THE IMPACT OF FINANCIAL INCLUSION ON POVERTY REDUCTION IN ETHIOPIA

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DECLARATION

I, the undersigned, Mohammed Tiku Tareke, declare that this thesis titled “The impact of financial inclusion on poverty reduction in Ethiopia” and the work presented herein are entirely my original work. It is submitted in partial fulfillment of the requirements for the Master of Science in Development Economics. I confirm that no part of this thesis has been submitted for the award of any other degree at any other university or institution.

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ENDORCEMENT

This thesis has been summited to Addis Ababa university school of commerce graduate program for examination with my approval as a university advisor.

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APPROVAL SHEET

This is to certify that the thesis prepared by Mohammed Tiku, entitled *"the impact of financial inclusion on poverty reduction in Ethiopia"* and submitted in partial fulfillment of the requirement for the Degree of Master of Science in Development Economics complies with the regulations of the university and meets the accepted standards with respect to originality and quality.

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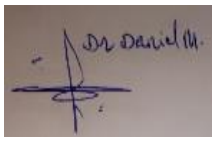
DANIEL MASRESHA(PhD)		June 20,2025
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ACRONYMS AND ABBREVIATIONS

ADF	Augmented Dickey Fuller
AIC	Akaike Information Criterion
ATM	Automated Teller Machine
ARDL	Auto Regressive Distributed Lag
BIC	Bayessian Information Criterion
ECM	Error Correction Model
ESR	Endogenous Switching Regression
FI	Financial inclusion
FIT	Financial Inclusion Theory
GDP	Gross Domestic Product
GFIF	Global Financial Inclusion Findex
HQIC	Hannan-Quinn Information Criterion
ILO	International Labor Organization
IM	Information Matrix
IMF	International Monetary Fund
IRFs	Impulse Response Functions
SMEs	Small and Medium Enterprises
VAR	Vector Auto Regression
VECM	Vector Error Correction Model
WDL	World Development Indicators
WB	World Bank

ABSTRACT

Ethiopia, a country with high poverty levels and a rapidly growing population, is actively promoting financial inclusion as a strategy for poverty reduction. The study uses a time series data analysis approach to quantify the impact of specific financial inclusion indicators on poverty reduction and identify channels through which they operate. The study fills a critical knowledge gap in the Ethiopian context by offering a nuanced understanding of how financial instruments impact poverty reduction. ARDL and Granger causality model is used to examine the relationship between financial inclusion and poverty reduction over a 30-year period. The analysis reveals a significant negative long-run relationship between the Poverty and independent variables. The findings emphasize that structural improvements in education and access to financial services are key to sustainable poverty reduction in Ethiopia. The study recommends Ethiopia's sustainable poverty reduction through education, risk mitigation, credit access strategies, mobile technology, and an integrated strategy. It emphasizes the importance of education, addressing barriers like school fees and cultural factors. The study also suggests lowering insurance costs, improving financial literacy, and using credit effectively. It also suggests an integrated strategy that connects financial inclusion, education, and socioeconomic elements. The paper advocates for long-term structural investments in key sectors and policies for long-term implementation. In conclusion, this research provides evidence-based insights to guide policymakers, evaluate government initiatives, assist financial institutions, and emphasize the importance of financial literacy programs in enhancing overall financial inclusion.
Key words: Ethiopia, Poverty reduction, financial inclusion

CHAPTER ONE

1 INTRODUCTION

1.1 Background of the study

Ethiopia has recently pursued aggressive financial inclusion policies as a strategy to combat poverty. This study investigates the effectiveness of these efforts by analyzing the long-term impact of financial inclusion on poverty reduction using time series data. The background explores key theoretical frameworks, global empirical insights, and the unique socioeconomic conditions of Ethiopia (Boateng, 2023).

The interrelationship between financial inclusion and poverty is supported by several key theories. The "Credit Constraint" Hypothesis" posits that access to financial services, particularly credit, enables households to overcome financial limitations and invest in high-income-generating activities, thereby boosting income and reducing poverty (Galor and Zeira, 1993). Similarly, the "Savings and Insurance" Hypothesis suggests that financial inclusion empowers individuals to save and insure against risks, building a financial buffer that protects them from adverse events that might otherwise push them into poverty (Morduch, 1995). Lastly, the "Human Capital Development" Hypothesis indicates that access to financial services can increase investments in human capital, such as education and health, leading to increased productivity and income potential, ultimately contributing to poverty reduction (Lopez-Castaño, 2019).

Poverty reduction through financial inclusion is widely recognized, with studies consistently showing its significant impact, particularly in low-income countries. Financial inclusion refers to the availability of convenient and affordable financial products and services to all individuals and businesses, aiming for inclusive growth and increased access, especially for disadvantaged populations (World Bank, 2020).

