market participation, lowers liquidity, and increases credit risk-all factors that impede the availability of credit, decrease market depth, and reduce the efficiency of financial markets in general. Further, this result could be probably caused by droughts' effects on agricultural output, especially reduction in food crop production, which lowers food availability and raises prices. This translates into increased food prices that dampen consumer demand, consequently affecting sectors reliant on discretionary spending, and decreasing business revenues, especially in agriculture and its related industries. As revenues and, consequently, earnings potential decrease, stock prices fall, eroding enterprises' market value. The erosion of confidence reduces investors' liquidity in the market, hence constraining the capacity of firms to mobilize funds through equity. This is in agreement with the findings of Cheng, Wang, and Wu (2022) and Sumaryati and Tristiarini (2017), who also show that financial markets are vulnerable to long-term economic disruptions emanating from natural hazards. This study narrows down to particular impacts on financial market development in Sub-Saharan Africa through access, depth, and efficiency with a composite index and thus provide comprehensive understanding.

In addition, from model 1a3, a unit increase in lifeyears lost to storms results in a decrease of 0.016 units at a 1% level of significance. Such a decrease can be due to the impact of storms on investor sentiment about future economic conditions for publicly traded companies. Normally, storms destroy property and disrupt supply chains thereby raising operational expenses. This eventually threatens the stability and financial performance of listed firms. Subsequently, investors may reassess the market value of equities on account of the heightened risk and reduced growth potential. The outcome will be that investors may not be willing to invest massively in equities, thus leading to a reduced volume of trades with a decreased market capitalization. These findings are consistent with the results of Benali and Feki (2017), which find that natural disasters have an adverse effect on investor behavior and market sentiment, eroding market confidence and liquidity.

In Model 1c4, the aggregate effect of all types of natural disasters on financial market development in SSA is statistically significant at the 1% level. A 1-unit increase in lifeyears lost due to natural disasters leads to a 0.030-unit decline in financial market development. This evidence shows that already small and underdeveloped financial markets in SSA are even more susceptible to the cumulative impact of natural disasters. The overall, negative effect reveals how repeated and widespread disasters erode investor confidence, disrupt economic activities, and increase risk perceptions across various sectors. The combined effect of asset destruction, operational disruptions, and diminished investor appetite for risk leads to lower market liquidity, reduced trading volumes, and weaker capital mobilization. This finding puts into focus the imperative of strong disaster mitigation frameworks, insurance schemes, and economic diversification that will increase the resilience of the market to protect financial development in the face of recurring natural disasters.

Effect of natural disasters on overall financial development

This section is devoted to presenting and discussing results on the impact of natural disasters on overall financial development. Four models, 1a1, 1a2, 1a3, and 1a4, are shown in Table 21 below, revealing the impact of floods, droughts, storms, and aggregate natural disasters on overall financial development in SSA. The results of the diagnostic tests shown in Table 21 show that all four models pass the diagnostic tests and are, therefore, suitable for interpretation.

Table 21: Effect of different types of natural disasters on overall financial development in SSA
Dependent Variable: Overall Financial Development

	Model 1a1	Model 1a2	Model 1a3	Model 1a4
L.FINDEVDEX	0.908***	0.833***	0.844***	0.777***
	(0.066)	(0.062)	(0.025)	(0.076)
FLOOD	-0.063***			
	(0.018)			
DROUGHT		-0.052*		
		(0.030)		
STORM			-0.007**	
			(0.004)	
NDA				-0.040*
				(0.022)
Control				
lnGDPPC	0.002	0.000	-0.003	-0.003
	(0.006)	(0.005)	(0.004)	(0.003)
Lnrem	-0.000	-0.006*	0.002*	0.003
	(0.001)	(0.003)	(0.001)	(0.002)
Lnrate	0.007**	0.004	0.005	0.007***
	(0.003)	(0.004)	(0.003)	(0.002)
Lnopn	0.019***	0.021**	0.017***	-0.001
	(0.007)	(0.009)	(0.004)	(0.009)
Lncpi	0.003***	0.002***	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Lnreserv	-0.012***	0.012	-0.019***	-0.020*
	(0.004)	(0.008)	(0.004)	(0.010)
LOWR	-0.023**	0.005	0.006	0.015**
	(0.009)	(0.004)	(0.010)	(0.007)
UPPR	0.020	0.036**	0.047***	0.069***
	(0.019)	(0.014)	(0.011)	(0.016)
Diagnostic				
Wald Chi2	12006.52	4325.60	365851.70	2679.17
P(Wald)	0.000	0.000	0.000	0.000
AR(1):z	-2.793	-3.171	-3.261	-3.034
P-values	0.005	0.002	0.001	0.002
AR(2)	1.497	1.164	1.501	1.180
P-values	0.134	0.244	0.133	0.238
Sargan Chi2	12.376	15.370	12.105	13.028
Prob(Sargan)	0.650	0.166	0.671	0.291
No. of grps	30	30	30	30
No. of Inst	26	22	26	22
No. of Obs	865	865	865	865

Note: Standard errors are in parentheses. *, **, and *** represent 10%, 5%, and 1% significance levels, respectively. L.FINDEVDEX lag of overall financial development index, NDA is an indicator of aggregate natural disasters, FLOOD, DROUGHT, STORM denote flood, drought, storm as a sub-component of aggregate natural disasters. InGDPPC represents the log of real GDP per capita, Inrem represents the log of remittances, Inrate represents the log of lending rate, and Inopn denotes the log of trade openness. Incpi represents the log of inflation. Inreserv presents the log of reserve requirements. LOWR and UPPR are dummy variables for lower-middle-income and upper-middle-income countries, respectively.

Source: Field data (2023)

Model 1a1 reveals that flood is negative and statistically significant at a 1% significance level and suggests that a unit increase in lifeyears lost to flood causes overall financial development to decline by 0.063 units. This represents the cumulative effect of floods on the population through mortality, injury, and economic displacement, disrupting major financial activities. Damage to physical infrastructure, loss of productivity, and increased costs to rebuild all diminish the capacity of financial institutions and markets to operate.

Similarly, model 1a3 reveals that drought is negative and statistically significant at a 10% significance level. This indicates that a unit rise in lifeyears lost to drought causes overall financial development to decline by 0.052 units. This can be attributed to the decrease in agricultural productivity that accompanies periods of drought with is attendant challenges such shortage of food, rising food prices and decreased economic activities. These impacts are aggravated by financial strain on agricultural lenders and more general market volatility, further weakening financial system stability.

Likewise, model 1a4 indicates that storms are negative and statistically significant at a 5% significance level. This highlights that a unit rise in lifeyears lost to storm causes a 0.007 unit decline in SSA's overall financial development. This is because usually storms cause extensive destruction to property and disrupt the operations of the business resulting in a high cost of operation, eroding investor confidence and disturbs economic activities. These factors reduce the capacity of markets and financial institutions to support growth and adversely affect the broader financial ecosystem.

Finally, model 1a4 shows the cumulative impact of all-natural disasters. The 0.040-unit decline in financial development for each 1-unit increase in life years lost due to these events is statistically significant at the 10% level. This overall measure points out the systemic vulnerability of SSA's financial system to large-scale disasters under consideration in the face of mortality, displacement, and economic disruption that seems to pose an extremely adverse impact on the financial institutions and markets.

Summary of Section

This section examined the relationship between natural disasters that are measured using the lifeyears index, and financial development in SSA taking into account three important dimensions, financial development institutions, financial development markets, and overall financial development. The results indicate that floods, droughts and storms, even in their aggregate, have adverse effects on all measures of financial development that the study adopted. Floods damage assets and infrastructure, resulting in operational disruptions that weaken the capacity of financial institutions to offer services and erode investors’ confidence in financial markets. Similarly, droughts decrease agricultural production, which affects market values and makes investors reluctant. Also, storms increase risk perception in the markets which lowers trading volumes and market capitalization. Cumulatively, natural disasters magnify financial instability across SSA's underdeveloped financial system. These findings are consistent with the financial fragility theory which posits that exogenous shocks, such as natural disasters exacerbate the instability in the financial system. This emphasizes how imperative it is to have robust natural disaster resilience and risk mitigation strategies to protect SSA’s financial system.

The moderating role of the stage of development on the relationship between natural disasters and financial development in SSA

This section relates to the second objective of this study, which seeks to ascertain whether the stage of development of countries in SSA moderates the relationship between natural disasters and financial development in the sub-region. This objective is informed by the third assumption of the Events System Theory (EST), which states that an entity's development stage moderates the effects that an exogenous shock can have.

This study alternated the stages of development (low-income, lower-middle-income, and upper-middle-income) as reference categories in the estimations. Using this approach the study ensures that the differential impact of natural disasters on financial development is robust across income groups. Following this approach, the likely biases are avoided and thus result in a comprehensive understanding of how each income level uniquely moderates the relationship between natural disasters and financial development in SSA, providing actionable insights for policymakers tailored to each stage of development. This rotation bolsters the reliability of the findings, addressing any limits in interpreting the impacts across various income groups.

The discussions begin with using the low-income category as a reference to examine whether being a lower-middle and upper-middle-income country affects the relationship between natural disasters and financial development. This is followed by using lower-middle income as a reference for low and upper-middle income. The final stage uses upper-middle income for low- and lower-middle-income countries. Moreover, the interaction term between natural disasters and the low-income group is denoted as LOW, between natural disasters and the lower-middle-income group is indicated as LOWER, and that of the upper-middle-income group is UPPER.

The moderating effect of stage of development on the relationship between natural disasters and financial institution development

This section discusses how being a lower-middle or upper-middle-income country influences the relationship between floods, droughts, storms, composite natural disasters, and financial institution development in SSA or not.

There are four models in Table 22, namely, 3b1, 3b2, 3b3, and 3b4, each showing the direct and moderation effects of floods, droughts, storms, and composite natural disasters on financial institution development in SSA. Table 22 shows that all four models pass the model diagnostic tests and are, therefore, suitable for interpretation.

Table 22: The moderating effect of the stage of development of the relationship between natural disasters and financial institutions in SSA-Lower Middle and Upper Middle Income

	Model 3b1	Model 3b2	Model 3b3	Model 3b4
L.FINSTDEX	0.698***	0.663***	0.794***	0.721***
	(0.055)	(0.071)	(0.047)	(0.056)
FLOOD	-0.185***			
	(0.049)			
DROUGHT		-0.144***		
		(0.044)		
STORM			-0.013***	
			(0.004)	
NDA				-0.095**
				(0.041)
Interaction				
LOWER	0.187**	0.169**	0.175***	0.176**
	(0.070)	(0.065)	(0.060)	(0.066)
UPPER	-0.180**	0.256*	-0.042	0.149***
	(0.072)	(0.149)	(0.162)	(0.039)
Control				
lnGDPPC	0.043***	0.011	-0.007	-0.035***
	(0.010)	(0.006)	(0.004)	(0.010)
Lnrem	0.005**	-0.003*	-0.005**	0.006*
	(0.002)	(0.001)	(0.002)	(0.003)
Lnrate	0.018***	0.008**	-0.010**	0.003
	(0.005)	(0.004)	(0.004)	(0.004)
Lnreserv	-0.095***	-0.007	-0.007	-0.035*
	(0.019)	(0.013)	(0.006)	(0.017)
Lnopn	0.011	0.012	0.008	0.040**
	(0.014)	(0.011)	(0.008)	(0.015)
Lncpi	0.006***	0.003**	0.003***	0.002***
	(0.001)	(0.001)	(0.001)	(0.000)
LOWR	-0.117***	-0.008	0.019***	0.080***
	(0.026)	(0.010)	(0.004)	(0.027)
UPPR	-0.042	0.047**	0.049***	0.154***
	(0.035)	(0.023)	(0.016)	(0.041)
Diagnostic				
Wald Chi2	3994.72	4019.13	4096.04	1.22e+06
P(Wald)	0.000	0.000	0.000	0.000
AR(1):z	-3.944	-3.620	-3.751	-3.311
P-values	0.000	0.000	0.000	0.001
AR(2):z	-0.817	-0.666	0.996	-1.060
P-values	0.414	0.505	0.319	0.289
Sargan Chi2	12.376	11.273	14.852	11.000
Prob(Sargan)	0.576	0.664	0.388	0.686
No. of Grps	30	30	30	30
No. of Insts	27	27	27	27
No. of Obs	865	865	865	865

Note: Standard errors are in parentheses. *, **, and *** represent 10%, 5%, and 1% significance levels, respectively. L.FINSTDEX lag of financial institution development index, NDA is an indicator of aggregate natural disasters, FLOOD, DROUGHT, STORM denote flood, drought, storm as a sub-component of aggregate natural disasters. InGDPPC represents the log of real GDP per capita, Inrem represents the log of remittances, Inrate represents the log of lending rate, and Inopn denotes the log of trade openness. Incpi represents the log of inflation. Inreserv presents the log of reserve requirements. LOWER is an interaction term between the dummy variable of lower-middle-income countries and natural disasters. UPPER is an interaction term between the dummy variable of upper-middle-income countries and natural disasters. LOWR and UPPR are dummy variables for lower- and upper-middle-income countries.

Source: Field data (2023

The result shown in Table 22 reveals that the introduction of the interaction terms between the stage of development and natural disasters in SSA remained the same negative relationship between natural disasters and financial institution development in SSA.

Considering the moderating role of the stage of development on the effect of flood on financial institution development under in Table 22, it can be seen that the interaction of the various types of natural disasters with the lower-middle income category denoted as LOWER is positive, statistically significant in all four models, 3b1,3b2, 3b3 and 3b4, at 5%, 5% 1% and 5% levels of significance respectively.

The results shown in Table 22 show the moderating role of the stage of development on the relationship between natural disasters and financial development in SSA in line with the Event Systems Theory. LOWER shows consistently positive moderation in all models (3b1-3b4), suggesting that lower-middle-income countries employ some adaptive strategies such as community engagement and disaster preparedness to help protect their financial institutions from the negative impacts of natural disasters. In contrast, the moderating role of UPPER shows mixed results: positive for some models (models 3b2 and 3b4), showing stronger frameworks in disaster response, but negative for model 3b1, meaning that besides their resource endowment, some vulnerabilities persist due to uneven disaster management or the lack of capacity to adjust efficiently. This again highlights the complexity of disaster impacts at different development stages and the need for tailored financial resilience strategies in SSA.

The moderating effect of stage of development on the relationship between natural disasters and financial market development

This section presents the results and discussion on how being a lower middle-income or upper-middle-income country moderates the relationship between the effect of the various on financial market development in SSA. There are models under Table 23, namely, 4c1, 4c2, 4c3, and 4c4, with each capturing the direct effects of floods, droughts, storms, and aggregate natural disasters of financial market development as well as their interaction with the respective stages of development. This section uses the low-income category to analyse how being a lower-middle and upper-middle-income country moderates the relationship between natural disasters and financial market development in SSA. As can be seen from Table 23, all post-estimation diagnostic tests meet the expected requirements.

Table 23: The moderating effect of the stage of development of the relationship between natural disasters and financial market development in SSA

Dependent Variable: Financial market development

	Model 4c1	Model 4c2	Model 4c3	Model 4c4
L.FMKTDEX	0.779***	0.827***	0.970***	0.996***
	(0.017)	(0.036)	(0.020)	(0.024)
FLOOD	-0.060**			
	(0.028)			
DROUGHT		-0.105*		
		(0.051)		
STORM			-0.009*	
			(0.004)	
NDA				-0.093***
				(0.033)
Interaction				
LOWER	0.094***	0.139*	0.042***	0.100***
	(0.031)	(0.074)	(0.010)	(0.035)
UPPER	-0.152***	0.118	-0.012	0.001
	(0.038)	(0.100)	(0.008)	(0.099)
Control				
lnGDPPC	-0.013***	-0.019***	-0.002	-0.006
	(0.003)	(0.004)	(0.002)	(0.004)
Lnrem	-0.002	0.001	-0.003**	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Lnrate	0.004	0.005	0.007	0.000
	(0.004)	(0.004)	(0.007)	(0.004)
Lnreserv	-0.031***	-0.015*	0.009***	-0.008**
	(0.005)	(0.008)	(0.003)	(0.003)
Lnopn	0.033***	0.029	0.024*	0.019***
	(0.012)	(0.017)	(0.013)	(0.006)
Lncpi	0.003***	0.003***	0.000	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)
LOWR	0.014	0.019*	-0.001	-0.006
	(0.009)	(0.009)	(0.006)	(0.008)
UPPR	0.084***	0.073***	0.003	0.003
	(0.011)	(0.015)	(0.008)	(0.014)
Diagnostic				
Wald Chi2	33177.60	149481.78	64052.15	66246.14
P(Wald)	0.000	0.000	0.000	0.000
AR(1):z	-2.498	-2.485	-2.067	-2.559
P-Values	0.012	0.013	0.039	0.010
AR(2):z	1.608	1.502	1.620	1.601
P-values	0.108	0.133	0.105	0.109
Sargan Chi2	14.225	11.117	10.803	11.009
Prob (Sargan)	0.358	0.601	0.627	0.610
No. of Grps	30	30	30	30
No. of Insts	26	26	26	26
No. of Obs	865	865	865	865

Note: Standard errors are in parentheses. *, **, and *** represent 10%, 5%, and 1% significance levels, respectively. L.FMKTDEX lag of financial market development index, NDA is an indicator of aggregate natural disasters, FLOOD, DROUGHT, STORM denote flood, drought, storm as a sub-component of aggregate natural disasters. InGDPPC represents the log of real GDP per capita, Inrem represents the log of remittances, Inrate represents the log of lending rate, and Inopn denotes the log of trade openness. Incpi represents the log of inflation. Inreserv presents the log of reserve requirements. LOWER is an interaction term between the dummy variable of lower-middle-income countries and natural disasters. UPPER is an interaction term between the dummy variable of upper-middle-income countries and natural disasters. LOWR and UPPR are dummy variables for lower-middle-income and upper-middle-income countries, respectively.

Source: Field data (2023)

From Table 23, the introduction of the interaction terms did not change the negative effect of natural disasters on financial market development in SSA.

The introduction of the interaction term increased the coefficients of flood, drought, and composite natural disasters, emphasising that the stage of development significantly influences financial market development. On the other hand, the effect size for storms is reduced, signifying that a country's development stage has a marginal effect

From Table 23, LOWER shows a consistently positive and significant moderating effect across all models (4c1-4c4), implying that lower-middle-income economies do possess some form of mechanisms of adaptation that make their financial markets more resilient to natural disasters. This seems to suggest some level of financial market stability in lower-middle-income countries. On the contrary, UPPER reveals mixed moderating effects across the models. For instance, the moderation effect under Model 4c1 is negative suggesting that even for these countries with higher levels of income, rigid financial market structures or lack of uniform approach in their disaster response strategies could make them vulnerable. In models 4c3 and 4c4, the moderation effect is statistically insignificant. Such variation might arise from unequal resource endowments or institutional capacity across regions

The moderating effect of stage of development on the relationship between natural disasters and overall financial development in SSA

This section presents and discusses the results of how lower-middle and upper-middle-income countries moderate the relationship between natural disasters and overall financial development in SSA. Table 24, having four models, namely, 4a1,4a2,4a3, and 4a4, presents the results on how the stage of development moderates the relationship between natural disasters and overall financial development in SSA. Also, the results of the post-estimation tests for all four models show that they pass the model adequacy test for interpretation.