Access to financial tools like checking, savings, or term deposit accounts, as well as credit, money transfers, and insurance, has been identified as crucial for poverty re-

duction. Despite this, a significant portion of the global population remains unbanked; in 2017, approximately 1.7 billion adults worldwide lacked bank accounts, with the majority residing in developing countries with limited economic, political, and social influence. Countries across Asia and Africa, including Pakistan, Bangladesh, Ghana, Nigeria, and Uganda, still face substantial barriers to comprehensive access to financial services (Hasan and Khan, 2013).

Empirical evidence broadly supports the relationship between financial inclusion and poverty reduction, demonstrating that improved access to financial services and education leads to better saving and investment habits, which can further alleviate poverty (Demirgüç-Kunt and Levine, 2009). However, the literature is not entirely in agreement. Some studies report mixed or inconclusive results, implying that the beneficial effects of financial inclusion on poverty reduction vary by context and depend on specific factors such as the type of financial services provided, the quality of institutions, and overall economic development levels (World Bank Group, 2023).

Ethiopia, like many developing countries, has grappled with high levels of poverty for an extended period, despite considerable strides in recent decades. It faces challenges such as limited access to formal financial services and a heavy reliance on agriculture. Recognizing financial inclusion as a powerful tool to combat poverty, the Ethiopian government has launched aggressive policies aimed at expanding access to affordable and accessible financial services for individuals and small and medium-sized enterprises. These initiatives include the expansion of micro-finance institutions, promotion of mobile banking, and implementation of financial literacy programs (Aredo, 2019). The foundational idea is that financial inclusion empowers individuals and businesses with the necessary financial instruments to invest, save, and manage risk, leading to higher incomes, increased assets, and greater welfare.

Despite the acknowledged importance of financial inclusion for economic development and poverty reduction in modern economies, significant challenges persist in developing countries, particularly in Ethiopia. Scholars continue to investigate the barriers hindering the progress of financial inclusion, which include issues like low financial resources, long distances to financial institutions, high fixed costs, complex documentation processes, and underdeveloped infrastructure (Tesema, 2023). Crucially, while academic literature on financial inclusion in Ethiopia has explored aspects

like access and usage, it often overlooks the direct relationship with poverty reduction. Previous studies, such as Desalegn and Yematawy (2017), have highlighted the importance of financial inclusion but a comprehensive time-series analysis explicitly quantifying its long-term impact on poverty in Ethiopia remains underexplored. This gap underscores the need for the current research to contribute to a more complete understanding of financial inclusion's role in Ethiopia's poverty alleviation efforts.

1.2 Statement of the problem

This section delves into the specific problem statement that motivates the research on the impact of financial inclusion on poverty reduction in Ethiopia. It highlights the existing knowledge gaps, the urgency of the issue, and the need for a comprehensive analysis using time series data.

Ethiopia currently faces a persistent challenge of high poverty rates, with 23.7% of its population living below the international poverty line in 2021 (World Bank Group, 2023). This pervasive poverty significantly hinders the nation's development aspirations and impedes overall socioeconomic progress. Financial inclusion(FI), defined as the ability of individuals and businesses to access and effectively use a range of appropriate financial services, is widely recognized as a pivotal strategy for poverty reduction globally. However, the specific, nuanced impact of financial inclusion on poverty within the Ethiopian context remains inadequately understood. Existing studies often concentrate on isolated facets, such as access to credit or micro-finance, rather than providing a comprehensive analysis of various financial services (World Bank, 2020).

This study aims to quantify the long-term impact of financial inclusion on poverty reduction in Ethiopia, identify the most effective financial services, and evaluate relevant policy measures. While cross-national research generally indicates that financial inclusion can reduce poverty (Mohammed A & Kazuo I, 2017). The empirical evidence specific to Ethiopia is limited and, at times, conflicting. For instance, in 2021 Fikre (2021), study raised concerns about contextual constraints, finding only short-term impacts on poverty reduction but no significant long-term effect.

A critical limitation in the existing Ethiopian literature on financial inclusion and poverty reduction is its predominant reliance on cross-sectional data (Central Statistical Agency, 2019). While such data can reveal correlations, it is inherently insufficient for establishing causal relationships or tracking their evolution over time. This methodological gap necessitates a research design capable of disentangling these complex, dynamic relationships. Although advanced econometric techniques like Endogenous Switching Regression (ESR) can address some causality concerns. According to Lokshin, M & Sajaia Z (2004), they often rely on specific assumptions and may not fully capture the intricate, dynamic interplay between financial inclusion and poverty over time.

Furthermore, robust longitudinal analysis using time series data is crucial for inferring true long-term causal impacts (Demirgüç-Kunt A. et al, 2022).This involves observing how changes in access to and usage of financial services influence poverty trajectories within the same population over extended periods. The absence of such rigorous longitudinal studies represents a significant void in the Ethiopian context, especially as resources like the World Bank's Global Findex Database are primarily cross-sectional and thus cannot establish definitive causal links between financial inclusion and poverty dynamics. Therefore, there is an urgent need for research employing time series data and appropriate econometric methods to rigorously evaluate the long-term impact of financial inclusion on poverty reduction in Ethiopia.