Table 24: Moderating effect of stage of development of the relationship between natural disasters and financial development in SSA

Dependent Variable: Overall Financial development

	Model 4a1	Model 4a2	Model 4a3	Model 4a3
L.FINDEVDEX	0.833***	0.866***	0.910***	0.938***
	(0.053)	(0.040)	(0.063)	(0.022)
FLOOD	-0.046*			
	(0.024)			
DROUGHT		-0.078**		
		(0.031)		
STORM			-0.004*	
			(0.002)	
NDA				-0.044*
				(0.026)
Interaction				
LOWER	0.097**	0.085**	-0.018	0.159***
	(0.044)	(0.039)	(0.048)	(0.049)
UPPER	-0.169***	0.063	0.050***	-0.036
	(0.041)	(0.069)	(0.014)	(0.062)
Control				
lnGDPPC	0.005	-0.003	0.008	0.001
	(0.004)	(0.003)	(0.005)	(0.012)
Lnrem	-0.003	-0.003*	-0.005***	0.002
	(0.002)	(0.002)	(0.001)	(0.002)
Lnrate	0.016***	0.007**	-0.016*	0.008***
	(0.005)	(0.003)	(0.009)	(0.002)
Lnreserv	0.004	-0.002	0.015***	-0.025**
	(0.005)	(0.003)	(0.002)	(0.009)
Lnopn	0.024*	0.028***	0.030***	0.011*
	(0.012)	(0.005)	(0.003)	(0.006)
Lncpi	0.002	0.002**	-0.001	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)
LOWR	-0.005	-0.004	-0.014	-0.036
	(0.006)	(0.005)	(0.010)	(0.039)
UPPR	0.046**	0.029**	-0.012	0.007
	(0.019)	(0.011)	(0.020)	(0.043)
Diagnostic				
Wald Chi2	11922.51	11728.37	208679.20	2.46e+08
P(Wald)	0.000	0.000	0.000	0.000
AR(1):z	-2.957	-3.635	-3.009	-3.447
P-values	0.003	0.000	0.003	0.001
AR(2):z	1.204	0.910	1.516	1.035
P-Values	0.229	0.363	0.129	0.301
Sargan Chi2	11.646	13.519	15.259	13.010
Prob (Sargan)	0.557	0.486	0.291	0.162
No. of Grps	30	30	30	30
No. of Inst	26	27	26	22
No. of Obs	865	865	865	865

Note: Standard errors are in parentheses. *, **, and *** represent 10%, 5%, and 1% significance levels, respectively. L.FINDEVDEX lag of overall financial development index, NDA is an indicator of aggregate natural disasters, FLOOD, DROUGHT, STORM denote flood, drought, storm as a sub-component of aggregate natural disasters. InGDPPC represents the log of real GDP per capita, Inrem represents the log of remittances, Inrate represents the log of lending rate, and Inopn denotes the log of trade openness. Incpi represents the log of inflation. Inreserv presents the log of reserve requirements. LOWER is an interaction term between the dummy variable of lower-middle-income countries and natural disasters. UPPER is an interaction term between the dummy variable of upper-middle-income countries and natural disasters. LOWR and UPPR are dummy variables for lower- and upper-middle-income countries.

Source: Field data (2023)

In Table 24, LOWER demonstrates a significant positive moderating effect on the relationship between natural disasters and overall financial development in SSA in most models. This indicates that lower-middle-income countries have strategies that bolster their financial system's resilience to natural disasters. Conversely, the UPPER shows mixed. For example, the moderating role was negative in model 4a1, insignificant in models 4a2 and 4c4 but positive in model 4a3. These results signify a higher sensitivity of higher-middle-income countries to natural disasters despite their economic status indicating an uneven preparedness for natural disasters and financial robustness across these countries

The moderating roles of low-income and upper-middle-income countries on the relationship between natural disasters in financial development in SSA

In this section, the lower-middle-income country category is used to help analyse how being a low-income or upper-middle-income country influences the relationship between natural disasters and financial development.

Further, three tables, Table 25-27, each containing four models, are presented and discussed. Table 25 shows results regarding financial institution development; Table 26 shows results regarding financial market development, and Table 27 shows results regarding the overall financial effect of SSA. The interaction terms in this section are denoted as LOW and UPPER. LOW is an interaction of the specific natural disaster in the respective column and the dummy variable for being a lower middle-income country in SSA. Similarly, UPPER represents the interaction between a particular natural disaster in the relevant column and the dummy variable for being an upper-middle-income country in SSA.

The moderating role of low-income and upper-middle-income countries on the relationship between natural disasters and financial institution development in SSA

Table 25 below presents the results of the analysis of how low- and upper-middle-income countries moderate the relationship between natural disasters and financial institutions in development in SSA. Four models, 1,2, 3, and 4, concerning floods, droughts, storms, and aggregate natural disasters, are presented in Table 25. The post-estimation test results show that all four models are adequate for interpretation

Table 25: Moderating effect of stage of Development, Natural Disaster and Financial Institution Development

Dependent Variable: Financial Institution Development

	1	2	3	4
L.FINSTDEX	0.903***	1.030***	0.920***	1.054***
	(0.057)	(0.036)	(0.035)	(0.045)
FLOOD	-0.090**			
	(0.035)			
DROUGHT		-0.084***		
		(0.022)		
STORM			-0.076**	
			(0.029)	
NDA				-0.078**
				(0.033)
Interaction				
LOW	0.133***	0.154***	0.079**	0.111**
	(0.048)	(0.043)	(0.029)	(0.044)
UPPER	-0.084	0.151	-0.048	-0.034
	(0.118)	(0.140)	(0.083)	(0.249)
Controls				
lnGDPPC	0.008***	0.007*	-0.003	0.001
	(0.002)	(0.003)	(0.003)	(0.003)
Lnrem	-0.006***	-0.000	0.004***	0.001
	(0.002)	(0.001)	(0.001)	(0.001)
Lnrate	0.000	0.005*	0.009***	0.005*
	(0.003)	(0.003)	(0.003)	(0.003)
Lnreserv	-0.034***	-0.007	-0.009**	-0.012
	(0.009)	(0.004)	(0.004)	(0.008)
Lnopn	0.028***	0.009**	0.016**	0.023***
	(0.008)	(0.004)	(0.006)	(0.005)
Lncpi	-0.000	-0.001***	0.000	-0.001***
	(0.001)	(0.000)	(0.000)	(0.000)
LOWR	-0.010*	0.004	-0.009	-0.007
	(0.006)	(0.006)	(0.006)	(0.008)
UPPR	0.005	-0.021*	0.034***	-0.017
	(0.015)	(0.011)	(0.011)	(0.014)
Diagnostics				
Wald Chi2	10649.52	46621.01	77395.71	33065.62
P(Wald)	0.000	0.000	0.000	0.000
AR(1):z	-3.557	-3.473	-3.224	-3.362
P-value	0.000	0.001	0.001	0.001
AR(2):z	0.905	1.491	0.587	0.769
P-value	0.365	0.136	0.557	0.442
Sargan Chi2	11.876	18.963	16.255	17.661
Prob (Sargan)	0.538	0.124	0.236	0.171
Number of Grps	30	30	30	30
Number of Inst	26	26	26	26
Number of Obs	865	865	865	865

Note: Standard errors are in parentheses. *, **, and *** represent 10%, 5%, and 1% significance levels, respectively. L.FINSTDEX lag of financial institution development index, NDA is an indicator of aggregate natural disasters, FLOOD, DROUGHT, STORM denote flood, drought, storm as a sub-component of aggregate natural disasters. InGDPPC represents the log of real GDP per capita, Inrem represents the log of remittances, Inrate represents the log of lending rate, and Inopn denotes the log of trade openness. Incpi represents the log of inflation. Inreserv presents the log of reserve requirements. LOW is an interaction term between the dummy variable of low-income countries and natural disasters. UPPER is an interaction term between the dummy variable of upper-middle-income countries and natural disasters. LOWR and UPPR are dummy variables for lower-middle-income and upper-middle-income countries, respectively

Source: Field data (2023)

Table 25 shows that the interaction terms did not change the natural relationship between the different natural disasters and financial institution development; natural disasters negatively affect financial institution development in SSA.

The results shown in Table 25, depict that LOW demonstrates a consistently positive moderating effect in all models implying that low-income countries may have financial systems which are more resilient or adaptive strategies to mitigate the impacts of natural disasters. UPPER, on the other hand, exhibits a statistically insignificant moderation effect across all models.

The moderating role of low-income and upper-middle-income countries on the relationship between natural disasters and financial market development in SSA

This section discusses how being a low or upper-middle-income country in SSA moderates the relationship between natural disasters and financial market development. The results of the empirical analysis are shown in Table 30 below, which has four models, namely models 5, 6, 7, and 8, covering the analysis of floods, drought, storms and composite natural disasters as well as their respective interaction terms, respectively. All the models pass the requirement model diagnostic tests; hence, the results can be interpreted.

Table 26: Moderating effect of stage of Development, Natural Disaster and Financial Market Development and Upper Middle Income
Dependent variable: Financial Market Development

	5	6	7	8
L.FMKTDEX	0.678***	0.673***	0.719***	0.863***
	(0.044)	(0.060)	(0.032)	(0.044)
FLOOD	-0.053**			
	(0.021)			
DROUGHT		-0.078**		
		(0.036)		
STORM			-0.042**	
			(0.018)	
NDA				-0.032*
				(0.018)
Interaction				
LOW	0.031	0.066*	0.044***	0.041*
	(0.024)	(0.036)	(0.015)	(0.021)
UPPER	0.125***	0.065	-0.230**	-0.016
	(0.036)	(0.171)	(0.096)	(0.051)
Controls				
lnGDPPC	0.003	0.002	0.006*	0.002
	(0.004)	(0.005)	(0.003)	(0.003)
Lnrem	-0.008***	-0.009***	-0.007***	-0.003***
	(0.001)	(0.002)	(0.002)	(0.001)
Lnrate	0.010**	0.012**	0.009***	0.010
	(0.004)	(0.004)	(0.002)	(0.008)
Lnreserv	-0.008*	-0.011*	-0.005	-0.022***
	(0.005)	(0.006)	(0.004)	(0.004)
Lnopn	0.001	0.007	0.008*	-0.011***
	(0.004)	(0.007)	(0.004)	(0.004)
Lncpi	0.001	0.002	-0.001	0.001
	(0.001)	(0.002)	(0.001)	(0.001)
LOWR	-0.004	-0.010	-0.000	-0.004
	(0.008)	(0.010)	(0.004)	(0.005)
UPPR	0.061***	0.072***	0.054***	0.039***
Diagnostics				
Wald Chi2	1453.59	785.26	2315.77	5106.40
P-Value	0.000	0.000	0.000	0.000
AR(1):z	-2.069	-2.230	-2.276	-2.135
P-Value	0.039	0.026	0.023	0.033
AR(2)	1.382	1.522	1.552	1.515
P-Value	0.167	0.128	0.121	0.130
Sargan Chi2	16.945	12.446	14.728	13.020
Prob (Sargan)	0.202	0.491	0.325	0.446
Number of Grps	30	30	30	30
Number of Inst	26	26	26	26
Number of Obs	865	865	865	865

Note: Standard errors are in parentheses. *, **, and *** represent 10%, 5%, and 1% significance levels, respectively. L.FMKTDEX lag of financial market development index, NDA is an indicator of aggregate natural disasters, FLOOD, DROUGHT, STORM denote flood, drought, storm as a sub-component of aggregate natural disasters. InGDPPC represents the log of real GDP per capita, Inrem represents the log of remittances, Inrate represents the log of lending rate, and Inopn denotes the log of trade openness. Incpi represents the log of inflation. Inreserv presents the log of reserve requirement. LOW is an interaction term between the dummy variable of low-income countries and natural disasters. UPPER is an interaction term between the dummy variable of upper-middle-income countries and natural disasters. LOWR and UPPR are dummy variables for lower-middle-income and upper-middle-income countries, respectively.

Source: Field data (2023)

From Table 26, it can be observed that the introduction of the interaction terms for the four models did not alter the effect that the different natural disasters, as well as their composite natural, have on financial market development; there is still a negative effect.

From Table 26, the results show that LOW exhibits a moderate positive relationship between natural disasters and financial market development in most models, except in model 5. This implies that despite economic limitations, low-income countries may have certain mitigating strategies in their financial markets, even though they may not be as robust as those in higher-income nations. For UPPER the moderation effect is complex. While Model 5 depicts a positive and statistically significant moderation effect, the effect is insignificant in Models 6 and 8 but negative in Model 7 suggesting that even though upper-middle-income countries may appear resilient initially, the ability of their financial markets to adapt to natural disasters may diminish as a result several factors such as market structures and institutional weaknesses.

The moderating role of low and upper-middle-income countries on the relationship between natural disasters and overall financial development in SSA

This section presents the results and discusses how being in a low-income or an upper-middle-income country moderates the relationship between natural disasters and overall financial development in SSA. Table 27 comprises four models: 9, 10, 11 and 12. These columns present results concerning floods, droughts, storms, and composite natural disasters. All four models passed the post-estimation diagnostic tests and are suitable to interpret.

Table 27: The moderating role of low and upper-middle-income countries on the relationship between natural disasters and overall financial development in SSA

	9	10	11	12
L.FINDEVDEX	0.850***	0.897***	0.950***	0.898***
	(0.109)	(0.028)	(0.031)	(0.045)
FLOOD	-0.142***			
	(0.036)			
DROUGHT		-0.100***		
		(0.033)		
STORM			-0.076***	
			(0.027)	
NDA				-0.038***
				(0.012)
Interaction				
LOW	0.202***	0.094**	0.074**	0.063***
	(0.060)	(0.037)	(0.027)	(0.022)
UPPER	0.180***	-0.168	-0.057	0.032
	(0.061)	(0.119)	(0.073)	(0.056)
Diagnostics				
lnGDPPC	0.001	-0.008***	-0.009***	0.005**
	(0.007)	(0.003)	(0.002)	(0.002)
Lnrem	-0.005**	0.002***	0.003**	-0.002**
	(0.002)	(0.001)	(0.001)	(0.001)
Lnrate	-0.015*	0.005***	0.007***	-0.003
	(0.008)	(0.001)	(0.002)	(0.003)
Lnreserv	-0.007	-0.001	-0.001	-0.019***
	(0.015)	(0.003)	(0.003)	(0.006)
Lnopn	0.024**	0.013***	0.013**	0.010**
	(0.011)	(0.004)	(0.006)	(0.005)
Lncpi	-0.002*	0.000***	0.001**	-0.001***
	(0.001)	(0.000)	(0.000)	(0.000)
LOWR	-0.029	-0.024***	-0.019***	-0.005
	(0.020)	(0.008)	(0.006)	(0.006)
UPPR	-0.008	0.050***	0.034***	0.005
	(0.028)	(0.010)	(0.008)	(0.014)
Diagnostics				
Wald Chi2	3252.77	32653.14	48340.24	45721.42
P(Wald)	0.000	0.000	0.000	0.000
AR(1):z	-3.633	-4.401	-3.278	-3.223
P-Value	0.000	0.000	0.001	0.001
AR(2):z	1.300	0.970	1.559	1.380
P-Value	0.194	0.332	0.119	0.168
Sargan Chi2	19.255	17.743	16.743	19.365
Prob(Sargan)	0.115	0.168	0.211	0.112
No. of Grps	30	30	30	30
No. of Inst.	26	26	26	26
No. of Obs.	865	865	865	865

Note: Standard errors are in parentheses. *, **, and *** represent 10%, 5%, and 1% significance levels, respectively. L.FINDEVDEX lag of overall financial development index, NDA is an indicator of aggregate natural disasters, FLOOD, DROUGHT, STORM denote flood, drought, storm as a sub-component of aggregate natural disasters. InGDPPC represents the log of real GDP per capita, Inrem represents the log of remittances, Inrate represents the log of lending rate, and Inopn denotes the log of trade openness. Incpi represents the log of inflation. Inreserv presents the log of reserve requirement. LOW is an interaction term between the dummy variable of low-income countries and natural disasters. UPPER is an interaction term between the dummy variable of upper-middle-income countries and natural disasters. LOWR and UPPR are dummy variables for lower-middle-income and upper-middle-income countries, respectively.

Source: Field data (2023)

Table 27 shows that LOW is positive and statistically significant in all models (9-12) indicating that the overall financial development in low-income countries is resilient to natural disasters. In the case of UPPER, that is, upper-middle-income countries, mixed moderation results are found. For example, whereas in model 9, the interaction term is positive, it is negative and statistically insignificant in the remaining models (10-12), signalling less resilience or differences in vulnerability to natural disasters. These findings highlight how the relationship between financial development and natural disasters varies with the stage of development, with lower-income countries being more responsive.

The moderating roles of low and lower-middle-income countries on the relationship between natural disasters in financial development in SSA

This section presents and discusses how being a low or lower-middle-income country moderates the relationship between natural disasters and financial development in SSA. Three tables, Table 28-30, have four columns where the results of each disaster are presented in this section. Also, the interaction between each type of natural disaster and the dummy for low-income countries is denoted by LOW. Similarly, the interaction between each natural disaster type and the dummy for lower-middle-income countries is represented by LOWER. Based on the results of the post-estimation test, all the models are adequate for interpretation.

The moderating role of low and low-middle-income countries on the relationship between natural disasters and financial institution development in SSA

Table 28 below displays the result of the moderating role of low- and lower-middle-income countries on the relationship between the different natural disaster types and financial institution development in SSA. Four models, 13, 14, 15 and 16, represent each respective model relating to floods, drought, storms and overall natural disasters and how they influence financial institution development in SSA.

Table 28: The moderating role of low and lower-middle-income countries on the relationship between natural disasters and Financial Institution Development in SSA

	13	14	15	16
L.FINSTDEX	0.698***	0.891***	0.845***	1.033***
	(0.055)	(0.032)	(0.033)	(0.024)
FLOOD	-0.366***			
	(0.083)			
DROUGHT		-0.228**		
		(0.104)		
STORM			-0.359***	
			(0.112)	
NDA				-0.107***
				(0.011)
Interaction				
LOW	0.180**	0.236*	0.364***	0.126*
	(0.072)	(0.119)	(0.113)	(0.065)
LOWER	0.367***	0.160	0.311**	0.026
	(0.089)	(0.104)	(0.116)	(0.033)
			-0.054	
Controls				
lnGDPPC	0.043***	0.006*	0.014	0.019***
	(0.010)	(0.003)	(0.008)	(0.007)
Lnrem	0.005**	-0.002*	-0.002	0.001
	(0.002)	(0.001)	(0.002)	(0.002)
Lnrate	0.018***	0.006*	0.004*	0.014***
	(0.005)	(0.003)	(0.002)	(0.005)
Lnreserv	-0.095***	-0.010**	-0.011**	-0.014**
	(0.019)	(0.004)	(0.004)	(0.006)
Lnopn	0.011	-0.004	0.011*	0.004
	(0.014)	(0.008)	(0.005)	(0.010)
Lncpi	0.006***	-0.001	-0.001	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)
LOWR	0.042	-0.056***	-0.024	0.058**
	(0.035)	(0.017)	(0.016)	(0.027)
UPPR	-0.075***	-0.050***	-0.030***	0.011
	(0.024)	(0.011)	(0.009)	(0.013)
Diagnostics				
Wald Chi2	3994.72	31920.13	19858.69	161994.00
P(Wald)	0.000	0.000	0.000	0.000
AR(1):z	-3.944	-3.325	-3.957	-3.434
P-Value	0.000	0.001	0.000	0.001
AR(2):z	-0.817	0.937	0.595	0.517
P-Value	0.414	0.349	0.552	0.605
Sargan Chi2	12.376	11.773	13.685	17.830
Prob (Sargan)	0.576	0.546	0.396	0.164
Number of groups	30	30	30	30
No of Inst	27	26	26	26
No of Obs	865	865	865	865

Note: Standard errors are in parentheses. *, **, and *** represent 10%, 5%, and 1% significance levels, respectively. L.FINSTDEX lag of financial institution development index, NDA is an indicator of aggregate natural disasters, FLOOD, DROUGHT, STORM denote flood, drought, storm as a sub-component of aggregate natural disasters. InGDPPC represents the log of real GDP per capita, Inrem represents the log of remittances, Inrate represents the log of lending rate, and Inopn denotes the log of trade openness. Incpi represents the log of inflation. Inreserv presents the log of reserve requirement. LOW is an interaction term between the dummy variable of low-income countries and natural disasters. LOWER is an interaction term between the dummy variable of lower-middle-income countries and natural disasters. LOWR and UPPR are dummy variables for lower-middle-income and upper-middle-income countries, respectively

Source: Field data (2023)

The result from Table 28 shows that LOW exhibits positive moderation across all models signifying that despite their inadequate resource endowment, in low-income countries, their financial institutions are resilient to the impact of all forms of natural disasters. This could be attributed to these economies adopting informal strategies such as adaptive financial mechanisms and community-based recovery. The moderation effect for LOWER, though positive is less consistent across the models suggesting that in lower-middle-income countries, moderate resilience is exhibited. This implies that while some strategies are effective in dealing with natural disasters, they are less robust or uniformly applied.

The moderating role of low and low-middle-income countries on the relationship between natural disasters and financial market development in SSA

This section presents and discusses results concerning the moderation role of low-income and lower-middle income on the relationship between natural disasters and financial market development in SSA. Four models are captured under columns 17, 18, 19 and 20 in Table 29. Each column presents the results of floods, droughts, storms and composite natural disasters. The interaction between each disaster and the dummy for low-income countries is denoted by LOW. Also, the interaction between each disaster and the dummy for lower-middle-income countries is indicated as LOWER. Additionally, it is worth mentioning that the interaction terms did not change the natural relationship between natural disasters and financial market development in SSA.

Table 29: The moderating role of low and lower-middle-income countries on the relationship between natural disasters and overall Financial Market Development

	17	18	19	20
L.FMKTDEX	0.895***	0.832***	0.954***	0.994***
	(0.033)	(0.066)	(0.030)	(0.011)
FLOOD	-0.210***			
	(0.027)			
DROUGHT		-0.107**		
		(0.041)		
STORM			-0.057***	
			(0.011)	
NDA				-0.039***
				(0.005)
Interaction				
LOW	0.224***	0.145***	0.046***	0.044***
	(0.038)	(0.052)	(0.007)	(0.015)
LOWER	0.233***	0.008	0.141***	0.052***
	(0.040)	(0.054)	(0.014)	(0.015)
Controls				
lnGDPPC	-0.009**	0.003	-0.001	-0.005
	(0.004)	(0.005)	(0.003)	(0.004)
Lnrem	-0.005**	-0.003*	0.002***	-0.003*
	(0.002)	(0.002)	(0.000)	(0.001)
Lnrate	0.014*	0.013*	0.003	-0.006**
	(0.007)	(0.006)	(0.004)	(0.002)
Lnreserv	0.004	-0.013***	0.002	0.008
	(0.004)	(0.003)	(0.007)	(0.005)
Lnopn	0.031***	0.000	0.010***	0.037***
	(0.010)	(0.005)	(0.003)	(0.006)
Lncpi	0.000	-0.000	0.001	0.001**
	(0.001)	(0.001)	(0.001)	(0.000)
LOWR	-0.084***	-0.055***	0.027*	0.009
	(0.013)	(0.016)	(0.014)	(0.012)
UPPR	-0.062***	-0.034***	0.024**	-0.002
	(0.012)	(0.009)	(0.010)	(0.005)
Diagnostic				
Wald Chi	2297.22	17863.01	151371.20	566326.71
P-value	0.000	0.000	0.000	0.000
AR(1):z	-2.170	-2.378	-2.150	-2.069
P-Value	0.030	0.017	0.032	0.039
AR(2):z	1.558	1.450	1.558	1.591
P-Value	0.119	0.147	0.119	0.112
Sargan Chi2	9.934	10.575	12.768	15.299
Prob (Sargan)	0.699	0.646	0.466	0.289
No. of Grps	30	30	30	30
No. of Inst.	26	26	26	26
No. of Obs	865	865	865	865

L.FMKTDEX lag of financial market development index, NDA is an indicator of aggregate natural disasters, FLOOD, DROUGHT, STORM denote flood, drought, storm as a sub-component of aggregate natural disasters. InGDPPC represents the log of real GDP per capita, Inrem represents the log of remittances, Inrate represents the log of lending rate, and Inopn denotes the log of trade openness. Incpi represents the log of inflation. Inreserv presents the log of reserve requirement. LOW is an interaction term between the dummy variable of low-income countries and natural disasters. LOWER is an interaction term between the dummy variable of lower-middle-income countries and natural disasters. LOWR and UPPR are dummy variables for lower-middle-income and upper-middle-income countries, respectively.

Source: Field data (2023)

The results in Table 29, reveal that the stage of development plays a significant moderating role on the relationship between natural disasters and financial market development in SSA. LOW shows a positive and statistically significant moderation effect across all models (17-20). This indicates that even though low-income suffer significantly from the impact of natural disasters, they also pose some adaptive strategies that mitigate the adverse effect of natural disasters on their financial markets.

In contrast, the moderation effects of LOWER are mixed. For instance, whereas, a positive moderation effect is observed under models 17,19 and 20, the moderation effect under model 18 is statistically insignificant. This suggests that lower-middle-income countries have a developing but relatively weak capacity to resist financial shocks emanating from disasters. Their respective financial systems may not be as well endowed with appropriate resilience mechanisms or policy frameworks necessary to absorb and recover from economic disruptions caused by disasters of natural origin. Therefore, targeted interventions and support for building the stability of financial markets in disaster-prone environments might become necessary.

The moderating role of low and low-middle-income countries on the relationship between natural disasters and overall financial development in SSA

This section presents, discusses and compares how being a low or lower-middle-income country moderates the relationship between floods, drought, storm and their aggregate on overall financial development in SSA. The result of the empirical analysis is shown in columns 21, 22, 23 and 24 of Table 30. Each column presents the results of floods, droughts, storms and composite natural disasters. The interaction between each disaster and the dummy for low-income countries is denoted by LOW. Also, the interaction between each disaster and the dummy for lower-middle-income countries is indicated as LOWER. Additionally, it must be mentioned that the interaction terms did not change the natural relationship between natural disasters and overall financial development in SSA.

Table 30: The moderating role of low and lower-middle-income countries on the relationship between natural disasters and overall financial development in SSA

Dependent Variable: Overall Financial Development

	21	22	23	24
L.FINDEVDEX	0.876***	1.016***	0.887***	1.031***
	(0.031)	(0.033)	(0.022)	(0.040)
FLOOD	-0.155***			
	(0.052)			
DROUGHT		-0.147***		
		(0.049)		
STORM			-0.031*	
			(0.016)	
NDA				-0.263***
				(0.085)
Interaction				
LOW	0.136***	0.101*	0.030*	0.243***
	(0.047)	(0.053)	(0.016)	(0.080)
LOWER	0.166**	0.171***	-0.001	0.397***
	(0.068)	(0.056)	(0.042)	(0.111)
Control				
lnGDPPC	-0.000	-0.015***	-0.002	-0.019*
	(0.003)	(0.005)	(0.004)	(0.010)
Lnrem	-0.004*	0.003***	-0.003	0.004**
	(0.002)	(0.001)	(0.003)	(0.002)
Lnrate	0.012***	0.002	-0.001	0.003
	(0.004)	(0.004)	(0.002)	(0.003)
Lnreserv	0.007*	0.006**	-0.005***	-0.022*
	(0.004)	(0.003)	(0.002)	(0.011)
Lnopn	0.027**	0.019***	0.024**	0.024**
	(0.010)	(0.006)	(0.010)	(0.011)
Lncpi	0.001	0.000	-0.001	0.001
	(0.001)	(0.000)	(0.001)	(0.001)
LOWR	-0.043***	-0.047***	-0.051***	-0.034
	(0.014)	(0.014)	(0.018)	(0.025)
UPPR	-0.037**	-0.020***	-0.033***	-0.019
	(0.014)	(0.005)	(0.009)	(0.013)
Diagnostics				
Wald Chi2	2886.15	213588.18	2.93e+08	14616.47
P(Wald)	0.000	0.000	0.000	0.000
Sargan	13.280	17.221	16.075	6.721
Prob (Sargan)	0.426	0.189	0.519	0.666
AR(1):z	-3.005	-3.731	-3.188	-3.577
P-Value	0.003	0.000	0.001	0.000

Table 30 continued

AR(2):z	1.627	1.596	1.637	1.241
P-Value	0.104	0.110	0.102	0.215
No. of Grps	30	30	30	30
No. of Inst	26	26	30	22
No. of Obs	865	865	865	865

Note: L.FINDEVDEX lag of overall financial development index, NDA is an indicator of aggregate natural disasters, FLOOD, DROUGHT, STORM denote flood, drought, storm as a sub-component of aggregate natural disasters. InGDPPC represents the log of real GDP per capita, Inrem represents the log of remittances, Inrate represents the log of lending rate, and Inopn denotes the log of trade openness. Incpi represents the log of inflation. Inreserv presents the log of reserve requirement. LOW is an interaction term between the dummy variable of low-income countries and natural disasters. LOWER is an interaction term between the dummy variable of lower-middle-income countries and natural disasters. LOWR and UPPR are dummy variables for lower-middle-income and upper-middle-income countries, respectively.

Source: Field data (2023)

From Table 30, LOW exhibited a consistently positive and statistically significant moderation effect between natural disasters and overall financial development revealing across all the models that despite their lack of adequate adaptive capacity, low-income countries in SSA do have some proactive adaptive mechanisms that mitigate the effects of overall financial development in SSA. Such mechanism, though may be considered basic, effectively offer the financial cushion needed to navigate through crises and restore stability.

On the converse, LOWER, showed a more varied moderation effect. While the moderation effect was positive and significant in most models (21, 22, and 24), in model 23, it was statistically insignificant. Such a moderation result may indicate that heterogeneity could be due to less developed financial systems or weak institutional structures in some economies. However, when strong policies are instituted, these countries can even reduce the financial vulnerability due to natural hazards considerably, showing that an appropriate disaster management and financial development strategy can result in better financial stability.

Section Summary

This section discussed the result of the moderation effect of the stage of development, captured as, low-income (LOW), lower-middle-income (LOWER) and upper-middle-income (UPPER) on the relationship between natural disasters and financial development (and financial institutions, financial markets, and overall financial development) in SSA. The analysis showed that the stage of development plays a crucial moderating role on the relationship between natural disasters and financial institutions, financial markets, and overall financial development in SSA. For all the financial proxies, low-income countries present positive and significant moderation, lower-middle-income countries, however, have mixed results due to their inconsistent institutional readiness but the moderation effect of upper-middle-income countries was generally less consistent and weaker.

These findings are consistent with the Event Systems Theory which highlights the need to understand the impact of exogenous shocks such as natural disasters on an entity based on the time at which the shock occurred.

Result of control variables for examining the effect of natural disasters on financial development in Africa

Several control variables were used for the models to estimate the effect of natural disasters and their sub-components on overall financial development. Tables 19, 20 and 21 present the results of the impact of natural disasters on financial institution development, financial market development and overall financial market development, respectively.

In Table 19, real GDP per capita growth had a positive statistically significant effect in models 1b1 and 1b2 at a 5% significance level, implying that a one per cent increase in real per capita GDP growth still stimulates financial institution development by 1.8% and 1.3%, respectively. However, real GDP per capita growth was statistically insignificant in model 1b3 but had a negative statistically significant effect on financial institution development at a 5% significance level. For model 1b4, a one per cent increase in real per capita GDP growth will dampen financial market institution development by 0.8%. Furthermore, in Table 20, the real GDP per capita effect was statistically insignificant for models 1c1 and lc3 but a statistically negative significant effect in models 1c2 and lc4 at 1% and 5% significant levels, respectively. This suggests that for models 1c2 and 1c4, a one per cent rise in real GDP per capita growth causes financial institution development to decline by 0.7% and 0.8%, respectively.

Again, in Table 21, real GDP per capita growth was the statistically insignificant effect of financial development in all four models, namely 1a1, 1a2, 1a3 and 1a4. This implies that real GDP per capita does not stimulate financial development in SSA.

A positive effect of real GDP per capita growth on financial institution development, financial market development and overall financial development could imply that as the real GDP per income increases, it increases the disposal incomes of citizens, which enables them to save or invest in financial securities which consequently result in the development of the financial system. On the contrary, a negative effect could signal that a greater share of the benefits of economic growth are not fairly distributed across all sectors of the economies. As a result, the benefits do not trickle down to the financial sector. This is consistent with the findings of Naceur and Zhang (2016). A statistically insignificant effect of real GDP, as found by this study, suggests that a higher real GDP per capita may not essentially result in increased participation in the financial system as people might use the rise in income for consumption instead of investing or saving. This result contradicts the findings of Takyi and Obeng (2013)

Also, in Table 19, remittance had a negative statistically insignificant in model 1b1, a negatively statistically significant effect at a 1% level of significance in model 1b2 and a positive statistically significant in models 1b3 and model 1b4 at a 1% level of significance. Under model 1b2, a one per cent increase in remittance reduces financial institution development by 0.30%, but 0in the case of models 1b3 and 1b4, a one per cent increase in remittances will stimulate financial institution development by 0.3% and 0.60%, respectively. In Table 20, whereas remittances had a negative statistically significant effect in models 1c1 and 1c3 at a 1% significance level, respectively, remittances were statistically insignificant in models 1b2 and lb4. For models 1c1 and 1c3, a one per cent increase in remittances will cause financial market development to decline by 0.30% and 0.40%, respectively. In Table 21, remittances were statistically insignificant in models 1a1 and 1a4, negatively statistically significant in model 1a2, but positively significant in model 1a3 at 10% significance levels. A one per cent increase in remittance will cause overall financial development to decrease by 0.60% in model 1a2 but a rise of 0.20% in model 1a3. In model 3, however, remittance had a statistically significant negative effect at a 10% significance level. This means that the inflow of remittances increases in SSA, dampening financial development by 0.60%. A possible reason for this could be that remittances serve as an alternative to credit and do not encourage patronage of the financial system. This is in line with the results of Faheem et al. (2020). Further, in model 1a4, however, the effect of remittance on financial development is statistically significant at a 10% significance level. This result reveals that a one per cent increase in remittance inflow to SSA will increase financial growth by 0.20%.

This could be because remittances can foster domestic credit by making more funds available to financial institutions, thus encouraging greater lending.

A negative effect of remittance on financial development in SSA can be attributed to how remittances are used for consumption instead of investment. This finding confirms the findings of Saydaliyev et al. (2020). Nevertheless, a positive effect of remittance on financial development could mean remittances could increase the funds available to individuals. Hence, they can save, invest and interact more with the financial system. This corroborates Azizi's findings (2020). Being statistically insignificant could imply a lack of appropriate financial products in the financial sector for attracting remittances. This aligns with Naceur, Chami, and Trabelsi's (2020) findings.

Furthermore, in Table 19, the lending rate was only statistically significant and positive in model 1b1 at a 5% significance level but statistically insignificant in models 1b2, 1b3 and 1b4. In the case of model 1b1, an increase in the lending rate stimulated financial institution development by 0.60%. In Table 20, the lending rate had a positive statistically significant effect in models in the first three models, that is, 1c1, 1c2 and 1c3 at 5%, 1%, and 5% levels of significance, respectively, but a statistically significant negative effect in model 1c4 1% level of significance. A one-cent increase in lending rate improved financial market development in models 1c1, 1c2 and 1c3 by 1.1%, 070%, and 0.50%, respectively, but a decline of 0.70% in model 1c4. In Table 21, lending rate positively affected financial development in models 1a1 and 1a4 at 5% and 1% levels of significance, respectively. Under these two models, a one per cent increase in the lending rate increases overall financial development by 0.70%.

Positive and significant lending rates stimulate increased deposits, encouraging financial development. A negative effect of the lending rate could imply a high cost of credit, which disincentives businesses and households to access credit. This supports the findings of Takyi and Obeng (2013). A statistically insignificant effect of lending rate suggests that it cannot be used to stimulate changes in financial development, which aligns with the argument of Arshad et al. (2021).

In Table 19, trade openness had a statistically insignificant effect on financial institutions in models 1b1 and 1b2 but a statistically significant positive impact in models 1c3 and 1c4 at 5% and 10% significance levels, respectively. A one per cent increase in trade openness enhanced financial institution development by 1.3% and 2.4% in models 1c3 and 1c4, respectively. Further, in Table 20, trade openness had a statistically significant but negative effect in model 1a1 but a positive impact on model 1a3. In models 1a2 and 1a4, trade openness was statistically insignificant. A percentage increase in trade openness decreased financial market development by 0.70% in model 1c1 but a boost of 1.3% in financial development in model 1c3. In Table 21, trade positive was statistically significant in models 1a1, 1a2, and 1a3, respectively, but statistically insignificant in model 1a4. Therefore, a percentage increase in trade openness enhanced overall financial development by 1.9%, 2.1% and 1.7%, respectively, in models 1a1, 1a2, and 1a3.

Additionally, inflation was statistically insignificant in influencing financial development in models 1b1 and 1b3 but had a statistically positive effect in models 1b2 and 1b4 at 5% and 1% significance levels, respectively. Consequently, a one per cent increase in inflation improved financial institution development by 0.20% and 0.10%, respectively, in models 1b2 and 1b4. In Table 19, inflation was statistically significant and positive in models 1c1, 1c2 and 1c3 at 1%, 5% and 10% levels of significance, respectively, but was statistically insignificant in model 1c4. Therefore, a per cent increase in inflation enhanced financial market development in models 1c1, 1c2 and 1c3 by 0.30%, 0.20% and 0.10%, respectively. In Table 20, inflation was statistically significant and positive 1a1 and 1a2 at 1% significance, respectively, but statistically insignificant in models 1a3 and 1a4. Therefore, a one per cent rise in inflation stimulated overall financial development in models 1a1 and 1a2 by 0.30% and 0.20%, respectively.

Again, in Table 19, the bank liquid reserves to bank assets ratio was statistically significant but negative in models 1b1 and 1b2 at 1% and 5% levels of significance, positive in model 1c3 at 5% level of significance but statistically insignificant in model 1b4. A percentage rise in reserves dampened financial institution development in models 1b1 and 1b2 by 2% and 1.2%, respectively, but stimulated further development of financial institutions by 1.1%. Again, in Table 21, reserves were only statistically significant and negative in models 1c1 and 1c2 at 1% significance, respectively. A one per cent rise in reserves reduced financial market development by 2% and 1.1% in models 1c1 and 1c2, respectively. Furthermore, in Table 29, the bank liquid reserves to bank assets ratio was statistically but negatively significant in models 1a1,1a3 and 1a4 at 1%, 1% and 10% significance levels but statistically insignificant in mode 1a2. A one-cent increase in bank liquid reserves to bank assets ratio reduces overall financial development by 1.2%, 1.9% and 2%, respectively, in models 1a1,1a3 and 1a4. This suggests that a high liquid reserves to assets ratio reduces available funds for credit, thus constraining participation in the financial system. This corroborates the findings of Takyi and Camara (2013).

The income levels of countries represent the stage of development. In Table 19, low-income countries (DEV=0) are used as a reference for lower-middle-income countries (LOWR) and upper-middle-income countries (UPPR). In Table 21, being a lower-income country is negative and statistically significant in model 1b1 but positive in model 1b4 at 10% and 1% levels of significance but statistically insignificant in models 1b2 and 1b3. Being a lower-middle income causes development in financial institutions to decline by 2.5% in model 1b1 but boosted by 1.5% in model 1b4. Besides, being an upper middle-income country was statistically insignificant in mode 1b1 but positively and statistically significant in models 1b2, 1b3 and 1b4 at 1%, 5% and 1% significance levels, respectively. This result suggests that being an upper-income country enhances the expansion of financial institutions by 4.8%, 2.8% and 5.1% in models 1b2, 1b3 and 1b4, respectively. In Table 24, lower middle income was statistically insignificant in all models: 1c1, 1c2, 1c3 and 1c4. This suggests that being an upper-income country does not have any impact on financial market development. Also, being an upper income was statistically insignificant in models 1c1 and 1c4. Still, whereas it was statistically positive under model 1c2 at a 5% significance level, it was negative in model 1c3 at a 1% significance level. This suggests that even though being an upper-income country enhances financial market development by 2.2%, as in the case of model 1c2, it can also dampen financial market development by 1.6%, as found in model lc3. Differences in the quality of institutions, human capital development, policies, etc, can explain the contrasting effect of the same income level on financial development.

Again, Table 21 shows that lower-middle income countries were statistically significant in models 1a1 and 1a4 at a 5% significance level, respectively. Still, whilst the effect was negative under model 1a1, it was positive under model 1a4. Under models 1a2 and 1a3, lower-middle income was statistically insignificant. The result further reveals that lower-middle level of development causes a decline in overall financial development by 2.3%, as found under model 1a1, but contributes positively to financial development by 1.5%. The upper-middle income level of development was statistically insignificant in model 1a1 but statistically significant and positive in models 1a2, 1a3, and 1a4 at 5%, 1% and 1% levels of significance. Upper middle income enhanced overall financial development by 3.6%, 4.7% and 6.9% in models 1a2, 1a3, and 1a4, respectively. This could suggest that as countries develop more, their contributions to financial development improve because they can build better institutions and develop better financial policies that contribute towards improving the financial system. Conversely, lower-middle income countries negatively affect financial development. This can be attributed to the fact that at this stage of development, under-developed financial systems may limit access to financial services that promote financial sector development.

Chapter Summary

This chapter discussed the summary statistics and the test of endogeneity for key variables that the study employs. It also discussed the effect of natural disasters on financial development SSA. The indicators for natural disasters, floods, droughts, and storms, as well as a composite of the three, were used to examine how each affects the development of financial institutions, markets, and overall financial development in SSA. The study's findings generally revealed that natural disasters negatively affect all dimensions of financial development. However, the magnitude of the negative effect varied. Based on these findings, the null hypothesis that natural disasters positively affect financial institution development, financial market development and overall economic development is rejected.

Also, the chapter assessed and discussed the moderating role of the stage of development on the relationship between natural disasters and financial development in SSA. Based on the 2022 World Bank country classification using GNI, the countries used in the study were categorised into low-income, lower-middle-income and upper-middle-income countries to ascertain how a particular income category influences the relationship between natural disasters and financial development in SSA. Generally, even though there were moderation effect of the stage of development, it was not consistent across all models. Regarding the hypothesis set that the stage of development moderates the relationship between natural disasters and financial institution development, financial market development and overall financial development, the evidence was mixed.

CHAPTER FIVE

EFFECT OF NATURAL DISASTERS ON INCLUSIVE GROWTH IN SSA

Introduction

This chapter is dedicated to presenting and discussing results relating to the endogeneity of inclusive growth variable, objectives three and four of the study. Objective three of this study seeks to investigate the effect of natural disasters on inclusive growth; objective four, on the other hand, ascertains whether the stage of development of development moderates the relationship between natural disasters and inclusive growth in SSA.

Endogeneity test for inclusive growth

To test for the endogeneity of inclusive growth, the study follows the procedure recommended by Drichoutis, Lazaridis and Nayga (2009). This process of begins with estimating the 2sls instrumental variable regression, the result of which is shown in Table 31 below.

Table 31: 2SLS instrumental variable regression: Inclusive Growth Index

FDI	
GROWTHDEX	1.254***
	(0.223)
RESERV	0.0286
	(0.0297)
CPI	0.0230***
	(0.00882)
RATE	-0.109***
	(0.0282)
NDA	1.907
	(2.004)
OPN	0.157***
	(0.0227)
REM	-0.226***
	(0.0462)
FINDEVDEX	-26.10***
	(8.469)
LOWR	-0.653
	(1.293)
UPPR	8.333**
	(3.648)
Constant	-65.50***
	(11.28)
Observations	870

Note: FDI represents foreign direct investment, and GROWTHDEX is an index for inclusive growth. NDA represents the overall natural index of flood, drought and storm. CPI is consumer price index, RESERV requirement, RATE is lending rate, REM is remittances, FINDEVDEX denotes overall financial development index, OPN represents trade openness, LOWR and UPPR are dummy variables for lower-middle income and upper-middle income countries respectively. *** represents the 1% significance level, and ** denotes a 5% significance level.

Source: Field data (2023)

The results shown in Table 31 reveal that the inclusive growth index (GROWTHDEX) is statistically significant at a 1% level of significance and, hence, an endogenous regressor in the model. Following this, a test must be performed to determine the relevance of the instruments used in the estimation. The result of the rest of the instruments' relevance is shown in Table 32 below.

Table 32: Tests on the relevance of the instruments: Inclusive Growth

Variable	R-sq.	Adjusted R-sq.	Partial R-sq.	F(6,854)	Prob > F
GROWTHDEX	0.1542	0.1394	0.0362	5.34778	0.0000

Source: Field data (2023)

As seen in Table 32 above, the p-value of the F-statistic is statistically significant at a 5% significance level. With the null hypothesis of this test being that the instrument employed is weak, given the statistical significance of the F-statistic, the null hypothesis can be rejected. The instruments used in this model are, therefore, relevant and robust.

The next test required in concluding the endogeneity of inclusive growth is the test of over-identifying restrictions. The null hypothesis of this test is that the instruments are valid and uncorrelated with the error term. The result of this test is shown in Table 33 below.

Table 33: Test of over-identifying restrictions: Inclusive Growth

Sargan (score) chi2(5)	=	7.02685	(p=0.2187)
Basmann chi2(5)	=	6.95379	(p= 0.2241)

Source: Field data (2023)

Table 17 above reveals that the Sargan and Basmann tests are statistically insignificant since their p-values are more significant than the 5% significance level. Under such a condition, the null hypothesis cannot be rejected. The chosen instruments for the test were, therefore, valid.

As done earlier, the Durbin-Wu-Hausman test checks the endogeneity of the variable of interest, inclusive growth. The result of the test is presented in Table 34 below.

Table 34: Test of endogeneity: Inclusive Growth

Durbin (score) chi2(1)	=	273.416	(p=0.0000)
Wu-Hausman F(1,858)	=	393.225	(p=0.0000)

Source: Field data (2023)

Table 34 shows that the p-values of the Durbin and Wu-Hausman tests are less than the 5% significance level. The null hypothesis that the variable (inclusive growth) is exogenous can be rejected. Inclusive growth is, therefore, faced with the problem of endogeneity.

Regression results

Ullah, Akhtar and Zaefarian (2018) highlight that for an estimated model to be adequate for interpretation, two post-estimation tests are required: the Sargan test and the AR (1) and AR (2). The result of the Sargan test evaluates the validity and over-identification of instruments. It is expected that the null hypothesis, which states that the instruments are strong and valid, is not rejected at a 5% level of significance. Also, the auto-correlation test has the null hypothesis that there is no autocorrelation. For the auto-correlation test, whereas it is expected that the first-order autocorrelation test [(AR (1)] should be statistically significant, the second-order autocorrelation test [AR (2)] should not be statistically significant at a 5% level of significance.

It is worth emphasizing that the composite index used in this study aggregates multiple dimensions of inclusive growth, such as education, health, and employment. While this study did not analyze the effect of natural disasters on each component separately, the composite index as a whole represents the aggregate value of the various indicators. It is, therefore, consistent to discuss the possible channels through which natural disasters influence the individual components as part of understanding the meaning of the composite index. This is further supported by the endogenous growth theory and existing empirical evidence, which indicate that growth is a multidimensional process that is easily disrupted by natural disasters.

Effect of natural disasters on inclusive growth in SSA

Table 35 below presents the results of the analysis of the impact of natural disasters on financial development. The four models, INC 1, INC 2, INC 3and INC 4, in Table 35, represent the effects of floods, drought, storms and aggregate natural disasters on inclusive growth, respectively.

It can be seen from Table 35 that in all four models, the p-values of the AR (1) test are statistically significant, and those of AR (2) are statistically insignificant at a 5% level of significance. This implies that there are no issues with serial correlation in all four models. Also, the p-values for the Sargan test in all four models are statistically insignificant at a 5% significance level. This indicates that the instruments used are valid and robust. Hence, the models are adequate and can therefore be interpreted.

Table 35: Effect of different types of natural disasters on inclusive growth in SSA

Dependent Variable: Inclusive growth

	INC 1	INC 2	INC 3	INC 4
L.lngrowthdex	0.755***	0.712***	0.999***	0.816***
	(0.086)	(0.115)	(0.056)	(0.132)
FLOOD	-0.454***			
	(0.155)			
DROUGHT		-0.188*		
		(0.108)		
STORM			-0.204***	
			(0.069)	
NDA				-0.388***
				(0.133)
Control				
Lnrem	-0.004	-0.000	0.001	0.000
	(0.009)	(0.004)	(0.004)	(0.006)
Lnopn	-0.051*	-0.064*	-0.138**	-0.095*
	(0.028)	(0.036)	(0.060)	(0.051)
Lngcf	0.049**	0.001	0.030	0.010
	(0.019)	(0.026)	(0.031)	(0.036)
Lngfce	0.057	0.004	-0.040	-0.063
	(0.039)	(0.027)	(0.048)	(0.044)
Lnfindevdex	-0.070*	-0.170**	0.127***	-0.156**
	(0.037)	(0.066)	(0.035)	(0.076)
LOWR	-0.005	0.105**	-0.132*	0.127**
	(0.035)	(0.043)	(0.065)	(0.055)
UPPR	0.165**	0.178*	0.185**	0.215*
	(0.075)	(0.094)	(0.080)	(0.108)
Diagnostic				
Wald Chi2	3.62e+07	91047.64	412965.73	49700.46
P(Wald)	0.000	0.000	0.000	0.000
AR(1):z	-3.962	-4.519	-5.115	-4.115
P-values	0.000	0.000	0.000	0.000
AR(2)	1.449	1.407	1.326	1.110
P-values	0.147	0.159	0.185	0.267
Sargan Chi2	13.375	13.671	15.434	10.928
Prob(Sargan)	0.645	0.623	0.493	0.535
No. of Grps	35	35	35	35
No. of Inst	26	26	26	22
No. of Obs	1004	1004	1004	1004

Note: L.lngrowthdex is the lag of the log of inclusive growth. FLOOD represents lifeyears index of flood, DROUGHT is lifeyears index for drought, STORM denotes lifeyears index for storm, NDA is aggregate lifeyears index for all flood, drought and storm. Infindevdex represents the log of financial development, and Inopn denotes the log of trade openness. Inrem represents the log of remittances, Ingcf is the log of gross capital formation, and Ingfce represents the general government final consumption expenditure. *** represents the 1% significance level, and ** denotes a 5% significance level. LOWR and UPPR are dummy variables for lower-middle-income and upper-middle-income countries, respectively

Source: Field data (2023)

Model INC1 in Table 35 reveals that floods have a negative effect on inclusive growth at the 1% level of statistical significance indicating that a one-unit rise in the lifeyears lost to floods results in a 0.454 decline in inclusive growth. This implies that an increase in the frequency of flooding in

SSA undermines the achievement of inclusive growth in SSA. Floods pollute water sources which leads to mortality and morbidity and damage infrastructure such as school buildings and thus, disrupt education. These eventually amplify inequality and poverty since individuals lose their livelihoods and suffer economic hardship. This finding is consistent with Twiddy, Trump, and Ramsden (2022), who report negative socioeconomic outcomes of floods. Nonetheless, this study provides a more comprehensive understanding by assessing the impacts of various disasters on the multidimensional dimensions of inclusive growth such as health and education, poverty and inequality across SSA. This result is consistent with the endogenous growth hypothesis, which emphasises how infrastructure, productivity, and human capital contribute to long-term, steady economic growth and that the destruction of such internal factors by natural disasters undermines the growth prospects of the affected region.

Similarly, model INC 2 of Table 35 shows that the impact of droughts on inclusive growth is negative and statistically significant at the 10% significance level, further indicating that a unit rise in the life years lost to drought leads to a 0.188 decline in inclusive growth. This can be attributed to how drought disrupts the capital stock both human and physical, which drives the process of inclusive growth through mortality, morbidity and economic damages. This aligns with the endogenous growth theory which emphasizes the critical role of capital stock in stimulating growth and that any that negatively affects capital stock ultimately undermines growth. When droughts occur, they deplete water bodies resulting in many sanitation and health conditions such as diarrhoea, which have negative consequences on labour productivity. Further, the agricultural sector is critical to the sub-region as a majority of its labour force is engaged in that sector. Consequently, droughts lead to loss of economic livelihood and income resulting in poverty and the ability to provide essential needs such as healthcare and education. These findings align with Edwards, Gray, and Hunter 2018 assert that droughts affect workers in the agricultural industry as they suffer significant health and economic consequences. Moreover, droughts lead to poor employment outcomes in drought-affected local economies, and, also, loss of service by those not directly working in the sector. Nevertheless, the study further provides more evidence that droughts have multiplier effects on multi-dimensional inclusive growth, with various dimensions including education, health, and inequality.

According to model INC 3 in Table 35, storms have a statistically negative effect on inclusive growth at the 1% level. Specifically, one unit increase in the lifeyears lost to storms leads to a decline of 0.204 in inclusive growth. This can be attributed to the generally destructive nature of storms. Usually, storms destroy essential installations, residential facilities and disrupt agricultural activities resulting in major economic loss, displacement and sometimes severe injury and death. These storms destroy the internal factors that are required to stimulate growth. The damage to the agricultural sector for instance, leads to food insecurity, resulting in poverty and inequality. Loss of income due to injury and infrastructure limits access to vital services such as healthcare and education which augment human capital. Also, deaths associated with storms lead to a loss of human capital, hence reducing aggregate productivity which is critical for inclusive growth. The finding is consistent Foreman (2020) and Polachek and Strobl (2016), who report on the negative economic effects of storms. However, this study extends its findings by highlighting the multi-dimensional effect of storms on health, education, and inequality, all important dimensions of inclusive growth.

From model INC 4 in Table 35, composite natural disasters, measured by the Lifeyears Index, are statistically significant and negative at the 1% level. This indicates that a unit increase in lifeyears lost to the composite of floods, droughts and storms result in a 0.388 decline in inclusive growth. This reveals the severe and multidimensional risk posed by aggregate natural disasters to inclusive growth in SSA, consistent with the Endogenous Growth Theory, which underscores the crucial role of infrastructure, human capital, and innovation in driving inclusive growth. Composite natural disasters concurrently interrupt multiple sectors such as education, infrastructure, health and economic livelihoods, aggravating the challenges to achieving inclusive growth. For instance, natural disasters displace populations, damage infrastructure and restrict access to healthcare, and education and reduce human capital. Moreover, economic losses which emanate from the destruction of agricultural production and businesses further heighten poverty and inequality. Such cumulative outcomes threaten the efforts towards achieving SDG 11.5, which seeks to reduce disaster-related effects on the socioeconomic well-being of communities and achieve inclusive growth. These findings extend existing studies by demonstrating how the multidimensional impacts of composite natural disasters uniquely hamper inclusive growth in SSA, particularly by magnifying the already existing vulnerabilities across key development sectors.

Control Variables

Several control variables were used for this study, as can be found in Table 35. Remittances were statistically insignificant in influencing inclusive growth in all four models. Furthermore, although trade openness was statistically significant in all four models, it affected inclusive growth. Gross capital formation only influenced inclusive growth positively under model INC1; its effect on inclusive growth was insignificant in the remaining three models. Again, government final consumption expenditure was statistically insignificant in all four models. Also, although financial development was statistically significant in all four models, the effect differed. For instance, whereas its effect under models INC1, INC2 and INC4 was negative, under model INC3, it had a positive effect on inclusive growth.

The moderating effect of the stage of development on the relationship between natural disasters and inclusive growth in SSA

The Event System Theory (EST) serves as the basis for ascertaining whether the stage of development moderates the relationship between natural disasters and inclusive growth in SSA, as in line with objective four of the study. This section, therefore, seeks to investigate whether these stages of development in SSA can alter the nature of the relationship between natural disasters and inclusive growth in SSA.

To achieve the purpose of objective four of this study, dummy variables of each stage are interacted with respective natural disasters (floods, droughts, storms and their composite) into the original regression equations and their outcomes analysed. The interaction of each disaster with the dummy of low-income, lower-middle-income and upper-income countries are denoted as LOW, LOWER and UPPER, respectively.

The study rotated the stages of development (low-income, lower-middle-income, and upper-middle-income) as reference categories in the estimations. Using this approach the study ensures that the differential impact of natural disasters on financial development is robust across income groups. Following this approach, the likely biases are avoided and thus result in a comprehensive understanding of how each income level uniquely moderates the relationship between natural disasters and financial development in SSA, providing actionable insights for policymakers tailored to each stage of development. This rotation bolsters the reliability of the findings, addressing any limits in interpreting the impacts across various income groups. Consequently, three tables 36-38 are presented to analyse and compare findings. In Table 36, LOW is used to reference LOWER and UPPER. In Table 37, LOWER is employed as a reference to compare the results between LOW and UPPER. Also, in Table 38, UPPER is used as the reference to compare the findings between LOW and LOWER.

The moderating role of lower middle and upper middle income on the relationship between natural disasters and inclusive growth in SSA

This section compares the moderating effect of lower- and upper-middle-income countries on the relationship between natural disasters and inclusion in SSA. The results are presented in Table 36, which shows four models, INC 5, INC 6, INC 7 and INC 8, representing results on floods, droughts, storms and composite natural disasters. All four models passed the requirements of the diagnostic tests; thus, the models are suitable for interpretation.

Table 36: The moderating role of lower-middle and upper-middle income on the relationship between natural disasters and inclusive growth in SSA

	INC 5	INC 6	INC 7	INC 8
L.lngrowthdex	0.617***	0.756***	0.550***	0.677***
	(0.112)	(0.082)	(0.129)	(0.109)
FLOOD	-0.583***			
	(0.213)			
DROUGHT		-0.282***		
		(0.050)		
STORM			-0.106**	
			(0.046)	
NDA				-0.325**
				(0.152)
Interaction				
LOWER	0.722**	0.693	0.154	0.013
	(0.322)	(0.427)	(0.219)	(0.154)
UPPER	1.740*	0.677***	-0.306**	0.382*
	(0.888)	(0.083)	(0.144)	(0.194)
Control				
Lnrem	-0.022	-0.045***	0.019**	-0.001
	(0.014)	(0.015)	(0.007)	(0.007)
Lnopn	0.069	-0.017	-0.052	-0.037*
	(0.043)	(0.018)	(0.064)	(0.019)
Lngcf	-0.013	-0.002	-0.103**	0.011
	(0.026)	(0.014)	(0.041)	(0.018)
Lngfce	0.022	0.053	0.005	-0.002
	(0.031)	(0.059)	(0.043)	(0.038)
Lnfdi	0.030**	0.030***	-0.002	0.018*
	(0.014)	(0.010)	(0.015)	(0.010)
Lnfindevdex	0.186**	-0.016	0.010	0.025
	(0.087)	(0.038)	(0.078)	(0.027)
LOWR	-0.092*	-0.063	0.060	-0.047
	(0.053)	(0.040)	(0.047)	(0.041)
UPPR	-0.709**	-0.129*	-0.081	-0.103*
	(0.264)	(0.066)	(0.134)	(0.052)
Diagnostic				
Wald Chi2	1.47e+07	83122.34	77264.13	265948.17
P(Wald)	0.000	0.000	0.000	0.000
AR(1):z	-3.893	-4.093	-3.782	-4.279
P-values	0.000	0.000	0.000	0.000
AR(2)	0.858	0.554	1.574	1.291
P-values	0.391	0.579	0.116	0.197
Sargan Chi2	12.308	11.171	15.556	9.959
Prob(Sargan)	0.503	0.596	0.274	0.697
No. of Grps	35	35	35	35
No. of Inst	26	26.	26	26
No. of Obs	931	931	931	931

Note: L.lngrowthdex is the lag of the log of inclusive growth. FLOOD represents lifeyears index of flood, DROUGHT is lifeyears index for drought, STORM denotes lifeyears index for storm, NDA is aggregate lifeyears index for all flood, drought and storm. Infindevdex represents the log of financial development, and Inopn denotes the log of trade openness. Inrem represents the log of remittances, Ingcf is the log of gross capital formation, and Ingfce represents the general government final consumption expenditure. LOWER is the interaction term between the dummy variable of lower-middle-income countries and natural disasters; UPPER is the interaction term between upper-middle-income countries and natural disasters. *** represents the 1% significance level, and ** denotes a 5% significance level. LOWR and UPPR are dummy variables for lower-middle-income and upper-middle-income countries, respectively

Source: Field data (2023)

Model INC 5 in Table 36 reveals that LOWER exhibits mixed moderation results. For instance, while the moderation effect under Model INC5 is positive and statistically insignificant, the remaining models (INC 6-8) show a statistically insignificant moderation effect. This implies that lower-middle-income countries in SSA can deal with only the adverse impact of floods on inclusive growth. On the other hand, UPPER demonstrated a positive and statistically significant moderation across all models (INC5-INC8). This suggests that upper-middle-income countries possess a better capacity to moderate the adverse impacts of floods, droughts, storms and aggregate natural disasters in SSA. These findings reveal that even though lower-middle-income and upper-middle-income countries moderate the relationship between natural disasters and inclusive growth, the type of disasters determines their effectiveness and the stage of development.

The moderating role of low and upper-middle-income countries on the relationship between natural disasters and inclusive growth in SSA

This section is devoted to presenting and comparing results on how being a low-income (LOW) or upper-middle-income (UPPER) country moderates the relationship between natural disasters and inclusive growth in SSA. The results are presented in Table 37, which has four models, namely, INC 9, INC 10, INC 11 and INC 12, with the model representing results about floods, droughts, storms and aggregate natural disasters, respectively. Also, the models passed all the model diagnostics tests and are suitable for interpretation.

Table 37: Moderation role of low and upper-middle-income countries on the relationship between natural disasters and inclusive growth in SSA

	INC 9	INC 10	INC 11	INC 12
L.lngrowthdex	0.799***	0.727***	0.556***	0.782***
	(0.034)	(0.057)	(0.081)	(0.111)
FLOOD	-0.784**			
	(0.374)			
DROUGHT		-0.528***		
		(0.176)		
STORM			-0.713**	
			(0.270)	
NDA				-0.549*
				(0.275)
Interaction				
LOW	0.863**	0.454*	0.700**	0.477
	(0.384)	(0.236)	(0.270)	(0.361)
UPPER	0.168	0.440	-1.027*	2.275**
	(0.690)	(0.305)	(0.606)	(0.972)
Control				
Lnrem	-0.020**	-0.012**	-0.002	-0.002
	(0.009)	(0.005)	(0.004)	(0.008)
Lnopn	0.017	-0.053**	-0.005	-0.189**
	(0.034)	(0.024)	(0.028)	(0.083)
Lngcf	-0.076***	-0.037	-0.083***	-0.047*
	(0.027)	(0.024)	(0.024)	(0.027)
Lngfce	-0.049	-0.072*	0.048**	0.080
	(0.048)	(0.036)	(0.021)	(0.078)
Lnfdi	0.023*	0.016**	0.027**	0.045***
	(0.012)	(0.006)	(0.010)	(0.015)
Lnfindevdex	0.021	0.041**	-0.003	0.064*
	(0.042)	(0.020)	(0.014)	(0.034)
LOWR	-0.097	0.002	-0.015	0.063
	(0.074)	(0.035)	(0.019)	(0.060)
UPPR	-0.041	-0.067**	-0.086**	-0.162**
	(0.051)	(0.028)	(0.039)	(0.062)
Diagnostics				
Wald Chi2	99098.18	6.66e+06	947999.63	47100.60
P(Wald)	0.000	0.000	0.000	0.000
AR(1):z	-3.460	-4.706	-4.778	-3.863
P-Value	0.001	0.000	0.000	0.000
AR(2):z	1.060	0.885	1.292	1.069
P-Value	0.289	0.376	0.196	0.285
Sargan Chi2	15.746	14.036	14.231	9.896
P-Value	0.542	0.665	0.651	0.702
No. of grps	35	35	35	35
No. of Inst	30	30	30	26
No. of Ob	931	931	931	931

Note: L.lngrowthdex is the lag of the log of inclusive growth. FLOOD represents lifeyears index of flood, DROUGHT is lifeyears index for drought, STORM denotes lifeyears index for storm, NDA is aggregate lifeyears index for all flood, drought and storm. Infindevdex represents the log of financial development, and Inopn denotes the log of trade openness. Inrem represents the log of remittances, Ingcf is the log of gross capital formation, and Ingfce represents the general government final consumption expenditure. LOW is the interaction term between the dummy variable of low-income countries and natural disasters; UPPER is the interaction term between upper-middle-income countries and natural disasters. *** represents the 1% significance level, and ** denotes a 5% significance level. LOWR and UPPR are dummy variables for lower-middle-income and upper-middle-income countries, respectively

Source: Field data (2023)

From Table 37 LOWER demonstrates positive and statistically significant moderation across most models (INC 9-11) but a statistically insignificant moderation effect in Model INC 12. These findings imply that while low-income countries possess some capacity to separately moderate the effects of floods, droughts, and storms, on inclusive growth, they are limited in addressing the compounded impacts of multiple natural disasters in SSA. Conversely, for UPPER, the results of the moderation effects are mixed. For instance, whereas in models INC 9-10, the moderation effect was statistically insignificant, in model INC 11, the moderation effect was statistically significant yet negative suggesting that the impact of storms seems to overwhelm upper-middle-income countries. In model INC 12, however, the moderation effect is positive and statistically significant indicating that upper-middle-income countries can address the cumulative impacts of multiple natural disasters.

These findings highlight that in mitigating the impact of natural disasters in SSA, attention should be paid to the types of disasters and the stage of development of the affected economies.

The moderating role of low and lower-middle-income countries on the relationship between natural disasters and inclusive growth in SSA

This section presents, discusses and compares the moderating roles of low-income and lower-middle-income countries on the relationship between natural disasters and inclusive growth in SSA. The result is shown in Table 38, which has four models, INC 13, INC 14, INC 15, and INC 16, concerning floods, droughts, storms, and aggregate natural disasters. Further, the models passed all the diagnostic tests and are suitable for interpretation.

Table 38: The moderating role of low and lower-middle-income countries on the relationship between natural disasters and inclusive growth in SSA

	INC 13	INC 14	INC 15	INC 16
L.lngrowthdex	0.779***	0.675***	0.870***	1.030***
	(0.083)	(0.085)	(0.093)	(0.153)
FLOOD	-0.917***			
	(0.302)			
DROUGHT		-0.872***		
		(0.254)		
STORM			-1.072***	
			(0.384)	
NDA				-0.309*
				(0.165)
Interaction				
LOW	0.685**	1.015**	1.084***	0.647**
	(0.274)	(0.450)	(0.379)	(0.290)
LOWER	1.207***	0.565*	0.848*	1.199***
	(0.337)	(0.298)	(0.486)	(0.335)
Control				
Lnrem	-0.004	0.004	-0.011**	-0.005
	(0.010)	(0.016)	(0.005)	(0.009)
Lnopn	0.014	-0.122***	0.005	0.029
	(0.033)	(0.037)	(0.031)	(0.031)
Lngcf	-0.094**	-0.045	-0.054**	-0.072**
	(0.039)	(0.029)	(0.025)	(0.033)
Lngfce	0.062*	0.147**	-0.056*	0.118**
	(0.031)	(0.064)	(0.031)	(0.047)
Lnfdi	0.026**	0.040***	0.012**	0.030**
	(0.011)	(0.013)	(0.005)	(0.011)
Lnfindevdex	0.061	-0.012	0.050*	-0.035
	(0.039)	(0.023)	(0.027)	(0.031)
LOWR	0.053	0.100	0.023	0.130
	(0.091)	(0.077)	(0.028)	(0.092)
UPPR	-0.048	0.078**	0.038	0.000
	(0.048)	(0.034)	(0.030)	(0.046)
Constant	1.033**	1.388***	0.871	-0.531
	(0.492)	(0.376)	(0.528)	(0.683)
Wald Chi2	815519.30	163502.30	88141.42	1.67e+07
P(Wald)	0.000	0.000	0.000	0.000
AR(1):z	-4.805	-4.589	-4.851	-3.182
P-Value	0.000	0.000	0.000	0.001
AR(2): z	0.404	1.528	1.470	0.671
P-Value	0.686	0.126	0.142	0.502
Sargan Chi2	13.572	13.431	15.059	14.886
Prob (Sargan)	0.697	0.707	0.591	0.604
Number of Grps.	35	35	35	35
Number of inst.	30	30	30	30
Number of Obs.	931	931	931	931

Note: L.Ingrowthdex is the lag of the log of inclusive growth. FLOOD represents lifeyears index of flood, DROUGHT is lifeyears index for drought, STORM denotes lifeyears index for storm, NDA is aggregate lifeyears index for all flood, drought and storm. Infindevdex represents the log of financial development, and Inopn denotes the log of trade openness. Inrem represents the log of remittances, Ingcf is the log of gross capital formation, and Ingfce represents the general government final consumption expenditure. LOW is the interaction term between the dummy variable of low-income countries and natural disasters; LOWER is the interaction term between the dummy variable of lower-middle-income countries and natural disasters. *** represents the 1% significance level, and ** denotes a 5% significance level. LOWR and UPPR are dummy variables for lower-middle-income and upper-middle-income countries, respectively

Source: Field data (2023)

Table 38 demonstrates that LOW and LOWER depict positive and statistically significant moderation effects in all models (INC13, INC14, INC15, and INC16). These results imply that both low-income and lower-middle-income countries possess some ability to mitigate the impacts of natural disasters on inclusive growth in SSA. Also, these findings suggest that countries in the lower stages of development possess some forms of adaptive capacity that help to deal with the impacts of natural disasters despite being less resource-endowed when compared with those in the upper-income brackets. These findings may further suggest that possessing better financial resources does not automatically translate into natural disaster mitigation and ameliorating the impacts of natural disasters requires targeted and tailored inventions

Chapter Summary

This chapter analysed the effect of natural disasters on inclusive growth in SSA. This chapter examined how floods, droughts, storms, and their composite affect inclusive growth in SSA. The findings of the investigation showed that all indicators of natural disasters hurt inclusive growth and thus constitute a threat to the realisation of inclusive growth in the region despite the differences in the magnitude of their effect sizes. These findings reject the null hypothesis that natural disasters have a positive and equal magnitude of effect on inclusive growth.

Furthermore, given that there are differences in the stages of development of the countries in SSA and in line with the World Bank's country classification, this study investigated how the stages of development moderate the relationship between natural disasters and inclusive growth in

SSA. Three tables were used to present the results of the moderation analysis. In Table 36, a comparison is made on how being a lower-middle-income or upper-middle-income country moderates the relationship between natural disasters and inclusive growth. Similarly, Table 37 compared how low-income and upper-middle-income countries moderated the relationship between natural disasters and inclusive growth in SSA. Lastly, Table 38 investigated how being a low-income or lower-middle-income country mitigated the effect of natural disasters on inclusive growth in SSA. Rejecting the hypothesis set, the evidence from analysis of the moderating role of the stage of development on the relationship between natural disasters and inclusive growth is mixed.

CHAPTER SIX

THRESHOLD EFFECT BETWEEN FINANCIAL DEVELOPMENT AND INCLUSIVE GROWTH IN SSA

Introduction

This chapter is devoted to objective five of this study, which sought to ascertain whether the relationship between financial development and inclusive growth is non-monotonic. The chapter presents and discusses the outcome of the analysis of the threshold effect between financial development and inclusive growth in SSA. Three measures of financial development are used in the study: financial institution development, financial market development and overall financial development. The results of the analysis are presented in Table 39.

As can be seen from Table 39, three models capture the threshold analysis between financial institution development (THD 1), financial market development (THD 2), and overall financial development (THD 3). For a non-monotonic relationship to be established, it is expected that while the linear term for each financial development indicator is positive, the quadratic term should be negative. Further, Ullah, Akhtar and Zaefarian (2018) highlight that for a GMM estimation to be adequate for interpretation, there should be no issue with serial correlation in that whereas AR (1) is expected to be statistically significant, AR(2) should be statistically insignificant at 5% levels of significance. Also, the Sargan test should be insignificant at a 5% significance level to indicate that the instruments are valid. All three models of Table 39, above the post-estimation requirement, have been met as the p-values meet the required thresholds.

Table 39: Threshold effect between financial Development and Inclusive growth

	THD 1	THD 2	THD 2
L.lngrowthdex	0.774***	0.796***	0.657***
	(0.061)	(0.073)	(0.073)
Lnfinstdex	0.096*		
	(0.053)		
lnfinstdex^2	0.011		
	(0.013)		
Lnfmktdex		0.058**	
		(0.022)	
lnfmktdex^2		0.002	
		(0.001)	
Lnfindevdex			0.072*
			(0.042)
lnfindevdex^2			-0.000
			(0.007)
Controls			
Lnrem	-0.031***	-0.027*	-0.026***
	(0.007)	(0.013)	(0.009)
Lnopn	0.012*	-0.016	-0.004
	(0.007)	(0.015)	(0.009)
Lngcf	-0.057***	-0.113***	-0.052***
	(0.016)	(0.025)	(0.019)
Lngfce	0.036*	0.117*	0.039*
	(0.021)	(0.064)	(0.023)
Lnfdi	0.020***	0.028***	0.019***
	(0.005)	(0.007)	(0.005)
Constant	1.044***	1.114***	1.573***
	(0.307)	(0.395)	(0.355)
Diagnostics			
Wald Chi2	1.55e+06	23798.09	150164.15
P(Wald)	0.000	0.000	0.000
Sargan	24.496	13.046	21.698
Prob (Sargan)	0.491	0.733	0.417
AR (1):z	-4.609	-4.761	-4.526
P-value	0.000	0.000	0.000
AR (2):z	1.613	1.305	1.621
P-value	0.107	0.192	0.105
No. of group	35.000	33.000	35.000
No. of Inst	34.000	26.000	30.000
Observations	930	874	931

Note: L.lngrowthdex is the lag of the log of inclusive growth, lnfinstdex is the log of financial institution development, lnfinstdex2 is the square of the log of financial institution development, lnfmktdex is the log of financial market development, lnfmktdex2 is the square of the log financial market development, lnfindevdex is a log of overall financial development, lnfindevdex2 is the log of the square of overall financial development. Inopn denotes the log of trade openness. Inrem represents the log of remittances, Ingcf is the log of gross capital formation, Ingfce represents general government final consumption expenditure, lnfdi is the log of foreign direct investment. *** represents the 1% significance level, and ** denotes a 5% significance level.

Source: Field data (2023)

From Table 44, the lag of the inclusive growth (L.lngrowthdex) is positive and statistically significant at 1% in all three models. This implies that the past levels of inclusive growth influence the present values and that the benefits transcend beyond the current year.

In model THD 1, while the linear term of financial institution development (lnfinstdex) is statistically significant at a 10% significance level, the quadratic form ($lnfinstdex^2$) is statistically insignificant. This signifies that the relationship between financial institution development and inclusive growth is linear and not non-linear. This suggests that the relationship between financial institution development and inclusive growth in SSA is not non-linear but linear. Further, the results reveal that a unit increase in financial institution development will cause a 0.096 increase in inclusive growth. This indicates that the more the development in financial institutions in SSA, the better the chances of making more vigorous strides towards achieving inclusive growth.

Financial institutions are crucial to achieving inclusive growth as they increase access to credit and enable households to start their businesses and expand existing businesses. This leads to a reduction in unemployment and thus increases employment and incomes. The findings in this study support the findings of Ayyagari et al. (2016). Similarly, an increase in employment due to access to credit increases income, which helps to reduce poverty, close the widened income gap and foster local-level economic growth, especially for underserved communities. This is confirmed by Donou-Adonsou and Sylwester (2016). Furthermore, an increase in incomes due to the development of financial institutions enhances the ability of economic agents such as the government and individuals to invest in education. This eventually increases enrolment in schools and hence fosters human capital development. This aligns with the findings of Musah and Aawaar (2022).

Moreover, from model THD 2, whereas the linear term of financial market development is statistically significant, the quadratic term does not indicate that the relationship between financial market development and inclusive growth is linear and not non-monotonic. The result further reveals that a unit per cent increase in financial market development will stimulate inclusive growth by 0.058 in SSA. This implies that the more financial markets in SSA development, the more they will contribute to improving citizens' economic well-being and living standards. Several factors could explain why financial market development results promote inclusive growth. Financial markets provide opportunities for businesses to raise capital to expand their operations and create more jobs. Expanding business operations increases productivity, resulting in a high GDP per capita. Also, through job creation, unemployment is reduced, and incomes are generated, which helps to reduce poverty, provide access to better healthcare, and sponsor education, which in turn helps improve citizens' overall well-being. Borisova, Ellul and Sevilir (2021) support this finding.

Furthermore, from model THD 3, while the linear term of overall financial development is positive and statistically significant, the quadratic term is statistically insignificant. Therefore, the relationship between financial development and inclusive growth is linear and not non-monotonic. Notably, a one-unit increase in overall financial development will improve inclusive growth by 0.072. In other words, the combined effect of development in financial institutions and markets helps achieve inclusive growth in SSA. This, therefore, indicates that the development of the financial sector in SSA is crucial for achieving inclusive growth. This finding supports Asongu and Nting (2021).

It is worth emphasizing that from the results from models THD1, THD 2 and THD 3; financial development has yet to reach the threshold level beyond which its positive contribution to inclusive growth will become negative. Subsequently, the findings of this study could not confirm the proposition of the too-much finance hypothesis between financial development and inclusive growth in SSA.

The positive linear relationship between financial development and inclusive growth in SSA underscores the relevance of financial development to the SDGs, United Nations Agenda 2030 and African Union Agenda 2063. This is because inclusive growth must first be achieved to achieve the above goals, for which adequate financial development is required. This further suggests that economies in SSA must give critical attention to their financial sectors if they seek to achieve their inclusive growth targets.

Chapter Summary

This chapter sought to ascertain whether there is a threshold effect between financial development and inclusive growth in SSA. The proxies for financial development used were financial institution development, financial market development, and overall financial development, and results are presented under three models, THD 1, THD 2 and THD 3. For each of them, a positive and linear relationship was found with inclusive growth, as the squared term for each of the proxies of financial development was statistically insignificant, indicating no non-monotonic relationship between financial development and inclusive growth.

CHAPTER SEVEN

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Introduction

This chapter presents the concluding part of this study. The chapter summarises the study, key findings, conclusions, recommendations and contributions to literature, policy, and suggestions for future studies.

General Summary

This study sought to investigate the effect of natural disasters on financial development and inclusive growth in SSA, for which five specific objectives were set. First, the study examined natural disasters' effect on financial development. The second objective was to assess the moderating role of stage development of countries on the relationship between natural disasters and financial development. Thirdly, the study investigated the effect of natural disasters on inclusive growth. The fourth objective evaluated the moderating role of a country's development stage on the relationship between natural disasters and inclusive growth. The fifth objective ascertained whether there is a threshold effect between financial development and inclusive growth. In this study, the natural disasters considered were floods, droughts, storms and a composite of the three to determine the overall effect of natural disasters on financial development and inclusive growth.

Also, financial development consists of financial institutions, financial markets, and overall financial development. A composite index of real per capita GDP Growth, health and demographics, labour force and employment, education, poverty and inequality was developed for inclusive growth. The study used 35 out of the 48 countries in SSA from 1990-2019. It employed a quantitative research approach using econometric models to empirically analyse data drawn from IMF, EM-DAT, World Bank, and World Inequality Data. The System-GMM estimator was employed to empirically analyse data using STATA 14.2.

Summary of key findings

Natural Disasters and Financial Development

Regarding objective one, it was found that all the indicators of natural disasters negatively affected financial development with varied magnitudes. Among the three most prevalent and impactful natural disasters in SSA, the following were the key findings:

Financial institution development

Floods caused a decline of 0.020, drought, 0.087, and storms, 0.015. Drought was the most impactful, followed by floods and then storms.

Financial market development

Floods caused a decline of 0.022, drought, 0.039 and storms, 0.016. Droughts caused a significant adverse effect on financial markets, followed by floods and storms.

Overall financial development

Floods caused the most significant negative impact of 0.063, drought followed with 0.052, then storms with 0.070. Floods cause the most significant impact on overall financial development, followed by drought and storms.

The aggregate effect of natural disasters on financial development

Aggregate natural disasters (floods, droughts and storms combined) caused a decline of 0.038 in financial institution development, 0.030 in financial market development, and 0.040 in overall financial development.

Natural disasters, stage of development and financial development

Under objective two of this study, various models were estimated using low-income, lower-middle, and upper-middle-income categories. Their results were compared under financial institution development, financial market development and overall financial market development. The introduction of the interaction term did not alter the negative relationship between natural disasters and financial institution development in SSA: floods, drought, storms and their composite.

Financial institution development

i. Between lower-middle-income and upper-middle-income countries, whereas a moderation effect was found for the lower-middle-income country category among all measures of natural disasters and financial institution development, upper-middle-income countries only moderated the relationships between drought and aggregate natural disasters and financial institution development.

ii. Between low-income and upper-middle-income countries, while the low-income country category moderated the negative relationship between all indicators of natural disasters and financial institution development, no such effect was found for upper-middle-income countries

iii. Between low-income and lower-middle-income countries, even though, among the low-income category, a moderation effect was found for all measures of natural disasters, among lower middle-income countries, moderation existed only for floods and storms.

Financial market development

i. Between lower-middle-income and upper-middle-income countries, whereas a moderation effect was found from lower-middle-income countries across all measures of natural disasters, none was found for upper-middle-income countries.

ii. Between low-income and upper-middle-income countries, moderation effect for low-income countries for droughts, storms and aggregate natural disasters. Upper middle-income countries only moderated the effect of floods.

iii. Between low-income and lower-middle-income countries, whilst low-income countries moderated the effects of all natural disasters, lower-middle-income countries only moderated the effects of floods, storms and aggregate natural disasters.

Overall financial development

i. Between lower-middle-income and upper-middle-income countries, lower-middle-income countries only moderated the effects of floods, droughts and aggregate natural disasters. Upper middle-income countries only moderated the effect of storms.

ii. Between low-income and upper-middle-income countries, whilst low-income countries moderated the effects of all-natural disasters, upper-middle-income countries only moderated the effects of floods.

iii. Between low-income and lower-middle-income countries, even though low-income countries moderated the effects of all-natural disasters, lower-middle-income countries only moderated the impacts of floods, droughts and aggregate natural disasters.

Natural Disasters and Inclusive Growth in SSA

The third objective of the study sought to ascertain the effect of natural disasters on inclusive growth in SSA. The key findings are that floods caused an adverse effect of 0.454, droughts caused 0.204, and storms caused 0.188. Aggregate natural disasters negatively affected inclusive growth, causing a negative effect of 0.388. Among the different natural disasters, floods constitute a significant threat to inclusive growth, followed by droughts and storms.

Natural disasters, stage of development and inclusive growth in SSA

The study's fourth objective ascertained whether the development stage moderated the relationship between natural disasters and inclusive growth in SSA. Low-income, lower-middle income and upper-middle income were used as moderators in this study. Introducing interaction terms did not alter the negative relationship between natural disasters and inclusive growth. The significant findings are as follows:

i. Between lower and upper-middle-income countries, whereas lower-middle-income countries only moderated the effect of floods, upper-middle-income countries moderated the effect of floods, droughts and aggregate natural disasters.

ii. Between low-income and upper-middle-income countries, even though low-income countries moderated the effects of floods, droughts and storms, upper-middle-income countries only moderated the effects of natural disasters.

iii. Between low-income and lower-middle-income countries, categories moderated the effects of all natural disasters on inclusive growth.

Threshold effect between financial development and inclusive growth in SSA

The study found that the relationship between all measures of financial development and inclusive growth is positive, linear, and not non-monotonic. Regarding the contributions to inclusive growth, the study found that financial institution development stimulates inclusive growth by 9.6%, financial market development by 5.8% and overall financial development by 7.2%

Conclusions

Based on the findings of the study, the following conclusions have been drawn:

Firstly, based on the findings of objective one, that all natural disasters hurt all measures of financial development, it can be concluded that natural disasters threaten all forms of financial development in SSA. This means the benefits derived from the financial sector could dwindle as the frequency of natural disasters increases. This has negative implications on total local and national productivity, poverty reduction, inequality, human capital development, unemployment, asset allocation and many other sectors of SSA.

Although all-natural disasters negatively affect financial development, considering the individual effects on the two separate components of financial development, it can be concluded that droughts pose a significant threat to the development of both financial institutions and financial markets, followed by floods and storms. However, when financial development is considered composite, floods are most destructive to overall financial development in SSA, followed by droughts and storms.

Also, based on the findings of objectives two and four, it can be concluded that possessing superior financial resources does not necessarily position a country to mitigate the impact that natural disasters can have on affected regions. The study results revealed that, on average, upper-middle-income countries' response to moderation was poor across all measures of natural disasters. However, they are more resourced in terms of finances and technology. On the converse, low-income and lower-middle-income countries performed better in reducing the impact of natural disasters. This means factors other than financial strength contribute to reducing the effects of natural disasters. It can, therefore, be concluded that being more developed does not automatically promise immunity to the impact of natural disasters; deliberate effort is required to invest in resilience to natural disasters.

Based on the findings of objective three, it can be concluded that natural disasters can threaten the achievement of inclusive growth in SSA. This means natural disasters can impoverish the people of SSA and worsen the problems of poverty and inequality, and health challenges, reduce access to education, and aggravate the already existing unemployment issues. Further, this implies that natural disasters can make achieving SDGs difficult for countries in SSA. If SSA seeks to have a sub-region where the benefits of growth are equitably shared, resilience and adaption to natural disasters must become one of the top priorities.

Again, based on the findings of objective five, it can be concluded that the financial sector is critical for attaining inclusive growth in SSA. Explicitly, all structures of the financial system, that is, institutions, markets and their composite, had a positive effect on inclusive growth, signalling that the more the financial sector grows, the more benefits citizens can derive from the sector and hence improve the economic well-being of its citizens. The growth in the financial sectors will result in more business opportunities, access to better health care, more students in school and hence quality in human capital, all of which will improve SSA's living standard.

Recommendations of the Study

Natural disasters, financial development and inclusive growth

Based on the findings of this study, several recommendations are proffered to help mitigate the impact of natural disasters on financial development and inclusive growth, as well as to shore up the successes that have been made.

First, since natural disasters are exogenous and threaten financial development and inclusive growth in SSA, it is recommended that participants in the financial systems engage and deliberate on developing financial instruments that can help reduce the impact of natural disasters. For instance, governments and their relevant agencies, regulators, as well as institutions in the financial sector, insurance companies, and international financial organisations must come together to consider developing tailored financial instruments for the African continent, significantly when it has been predicted that the impact of climate change and natural disasters will worsen in the years to come. The availability of such financial instruments will make funds available to hasten recovery and reconstruction in the aftermath of natural disasters to mitigate the impact of the disasters faster.

Secondly, the study found that droughts constitute the most impact threat to both financial markets and institutions in SSA. It is therefore recommended that investment be made by both the financial sector players and governments into research into drought-resistant agricultural practices. Efforts to increase sponsorship given by financial institutions for researching drought-resistant seedlings and efficient management systems should be encouraged to reduce the impact of droughts.

On the part of the government, there is a need to facilitate programmes aimed at helping those involved in the agricultural sector diversify the sources of their incomes. In this case, businesses can continue their operations, and individuals can reduce the negative impact of droughts on these economic agents.

Moreover, it is recommended that critical attention be paid to the other factors that help to moderate the effect of natural disasters and other financial resources. This study found that possessing financial resources does not provide immunity because, on average, low-income and lower-middle-income countries moderated the effect of natural disasters better than those in the upper-middle-income brackets. This shows that other things help moderate the impact of natural disasters, which must be given attention.

Further, since the stage of development significantly moderated the relationships for most of the models, it is recommended that policies to address the negative effect of natural disasters on financial development and inclusive growth must consider the stage of development.

Financial development and inclusive growth

It is also recommended that financial sector regulators become ardent with their regulatory and supervisory roles to ward off any unfair and fraudulent practices that will affect the credibility of SSA's financial system.

The more confident investors and patrons of the financial systems are, the more they will interact with and thus engender development. The development of the financial systems will subsequently stimulate inclusive growth because of increased access to financial services.

Moreover, regarding the positive contributions of financial development to inclusive growth, governments and regulators should be committed to ensuring the stability of their economies and financial systems. This reduces the risk perception that investors form about their financial markets and attracts them to participate in markets, making funding available for allocating to the productive sector to enhance total local and national production output.

Furthermore, the cost of credit should be attractive so businesses and individuals can access it to facilitate their economic activities and other socially required needs. It is not advocated that the cost of credit should be so cheap; rather, it should be competitive and reflect the prevailing market conditions so that the repayment will not become an albatross for businesses and individuals.

Contributions of the study

Based on this study's findings, many contributions are made to extant literature, policy, methods and practice.

Firstly, this study is the first to empirically investigate the effect of natural disasters on financial development in SSA. Not only that, it is also the first to examine the disaggregated impacts of the most prevalent and impactful natural disasters on the two essential components of the financial system of the sub-region. Even though some earlier studies had investigated the effect of natural disasters on financial development, they were not peculiar to SSA. This thesis fills the gap regarding the absence of the impact of natural disasters on financial development in the sub-region. More so, extant studies studied the effects of natural disasters on financial markets or financial institutions, but not as comprehensively. In this study, financial institutions, financial markets and overall financial development were factored into the analysis. Subsequently, readers and policymakers of this study will better appreciate how floods, droughts, storms and aggregate natural disasters separately and holistically affect financial institutions, financial markets and overall financial development in SSA. Therefore, this study's findings can serve as the basis for target policies. Again, this thesis has provided the background for future studies investigating the effect of different natural disasters on financial markets, institutions and overall financial development in other jurisdictions.

Secondly, from the findings on objective one, some empirical evidence has been given to underscore the fact that natural disasters can influence financial development, especially in more exposed regions. The study's results have shown that natural disasters should be considered in addition to the already established factors that affect financial development, especially in SSA. From the findings, the study has shown that as the world faces the growing threat of climate change and its associated natural disasters. Natural disasters should therefore, be factored into any deliberations geared toward stimulating the development of the financial sectors of affected regions.

Furthermore, although SDG 11.5 explicitly points out that natural disasters threaten the realisation of inclusive growth, studies still need to be empirically undertaken in Africa. Earlier studies mostly estimated the effect of natural disasters on economic growth or individual components of inclusive growth, such as education and employment. This thesis, however, is the first to examine the effect of natural disasters on inclusive growth as a composite made up of real GDP per capita growth, education, health and demographics, inequality and poverty reduction and labour force and employment, thus giving a comprehensive view on how natural disasters affect inclusive growth in SSA. The study provides insight into how different natural disasters, namely floods, droughts and storms, affect inclusive growth and the extent of impacts so that mitigation mechanisms and strategies can be prioritised regarding policy and resource allocation.

Furthermore, the findings of this study are necessary for reconsidering the tenets of the Event Systems Theory (EST). The third assumption of the theory states that the extent of the impact of an exogenous shock on an entity is dependent on the level of development of the entity at the time the shock occurred. This assumption suggests that once an entity is at the infantile stage of development at the time of a shock, it becomes entirely vulnerable and cannot extricate itself from the impact of the shock. Also, it further assumes that the more developed entities can deal with external shocks better because they may be more resourced. Nonetheless, this study found that even though low-income and lower-middle-income countries lack adequate resources relative to upper-middle-income countries, they mitigated the effect of natural disasters on financial development and inclusive growth better than upper-middle-income countries. This, therefore, suggests that it is not always the case that exogenous shocks could leave a least resourced entity entirely vulnerable and a more developed entity less impacted. A caveat could be added that the extent of knowledge of the shock, the proactivity of the affected entity and the availability of external support to the entity are essential to determining the degree of impact of the stock.

This study improves previous studies using more comprehensive financial development indicators, the IMF's (2016) index. Unlike earlier studies that employed single indicators, the IMF index provides a more precise insight into how natural disasters affect financial development in SSA. This knowledge is relevant to ascertain how natural disasters influence financial development.

Also, this study augments the evaluation of natural disasters by employing the Lifeyears Index, a composite index comprising mortality, morbidity, and economic damages. Unlike the approaches that use individual indicators, the Lifeyears Index offers a more comprehensive insight into the overall impact that natural disasters can have in exposed regions.

Furthermore, SSA has more financial institutions than the financial market. Moreover, even though the financial markets are small and least developed relative to financial institutions, it does not imply they matter less when achieving inclusive growth. By decomposing financial development into financial institution development, financial market development, and overall financial development, this study has shown that all measures of financial development, not just financial institutions, play significant roles in fostering inclusive growth. This highlights the relevance of giving attention to both financial institutions and markets to encourage inclusive growth.

In practice, the findings that natural disasters affect all indicators of financial development indicate that financial institutions, financial markets and their regulators are all at risk. These findings provide information for necessary action to be taken before, during and after natural disasters.

Suggestions for Future Research

This study restricted itself to the structures of financial sectors, that is, financial institutions development and financial markets development as well as overall financial development in SSA. Future studies can look at how natural disasters affect each of the dimensions of financial development, such as access, depth, efficiency and stability in SSA. Moreover, future studies can extend the investigations to cover the whole of Africa. Furthermore, this study used income groupings as moderators to examine the effect of natural disasters on financial development and inclusive growth in SSA. Further studies can consider other measures of economic well-being such as human capital index and the level of infrastructure or the institutional quality as moderators. Also, follow-up studies can look into the impact of financial development on inclusive growth among the income group and compare outcomes. Moreover, future studies can examine the moderating role of financial development on the relationship between natural disasters and inclusive growth in SSA.

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APPENDICES

APPENDIX A

Effect of different types of natural disasters on financial institution in SSA

Dependent Variable: Financial Institution

	Model 1b1	Model 1b2	Model 1b3	Model 1b4
L.FINSTDEX	0.861***	0.697***	0.961***	0.924***
	(0.027)	(0.048)	(0.033)	(0.042)
FLOOD	-0.020*			
	(0.011)			
DROUGHT		-0.087***		
		(0.018)		
STORM			-0.015***	
			(0.004)	
NDA				-0.038*
				(0.019)
Control				
lnGDPPC	0.018**	0.013**	-0.004	-0.008**
	(0.008)	(0.005)	(0.004)	(0.003)
lnrem	-0.000	-0.003***	0.003***	0.006***
	(0.001)	(0.001)	(0.001)	(0.001)
lnrate	0.006**	0.003	0.003	0.010
	(0.002)	(0.003)	(0.003)	(0.006)
lnopn	0.001	0.007	0.013**	0.024*
	(0.008)	(0.006)	(0.006)	(0.014)
lncpi	0.000	0.002***	0.000	0.001*
	(0.001)	(0.000)	(0.000)	(0.000)
lnreserv	-0.020***	-0.012**	0.011**	-0.011
	(0.004)	(0.005)	(0.005)	(0.009)
DEV=1	-0.025*	-0.002	0.011	0.015***
	(0.014)	(0.006)	(0.006)	(0.006)
DEV=2	-0.021	0.048***	0.020**	0.051***
	(0.019)	(0.012)	(0.010)	(0.012)
Diagnostic				
Wald Chi2	873470.10	13322.76	10667.91	29455.66
P(Wald)	0.000	0.000	0.000	0.000
AR(1):z	-3.177	-3.827	-3.025	-3.106
P-values	0.001	0.000	0.002	0.002
AR(2)	0.866	-0.553	0.918	0.407
P-values	0.387	0.580	0.359	0.684
Sargan Chi2	13.147	14.742	12.227	20.584
Prob(Sargan)	0.591	0.544	0.662	0.195
No. of grps	30	30	30	30
No. of Inst	26	27	26	27
No. of Obs	865	865	865	865

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

APPENDIX B

Moderating effect of stage of development of the relationship between natural disasters and financial institutions in SSA-Lower Middle and Upper Middle Income

Dependent Variable: Financial Institution Development

	Model 4b2	Model 4b3	Model 4b4	Model 4b1
L.FINSTDEX	0.698***	0.663***	0.794***	0.721***
	(0.055)	(0.071)	(0.047)	(0.056)
FLOOD	-0.185***			
	(0.049)			
DROUGHT		-0.144***		
		(0.044)		
STORM			-0.013***	
			(0.004)	
NDA				-0.095**
				(0.041)
Interaction				
LOWER	0.187**	0.169**	0.175***	0.176**
	(0.070)	(0.065)	(0.060)	(0.066)
UPPER	-0.180**	0.256*	-0.042	0.149***
	(0.072)	(0.149)	(0.162)	(0.039)
Control				
lnGDPPC	0.043***	0.011	-0.007	-0.035***
	(0.010)	(0.006)	(0.004)	(0.010)
lnrem	0.005**	-0.003*	-0.005**	0.006*
	(0.002)	(0.001)	(0.002)	(0.003)
lnrate	0.018***	0.008**	-0.010**	0.003
	(0.005)	(0.004)	(0.004)	(0.004)
lnreserv	-0.095***	-0.007	-0.007	-0.035*
	(0.019)	(0.013)	(0.006)	(0.017)
lnopn	0.011	0.012	0.008	0.040**
	(0.014)	(0.011)	(0.008)	(0.015)
lncpi	0.006***	0.003**	0.003***	0.002***
	(0.001)	(0.001)	(0.001)	(0.000)
DEV=1	-0.117***	-0.008	0.019***	0.080***
	(0.026)	(0.010)	(0.004)	(0.027)
DEV=2	-0.042	0.047**	0.049***	0.154***
	(0.035)	(0.023)	(0.016)	(0.041)
Diagnostic				
Wald Chi2	3994.72	4019.13	4096.04	1.22e+06
P(Wald)	0.000	0.000	0.000	0.000
AR(1):z	-3.944	-3.620	-3.751	-3.311
P-values	0.000	0.000	0.000	0.001
AR(2):z	-0.817	-0.666	0.996	-1.060
P-values	0.414	0.505	0.319	0.289
Sargan Chi2	12.376	11.273	14.852	11.000
Prob(Sargan)	0.576	0.664	0.388	0.686
No. of Grps	30	30	30	30
No. of Insts	27	27	27	27
No. of Obs	865	865	865	865

Source: Field data (2023)

APPENDIX C

Moderating effect of stage of Development, Natural Disaster and Financial Institution Development-low and lower middle income

Dependent Variable: Financial Institution Development

	2	3	4	1
L.FINSTDEX	0.698***	0.891***	0.845***	1.033***
	(0.055)	(0.032)	(0.033)	(0.024)
FLOOD	-0.366***			
	(0.083)			
DROUGHT		-0.228**		
		(0.104)		
STORM			-0.359***	
			(0.112)	
NDA				-0.107***
				(0.011)
Interaction				
LOW	0.180**	0.236*	0.364***	0.126*
	(0.072)	(0.119)	(0.113)	(0.065)
LOWER	0.367***	0.160	0.311**	0.026
	(0.089)	(0.104)	(0.116)	(0.033)
Controls				
lnGDPPC	0.043***	0.006*	0.014	0.019***
	(0.010)	(0.003)	(0.008)	(0.007)
lnrem	0.005**	-0.002*	-0.002	0.001
	(0.002)	(0.001)	(0.002)	(0.002)
lnrate	0.018***	0.006*	0.004*	0.014***
	(0.005)	(0.003)	(0.002)	(0.005)
lnreserv	-0.095***	-0.010**	-0.011**	-0.014**
	(0.019)	(0.004)	(0.004)	(0.006)
lnopn	0.011	-0.004	0.011*	0.004
	(0.014)	(0.008)	(0.005)	(0.010)
lncpi	0.006***	-0.001	-0.001	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)
DEV=1	0.042	-0.056***	-0.024	0.058**
	(0.035)	(0.017)	(0.016)	(0.027)
DEV=2	-0.075***	-0.050***	-0.030***	0.011
	(0.024)	(0.011)	(0.009)	(0.013)
Diagnostics				
Wald Chi2	3994.72	31920.13	19858.69	161994.00
P(Wald)	0.000	0.000	0.000	0.000
AR(1):z	-3.944	-3.325	-3.957	-3.434
P-Value	0.000	0.001	0.000	0.001
AR(2):z	-0.817	0.937	0.595	0.517
P-Value	0.414	0.349	0.552	0.605
Sargan Chi2	12.376	11.773	13.685	17.830
Prob (Sargan)	0.576	0.546	0.396	0.164
Number of groups	30	30	30	30
No of Inst	27	26	26	26
No of Obs	865	865	865	865

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

APPENDIX D

Moderating effect of stage of Development, Natural Disaster and Financial Institution Development-Low and Upper Middle Income

	1	2	3	4
L.FINSTDEX	0.903***	1.030***	0.920***	1.054***
	(0.057)	(0.036)	(0.035)	(0.045)
FLOOD	-0.090**			
	(0.035)			
DROUGHT		-0.084***		
		(0.022)		
STORM			-0.076**	
			(0.029)	
NDA				-0.078**
				(0.033)
Interaction				
LOW	0.133***	0.154***	0.079**	0.111**
	(0.048)	(0.043)	(0.029)	(0.044)
UPPER	-0.084	0.151	-0.048	-0.034
	(0.118)	(0.140)	(0.083)	(0.249)
Controls				
lnGDPPC	0.008***	0.007*	-0.003	0.001
	(0.002)	(0.003)	(0.003)	(0.003)
lnrem	-0.006***	-0.000	0.004***	0.001
	(0.002)	(0.001)	(0.001)	(0.001)
lnrate	0.000	0.005*	0.009***	0.005*
	(0.003)	(0.003)	(0.003)	(0.003)
lnreserv	-0.034***	-0.007	-0.009**	-0.012
	(0.009)	(0.004)	(0.004)	(0.008)
lnopn	0.028***	0.009**	0.016**	0.023***
	(0.008)	(0.004)	(0.006)	(0.005)
lncpi	-0.000	-0.001***	0.000	-0.001***
	(0.001)	(0.000)	(0.000)	(0.000)
DEV=1	-0.010*	0.004	-0.009	-0.007
	(0.006)	(0.006)	(0.006)	(0.008)
DEV=2	0.005	-0.021*	0.034***	-0.017
	(0.015)	(0.011)	(0.011)	(0.014)
Diagnostics				
Wald Chi2	10649.52	46621.01	77395.71	33065.62
P(Wald)	0.000	0.000	0.000	0.000
AR(1):z	-3.557	-3.473	-3.224	-3.362
P-value	0.000	0.001	0.001	0.001
AR(2):z	0.905	1.491	0.587	0.769
P-value	0.365	0.136	0.557	0.442
Sargan Chi2	11.876	18.963	16.255	17.661
Prob (Sargan)	0.538	0.124	0.236	0.171
Number of groups	30.000	30.000	30.000	30.000
Number of instruments	26.000	26.000	26.000	26.000
Number of observations	865	865	865	865

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

APPENDIX E

Effect of different types of natural disasters on financial market in SSA

Dependent Variable: Financial Market Development

	Model 1c1	Model 1c2	Model 1c3	Model 1c4
L.FMKTDEX	1.027***	0.998***	1.030***	1.112***
	(0.022)	(0.024)	(0.015)	(0.027)
FLOOD	-0.022**			
	(0.008)			
DROUGHT		-0.039***		
		(0.011)		
STORM			-0.016***	
			(0.004)	
NDA				-0.030***
				(0.009)
Control				
lnGDPPC	-0.002	-0.007***	-0.000	-0.008***
	(0.002)	(0.003)	(0.002)	(0.002)
lnrem	-0.003***	0.001	-0.004***	-0.001
	(0.000)	(0.001)	(0.000)	(0.001)
lnrate	0.011**	0.007***	0.005**	-0.007***
	(0.005)	(0.002)	(0.002)	(0.002)
lnreserv	-0.020***	-0.011***	-0.000	-0.006
	(0.002)	(0.004)	(0.002)	(0.004)
lnopn	-0.007**	0.005	0.013***	0.002
	(0.003)	(0.006)	(0.003)	(0.005)
lncpi	0.003***	0.002**	0.001*	0.001
	(0.001)	(0.001)	(0.000)	(0.001)
DEV=1	0.008**	0.014***	0.007**	0.017***
	(0.004)	(0.005)	(0.003)	(0.004)
DEV=2	-0.010	0.022**	-0.016***	-0.012
	(0.008)	(0.009)	(0.004)	(0.011)
Diagnostic				
Wald Chi2	39899.71	3599.41	26162.73	34589.18
P(Wald)	0.000	0.000	0.000	0.000
AR(1):z	-2.086	-2.139	-2.075	-2.122
P-values	0.037	0.032	0.038	0.034
AR(2)	1.623	1.605	1.580	1.630
P-values	0.105	0.109	0.114	0.103
Sargan Chi2	19.516	17.630	16.951	13.949
Prob(Sargan)	0.243	0.283	0.389	0.529
No of Grps	30	30	30	30
No. of Insts	27	26	27	26
No. of Obs	865	865	865	865

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

APPENDIX F

Moderating effect of stage of Development, Natural Disaster and Financial Market Development- Low and Lower Middle Income

Dependent Variable: Financial Market Development

	17	18	19	20
L.FMKTDEX	0.895***	0.832***	0.954***	0.994***
	(0.033)	(0.066)	(0.030)	(0.011)
FLOOD	-0.210***			
	(0.027)			
DROUGHT		-0.107**		
		(0.041)		
STORM			-0.057***	
			(0.011)	
NDA				-0.039***
				(0.005)
Interaction				
LOW	0.224***	0.145***	0.046***	0.044***
	(0.038)	(0.052)	(0.007)	(0.015)
LOWER	0.233***	0.008	0.141***	0.052***
	(0.040)	(0.054)	(0.014)	(0.015)
Controls				
lnGDPPC	-0.009**	0.003	-0.001	-0.005
	(0.004)	(0.005)	(0.003)	(0.004)
lnrem	-0.005**	-0.003*	0.002***	-0.003*
	(0.002)	(0.002)	(0.000)	(0.001)
lnrate	0.014*	0.013*	0.003	-0.006**
	(0.007)	(0.006)	(0.004)	(0.002)
lnreserv	0.004	-0.013***	0.002	0.008
	(0.004)	(0.003)	(0.007)	(0.005)
lnopn	0.031***	0.000	0.010***	0.037***
	(0.010)	(0.005)	(0.003)	(0.006)
lncpi	0.000	-0.000	0.001	0.001**
	(0.001)	(0.001)	(0.001)	(0.000)
DEV =1	-0.084***	-0.055***	0.027*	0.009
	(0.013)	(0.016)	(0.014)	(0.012)
DEV=2	-0.062***	-0.034***	0.024**	-0.002
	(0.012)	(0.009)	(0.010)	(0.005)
Diagnostic				
Wald Chi	2297.22	17863.01	151371.20	566326.71
P-value	0.000	0.000	0.000	0.000
AR(1):z	-2.170	-2.378	-2.150	-2.069
P-Value	0.030	0.017	0.032	0.039
AR(2):z	1.558	1.450	1.558	1.591
P-Value	0.119	0.147	0.119	0.112
Sargan Chi2	9.934	10.575	12.768	15.299
Prob (Sargan)	0.699	0.646	0.466	0.289
Number of groups	30	30	30	30
Number of Instruments	26	26	26	26
Number of Observations	865	865	865	865

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

APPENDIX G

Moderating effect of stage of Development, Natural Disaster and Financial Market Development-Low and Upper Middle Income

	5	6	7	8
L.FMKTDEX	0.678***	0.673***	0.719***	0.863***
	(0.044)	(0.060)	(0.032)	(0.044)
FLOOD	-0.053**			
	(0.021)			
DROUGHT		-0.078**		
		(0.036)		
STORM			-0.042**	
			(0.018)	
NDA				-0.032*
				(0.018)
Interaction				
LOW	0.031	0.066*	0.044***	0.041*
	(0.024)	(0.036)	(0.015)	(0.021)
UPPER	0.125***	0.065	-0.230**	-0.016
	(0.036)	(0.171)	(0.096)	(0.051)
Controls				
lnGDPPC	0.003	0.002	0.006*	0.002
	(0.004)	(0.005)	(0.003)	(0.003)
lnrem	-0.008***	-0.009***	-0.007***	-0.003***
	(0.001)	(0.002)	(0.002)	(0.001)
lnrate	0.010**	0.012**	0.009***	0.010
	(0.004)	(0.004)	(0.002)	(0.008)
lnreserv	-0.008*	-0.011*	-0.005	-0.022***
	(0.005)	(0.006)	(0.004)	(0.004)
lnopn	0.001	0.007	0.008*	-0.011***
	(0.004)	(0.007)	(0.004)	(0.004)
lncpi	0.001	0.002	-0.001	0.001
	(0.001)	(0.002)	(0.001)	(0.001)
DEV=1	-0.004	-0.010	-0.000	-0.004
	(0.008)	(0.010)	(0.004)	(0.005)
DEV=2	0.061***	0.072***	0.054***	0.039***
Diagnostics				
Wald Chi2	1453.59	785.26	2315.77	5106.40
P(Wald)	0.000	0.000	0.000	0.000
AR(1):z	-2.069	-2.230	-2.276	-2.135
P-Value	0.039	0.026	0.023	0.033
AR(2)	1.382	1.522	1.552	1.515
P-Value	0.167	0.128	0.121	0.130
Sargan Chi2	16.945	12.446	14.728	13.020
sarganp	0.202	0.491	0.325	0.446
Number of groups	30	30	30	30
Number of instruments	26	26	26	26
Number of Observations	865	865	865	865

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

APPENDIX H

Moderating effect of stage of development on the relationship between natural disasters and financial market development in SSA-Lower Middle and Upper Middle Income

Dependent Variable: Financial Market Development

	Model 4c1	Model 4c2	Model 4c3	Model 4c4
L.FMKTDEX	0.779^{***}	0.827^{***}	0.970^{***}	0.996^{***}
	(0.017)	(0.036)	(0.020)	(0.024)
FLOOD	-0.060^{**}			
	(0.028)			
DROUGHT		-0.105^{*}		
		(0.051)		
STORM			-0.009^{*}	
			(0.004)	
NDA				-0.093^{***}
				(0.033)
Interaction				
LOWER	0.094^{***}	0.139^{*}	0.042^{***}	0.100^{***}
	(0.031)	(0.074)	(0.010)	(0.035)
UPPER	-0.152^{***}	0.118	-0.012	0.001
	(0.038)	(0.100)	(0.008)	(0.099)
Control				
lnGDPPC	-0.013^{***}	-0.019^{***}	-0.002	-0.006
	(0.003)	(0.004)	(0.002)	(0.004)
lnrem	-0.002	0.001	-0.003^{**}	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
lnrate	0.004	0.005	0.007	0.000
	(0.004)	(0.004)	(0.007)	(0.004)
lnreserv	-0.031^{***}	-0.015^{*}	0.009^{***}	-0.008^{**}
	(0.005)	(0.008)	(0.003)	(0.003)
lnopn	0.033^{***}	0.029	0.024^{*}	0.019^{***}
	(0.012)	(0.017)	(0.013)	(0.006)
lncpi	0.003^{***}	0.003^{***}	0.000	0.002^{***}
	(0.001)	(0.001)	(0.001)	(0.001)
DEV=1	0.014	0.019^{*}	-0.001	-0.006
	(0.009)	(0.009)	(0.006)	(0.008)
DEV=2	0.084^{***}	0.073^{***}	0.003	0.003
	(0.011)	(0.015)	(0.008)	(0.014)
Diagnostic				
Wald Chi2	33177.60	149481.78	64052.15	66246.14
P(Wald)	0.000	0.000	0.000	0.000
AR(1):z	-2.498	-2.485	-2.067	-2.559
P-Values	0.012	0.013	0.039	0.010
AR(2):z	1.608	1.502	1.620	1.601
P-values	0.108	0.133	0.105	0.109
Sargan Chi2	14.225	11.117	10.803	11.009
Prob (Sargan)	0.358	0.601	0.627	0.610
No. of Grps	30	30	30	30
No. of Insts	26	26	26	26
No. of Obs	865	865	865	865

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

APPENDIX I

Effect of different types of natural disasters on overall financial development in SSA

Dependent Variable: Overall Financial Development

	Model 1a1	Model 1a2	Model 1a3	Model 1a4
L.FINDEVDEX	0.908***	0.833***	0.844***	0.777***
	(0.066)	(0.062)	(0.025)	(0.076)
FLOOD	-0.063***			
	(0.018)			
DROUGHT		-0.052*		
		(0.030)		
STORM			-0.007**	
			(0.004)	
NDA				-0.040*
				(0.022)
Control				
lnGDPPC	0.002	0.000	-0.003	-0.003
	(0.006)	(0.005)	(0.004)	(0.003)
lnrem	-0.000	-0.006*	0.002*	0.003
	(0.001)	(0.003)	(0.001)	(0.002)
lnrate	0.007**	0.004	0.005	0.007***
	(0.003)	(0.004)	(0.003)	(0.002)
lnopn	0.019***	0.021**	0.017***	-0.001
	(0.007)	(0.009)	(0.004)	(0.009)
lncpi	0.003***	0.002***	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
lnreserv	-0.012***	0.012	-0.019***	-0.020*
	(0.004)	(0.008)	(0.004)	(0.010)
DEV=1	-0.023**	0.005	0.006	0.015**
	(0.009)	(0.004)	(0.010)	(0.007)
DEV=2	0.020	0.036**	0.047***	0.069***
	(0.019)	(0.014)	(0.011)	(0.016)
Diagnostic				
Wald Chi2	12006.52	4325.60	365851.70	2679.17
P(Wald)	0.000	0.000	0.000	0.000
AR(1):z	-2.793	-3.171	-3.261	-3.034
P-values	0.005	0.002	0.001	0.002
AR(2)	1.497	1.164	1.501	1.180
P-values	0.134	0.244	0.133	0.238
Sargan Chi2	12.376	15.370	12.105	13.028
Prob(Sargan)	0.650	0.166	0.671	0.291
No. of grps	30	30	30	30
No. of Inst	26	22	26	22
No. of Obs	865	865	865	865

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

APPENDIX J

Moderating effect of stage of development of the relationship between natural disasters and financial development in SSA-Lower Middle and Upper Middle Income

Dependent Variable: Overall Financial development

	Model 4a1	Model 4a2	Model 4a3	Model 4a3
L.FINDEVDEX	0.833***	0.866***	0.910***	0.938***
	(0.053)	(0.040)	(0.063)	(0.022)
FLOOD	-0.046*			
	(0.024)			
DROUGHT		-0.078**		
		(0.031)		
STORM			-0.004*	
			(0.002)	
NDA				-0.044*
				(0.026)
Interaction				
LOWER	0.097**	0.085**	-0.018	0.159***
	(0.044)	(0.039)	(0.048)	(0.049)
UPPER	-0.169***	0.063	0.050***	-0.036
	(0.041)	(0.069)	(0.014)	(0.062)
Control				
lnGDPPC	0.005	-0.003	0.008	0.001
	(0.004)	(0.003)	(0.005)	(0.012)
lnrem	-0.003	-0.003*	-0.005***	0.002
	(0.002)	(0.002)	(0.001)	(0.002)
lnrate	0.016***	0.007**	-0.016*	0.008***
	(0.005)	(0.003)	(0.009)	(0.002)
lnreserv	0.004	-0.002	0.015***	-0.025**
	(0.005)	(0.003)	(0.002)	(0.009)
lnopn	0.024*	0.028***	0.030***	0.011*
	(0.012)	(0.005)	(0.003)	(0.006)
lncpi	0.002	0.002**	-0.001	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)
DEV=1	-0.005	-0.004	-0.014	-0.036
	(0.006)	(0.005)	(0.010)	(0.039)
DEV=2	0.046**	0.029**	-0.012	0.007
	(0.019)	(0.011)	(0.020)	(0.043)
Diagnostic				
Wald Chi2	11922.51	11728.37	208679.20	2.46e+08
P(Wald)	0.000	0.000	0.000	0.000
AR(1):z	-2.957	-3.635	-3.009	-3.447
P-values	0.003	0.000	0.003	0.001
AR(2):z	1.204	0.910	1.516	1.035
P-Values	0.229	0.363	0.129	0.301
Sargan Chi2	11.646	13.519	15.259	13.010
Prob (Sargan)	0.557	0.486	0.291	0.162
No. of Grps	30	30	30	30
No. of Inst	26	27	26	22
No. of Obs	865	865	865	865

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

APPENDIX K

Moderating effect of stage of Development, Natural Disaster and Financial Development-Low and Upper Income

Dependent variable: overall financial development

	9	10	11	12
L.FINDEVDEX	0.850***	0.897***	0.950***	0.898***
	(0.109)	(0.028)	(0.031)	(0.045)
FLOOD	-0.142***			
	(0.036)			
DROUGHT		-0.100***		
		(0.033)		
STORM			-0.076***	
			(0.027)	
NDA				-0.038***
				(0.012)
Interaction				
LOW	0.202***	0.094**	0.074**	0.063***
	(0.060)	(0.037)	(0.027)	(0.022)
UPPER	0.180***	-0.168	-0.057	0.032
	(0.061)	(0.119)	(0.073)	(0.056)
Diagnostics				
lnGDPPC	0.001	-0.008***	-0.009***	0.005**
	(0.007)	(0.003)	(0.002)	(0.002)
lnrem	-0.005**	0.002***	0.003**	-0.002**
	(0.002)	(0.001)	(0.001)	(0.001)
lnrate	-0.015*	0.005***	0.007***	-0.003
	(0.008)	(0.001)	(0.002)	(0.003)
lnreserv	-0.007	-0.001	-0.001	-0.019***
	(0.015)	(0.003)	(0.003)	(0.006)
lnopn	0.024**	0.013***	0.013**	0.010**
	(0.011)	(0.004)	(0.006)	(0.005)
lncpi	-0.002*	0.000***	0.001**	-0.001***
	(0.001)	(0.000)	(0.000)	(0.000)
DEV=1	-0.029	-0.024***	-0.019***	-0.005
	(0.020)	(0.008)	(0.006)	(0.006)
DEV=2	-0.008	0.050***	0.034***	0.005
	(0.028)	(0.010)	(0.008)	(0.014)
Diagnostics				
Wald Chi2	3252.77	32653.14	48340.24	45721.42
P(Wald)	0.000	0.000	0.000	0.000
AR(1):z	-3.633	-4.401	-3.278	-3.223
P-Value	0.000	0.000	0.001	0.001
Ar(2):z	1.300	0.970	1.559	1.380
P-Value	0.194	0.332	0.119	0.168
Sargan Chi2	19.255	17.743	16.743	19.365
Prob(Sargan)	0.115	0.168	0.211	0.112
Number of groups	30	30	30	30
Number of Instruments	26	26	26	26
Number of observations	865	865	865	865

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

APPENDIX L

Moderating effect of stage of Development, Natural Disaster and Financial Development-Low and Lower income

Dependent Variable: Overall Financial Development

	21	22	23	24
L.FINDEVDEX	0.876***	1.016***	0.887***	1.031***
	(0.031)	(0.033)	(0.022)	(0.040)
FLOOD	-0.155***			
	(0.052)			
DROUGHT		-0.147***		
		(0.049)		
STORM			-0.031*	
			(0.016)	
NDA				-0.263***
				(0.085)
Interaction				
LOW	0.136***	0.101*	0.030*	0.243***
	(0.047)	(0.053)	(0.016)	(0.080)
LOWER	0.166**	0.171***	-0.001	0.397***
	(0.068)	(0.056)	(0.042)	(0.111)
Control				
lnGDPPC	-0.000	-0.015***	-0.002	-0.019*
	(0.003)	(0.005)	(0.004)	(0.010)
lnrem	-0.004*	0.003***	-0.003	0.004**
	(0.002)	(0.001)	(0.003)	(0.002)
lnrate	0.012***	0.002	-0.001	0.003
	(0.004)	(0.004)	(0.002)	(0.003)
lnreserv	0.007*	0.006**	-0.005***	-0.022*
	(0.004)	(0.003)	(0.002)	(0.011)
lnopn	0.027**	0.019***	0.024**	0.024**
	(0.010)	(0.006)	(0.010)	(0.011)
lncpi	0.001	0.000	-0.001	0.001
	(0.001)	(0.000)	(0.001)	(0.001)
DEV=1	-0.043***	-0.047***	-0.051***	-0.034
	(0.014)	(0.014)	(0.018)	(0.025)
DEV=2	-0.037**	-0.020***	-0.033***	-0.019
	(0.014)	(0.005)	(0.009)	(0.013)
Diagnostics				
Wald Chi2	2886.15	213588.18	2.93e+08	14616.47
P(Wald)	0.000	0.000	0.000	0.000
Sargan	13.280	17.221	16.075	6.721
Prob (Sargan)	0.426	0.189	0.519	0.666
AR(1):z	-3.005	-3.731	-3.188	-3.577
P-Value	0.003	0.000	0.001	0.000
AR(2):z	1.627	1.596	1.637	1.241
P-Value	0.104	0.110	0.102	0.215
Number of groups	30	30	30	30
Number of instruments	26	26	30	22
Number of Observation	865	865	865	865

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

APPENDIX M

Effect of different types of natural disasters on inclusive growth in SSA

Dependent Variable: Inclusive growth

	INC 1	INC 2	INC 3	INC 4
L.lngrowthdex	0.755***	0.712***	0.999***	0.816***
	(0.086)	(0.115)	(0.056)	(0.132)
FLOOD	-0.454***			
	(0.155)			
DROUGHT		-0.188*		
		(0.108)		
STORM			-0.204***	
			(0.069)	
NDA				-0.388***
				(0.133)
Control				
lnrem	-0.004	-0.000	0.001	0.000
	(0.009)	(0.004)	(0.004)	(0.006)
lnopn	-0.051*	-0.064*	-0.138**	-0.095*
	(0.028)	(0.036)	(0.060)	(0.051)
lngcf	0.049**	0.001	0.030	0.010
	(0.019)	(0.026)	(0.031)	(0.036)
lngfce	0.057	0.004	-0.040	-0.063
	(0.039)	(0.027)	(0.048)	(0.044)
lnfindevdex	-0.070*	-0.170**	0.127***	-0.156**
	(0.037)	(0.066)	(0.035)	(0.076)
DEV=1	-0.005	0.105**	-0.132*	0.127**
	(0.035)	(0.043)	(0.065)	(0.055)
DEV=2	0.165**	0.178*	0.185**	0.215*
	(0.075)	(0.094)	(0.080)	(0.108)
Diagnostic				
Wald Chi2	3.62e+07	91047.64	412965.73	49700.46
P(Wald)	0.000	0.000	0.000	0.000
AR(1):z	-3.962	-4.519	-5.115	-4.115
P-values	0.000	0.000	0.000	0.000
AR(2)	1.449	1.407	1.326	1.110
P-values	0.147	0.159	0.185	0.267
Sargan Chi2	13.375	13.671	15.434	10.928
Prob(Sargan)	0.645	0.623	0.493	0.535
No. of Grps	35	35	35	35
No. of Inst	26	26	26	22
No. of Obs	1004	1004	1004	1004

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

APPENDIX N

Moderating effect of stage of Development, Natural Disaster and Inclusive Growth-low and lower middle income

Dependent Variable: Inclusive growth

	INC 13	INC 14	INC 15	INC 16
L.lngrowthdex	0.779***	0.675***	0.870***	1.030***
	(0.083)	(0.085)	(0.093)	(0.153)
FLOOD	-0.917***			
	(0.302)			
DROUGHT		-0.872***		
		(0.254)		
STORM			-1.072***	
			(0.384)	
NDA				-0.309*
				(0.165)
Interaction				
LOW	0.685**	1.015**	1.084***	0.647**
	(0.274)	(0.450)	(0.379)	(0.290)
LOWER	1.207***	0.565*	0.848*	1.199***
	(0.337)	(0.298)	(0.486)	(0.335)
Control				
lnrem	-0.004	0.004	-0.011**	-0.005
	(0.010)	(0.016)	(0.005)	(0.009)
lnopn	0.014	-0.122***	0.005	0.029
	(0.033)	(0.037)	(0.031)	(0.031)
lngcf	-0.094**	-0.045	-0.054**	-0.072**
	(0.039)	(0.029)	(0.025)	(0.033)
lngfce	0.062*	0.147**	-0.056*	0.118**
	(0.031)	(0.064)	(0.031)	(0.047)
lnfdi	0.026**	0.040***	0.012**	0.030**
	(0.011)	(0.013)	(0.005)	(0.011)
lnfindevdex	0.061	-0.012	0.050*	-0.035
	(0.039)	(0.023)	(0.027)	(0.031)
DEV=1	0.053	0.100	0.023	0.130
	(0.091)	(0.077)	(0.028)	(0.092)
DEV=2	-0.048	0.078**	0.038	0.000
	(0.048)	(0.034)	(0.030)	(0.046)
Constant	1.033**	1.388***	0.871	-0.531
	(0.492)	(0.376)	(0.528)	(0.683)
Wald Chi2	815519.30	163502.30	88141.42	1.67e+07
P(Wald)	0.000	0.000	0.000	0.000
AR(1):z	-4.805	-4.589	-4.851	-3.182
P-Value	0.000	0.000	0.000	0.001
AR(2): z	0.404	1.528	1.470	0.671
P-Value	0.686	0.126	0.142	0.502
Sargan Chi2	13.572	13.431	15.059	14.886
Prob (Sargan)	0.697	0.707	0.591	0.604
Number of groups	35	35	35	35
Number of instruments	30	30	30	30
Number of Observations	931	931	931	931

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

APPENDIX O

Moderation effect of stage of development on the relationship between Natural Disasters and Inclusive Growth -Low and Upper Middle Income

Dependent Variable: Inclusive Growth

	INC 9	INC 10	INC 11	INC 12
L.lngrowthdex	0.799***	0.727***	0.556***	0.782***
	(0.034)	(0.057)	(0.081)	(0.111)
FLOOD	-0.784**			
	(0.374)			
DROUGHT		-0.528***		
		(0.176)		
STORM			-0.713**	
			(0.270)	
NDA				-0.549*
				(0.275)
Interaction				
LOW	0.863**	0.454*	0.700**	0.477
	(0.384)	(0.236)	(0.270)	(0.361)
UPPER	0.168	0.440	-1.027*	2.275**
	(0.690)	(0.305)	(0.606)	(0.972)
Control				
lnrem	-0.020**	-0.012**	-0.002	-0.002
	(0.009)	(0.005)	(0.004)	(0.008)
lnopn	0.017	-0.053**	-0.005	-0.189**
	(0.034)	(0.024)	(0.028)	(0.083)
lngcf	-0.076***	-0.037	-0.083***	-0.047*
	(0.027)	(0.024)	(0.024)	(0.027)
lngfce	-0.049	-0.072*	0.048**	0.080
	(0.048)	(0.036)	(0.021)	(0.078)
lnfdi	0.023*	0.016**	0.027**	0.045***
	(0.012)	(0.006)	(0.010)	(0.015)
lnfindevdex	0.021	0.041**	-0.003	0.064*
	(0.042)	(0.020)	(0.014)	(0.034)
DEV=1	-0.097	0.002	-0.015	0.063
	(0.074)	(0.035)	(0.019)	(0.060)
DEV=2	-0.041	-0.067**	-0.086**	-0.162**
	(0.051)	(0.028)	(0.039)	(0.062)
				(0.972)
	(0.269)	(0.370)	(0.348)	(0.545)
Diagnostics				
Wald Chi2	99098.18	6.66e+06	947999.63	47100.60
P(Wald)	0.000	0.000	0.000	0.000
AR(1):z	-3.460	-4.706	-4.778	-3.863
P-Value	0.001	0.000	0.000	0.000
AR(2):z	1.060	0.885	1.292	1.069
P-Value	0.289	0.376	0.196	0.285
Sargan Chi2	15.746	14.036	14.231	9.896
P-Value	0.542	0.665	0.651	0.702
No. of grps	35	35	35	35
No. of instruments	30.000	30.000	30.000	26.000
No. of Observations	931	931	931	931

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

APPENDIX P

Moderating effect of stage of development on the relationship between natural disasters and inclusive growth in SSA-Lower Middle and Upper Middle Income

Dependent Variable: Inclusive Growth

	INC 5	INC 6	INC 7	INC 8
L.lngrowthdex	0.617***	0.756***	0.550***	0.677***
	(0.112)	(0.082)	(0.129)	(0.109)
FLOOD	-0.583***			
	(0.213)			
DROUGHT		-0.282***		
		(0.050)		
STORM			-0.106**	
			(0.046)	
NDA				-0.325**
				(0.152)
Interaction				
LOWER	0.722**	0.693	0.154	0.013
	(0.322)	(0.427)	(0.219)	(0.154)
UPPER	1.740*	0.677***	-0.306**	0.382*
	(0.888)	(0.083)	(0.144)	(0.194)
Control				
lnrem	-0.022	-0.045***	0.019**	-0.001
	(0.014)	(0.015)	(0.007)	(0.007)
lnopn	0.069	-0.017	-0.052	-0.037*
	(0.043)	(0.018)	(0.064)	(0.019)
lngcf	-0.013	-0.002	-0.103**	0.011
	(0.026)	(0.014)	(0.041)	(0.018)
lngfce	0.022	0.053	0.005	-0.002
	(0.031)	(0.059)	(0.043)	(0.038)
lnfdi	0.030**	0.030***	-0.002	0.018*
	(0.014)	(0.010)	(0.015)	(0.010)
lnfindevdex	0.186**	-0.016	0.010	0.025
	(0.087)	(0.038)	(0.078)	(0.027)
DEV=1	-0.092*	-0.063	0.060	-0.047
	(0.053)	(0.040)	(0.047)	(0.041)
DEV=2	-0.709**	-0.129*	-0.081	-0.103*
	(0.264)	(0.066)	(0.134)	(0.052)
Diagnostic				
Wald Chi2	1.47e+07	83122.34	77264.13	265948.17
P(Wald)	0.000	0.000	0.000	0.000
AR(1):z	-3.893	-4.093	-3.782	-4.279
P-values	0.000	0.000	0.000	0.000
AR(2)	0.858	0.554	1.574	1.291
P-values	0.391	0.579	0.116	0.197
Sargan Chi2	12.308	11.171	15.556	9.959
Prob(Sargan)	0.503	0.596	0.274	0.697
No. of Grps	35	35	35	35
No. of Inst	26	26.	26	26
No. of Obs	931	931	931	931

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

APPENDIX Q

Threshold Effect between financial Development and Inclusive growth

Dependent Variable: Inclusive growth

	FINSTDEX	FMKTDEX	FINDEVDEX
L.lngrowthdex	0.774***	0.796***	0.657***
	(0.061)	(0.073)	(0.073)
lnfinstdex	0.096*		
	(0.053)		
lnfinstdex2	0.011		
	(0.013)		
lnfmktdex		0.058**	
		(0.022)	
lnfmktdex2		0.002	
		(0.001)	
lnfindevdex			0.072*
			(0.042)
lnfindevdex2			-0.000
			(0.007)
lnrem	-0.031***	-0.027*	-0.026***
	(0.007)	(0.013)	(0.009)
lnopn	0.012*	-0.016	-0.004
	(0.007)	(0.015)	(0.009)
lngcf	-0.057***	-0.113***	-0.052***
	(0.016)	(0.025)	(0.019)
lngfce	0.036*	0.117*	0.039*
	(0.021)	(0.064)	(0.023)
lnfdi	0.020***	0.028***	0.019***
	(0.005)	(0.007)	(0.005)
Constant	1.044***	1.114***	1.573***
	(0.307)	(0.395)	(0.355)
Observations	930	874	931
F_p	0.000	0.000	0.000
sargan	24.496	13.046	21.698
sarganp	0.491	0.733	0.417
hansen	23.099	17.345	25.283
hansenp	0.572	0.431	0.235
artests	2.000	2.000	2.000
ar1	-4.609	-4.761	-4.526
ar1p	0.000	0.000	0.000
ar2	1.613	1.305	1.621
ar2p	0.107	0.192	0.105
j	34.000	26.000	30.000
N_g	35.000	33.000	35.000

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$