Beyond data type, existing financial inclusion research often overlooks the complex interactions between different financial instruments and their combined effect on poverty reduction. Many studies narrowly focus on specific services like credit or savings, failing to consider how these interact with other crucial tools such as insurance and digital payments. This narrow focus limits a holistic understanding. For example, while Mohamed (2023), show that formal financial access improves household welfare, their study does not differentiate the specific contributions of various financial mechanisms. It remains unclear whether observed gains are primarily due to increased credit, enhanced savings, digital payment usage, or a synergy of these.

Falsini (2023), notes the low uptake of digital payments in Ethiopia but does not quantify the potential benefits of wider usage compared to traditional financial services. A more in-depth analysis is required to understand the relative effectiveness of different financial instruments in reducing poverty, considering usage intensity, specific population group needs, and potential synergies between financial services. A

holistic examination of these interacting channels is crucial for designing targeted interventions that maximize financial inclusion's impact on poverty reduction.

Finally, Ethiopia's digital finance sector is still in its early stages, characterized by low adoption of mobile money, with only 35% of adults holding formal accounts in 2017 (Melesse, S. et al, 2017). This limited adoption is compounded by significant disparities in infrastructure between rural and urban areas.

Despite the growing importance of digital financial inclusion, the precise relationship between access to these services and poverty reduction at the household level remains poorly understood. Much of the existing research, such as Arebo et al. (2024), focuses on the impact of financial inclusion on bank stability, utilizing bank-level data, which often neglects crucial household-level welfare implications. While Falsini (2023), examines Ethiopia's broader financial inclusion journey, it does not explicitly quantify the link between digital financial services and poverty reduction outcomes. Hence, further research is critically needed to investigate how digital financial inclusion can directly contribute to improving livelihoods and reducing poverty in Ethiopia.

This study aims to address several gaps in understanding the nuances of financial inclusion (FI) on poverty in Ethiopia. These gaps include a lack of comprehensive analysis of various financial services, a reliance on cross-sectional data, a lack of robust longitudinal analysis using time series data, a neglect of complex interactions between different financial instruments, and a limited understanding of the impact of digital financial inclusion at national-level data from 1994 to 2023 obtained from World Bank Development Indicators (WDI). Poverty measured by the Poverty Headcount Ratio (at $2.15 a day, 2017 PPP), while financial inclusion will be comprehensively measured by proxy indicators including the Primary Education Completion Rate, Mobile Cellular Subscriptions, Private Creditors, and Insurance in Financial Services. By quantifying the impact of these specific financial inclusion indicators on poverty reduction, identifying the channels through which they operate, and evaluating relevant policy measures, this research will enable more effective and targeted development interventions, ultimately contributing to sustainable poverty reduction in Ethiopia.

1.3 Objective of the Study

1.3.1 General Objective

The general objective of this study is to examine the impact of financial inclusion on poverty reduction in Ethiopia using a time series data analysis approach.

1.3.2 Specific Objectives

The specific objectives of this study are to:

- ❖ Assess the long term impact of financial inclusion on poverty reduction in Ethiopia.
- ❖ Assess the short term impact of financial inclusion on poverty reduction in Ethiopia.
- ❖ Examine the causal relationship between financial inclusion and poverty reduction.

1.4 Hypothesis of the Study

The study has reviewed different literature and developed hypotheses that relate financial inclusion indicators and poverty reduction measurements.

I. H_o: an increase Primary Education Completion Rate has a significant negative impact on the Poverty Headcount Ratio

   H_1: an increase Primary Education Completion Rate has a significant positive impact on the Poverty Headcount Ratio.

II. H_o: an increase Insurance in Financial Services has a significant negative impact on the Poverty Headcount Ratio.

   H_1: an increase Insurance in Financial Services has a significant positive impact on the Poverty Headcount Ratio.

III. H_o: an increase Private Creditors have significant negative impact on the Poverty Headcount Ratio.

   H_1: an increase Private Creditors have significant positive impact on the Poverty Headcount Ratio.

IV. H_o: an increase Mobile Cellular Subscriptions has a statistically significant impact on the Poverty Headcount Ratio.

   H_1: an increase Mobile Cellular Subscriptions do not have a statistically significant impact on the Poverty Headcount Ratio.

1.5 Significance of the Study

This study is crucial for policymakers, financial institutions, and development practitioners in Ethiopia. It provides evidence-based insights to guide the formulation and implementation of effective financial inclusion strategies, contributing to poverty reduction. It evaluates government initiatives, highlighting areas for improvement and suggesting necessary modifications. The study also assists financial institutions in designing innovative products and services for underserved populations, particularly low-income groups and rural communities. It emphasizes the importance of robust financial literacy programs in enhancing financial inclusion and maximizing its potential for sustainable poverty reduction.

Academically, this study makes a vital contribution by enriching the limited body of empirical research on the financial inclusion-poverty nexus within the Ethiopian context. By offering a nuanced and contextualized understanding of how various financial instruments impact poverty reduction, it helps to fill a critical knowledge gap. Furthermore, the robust empirical evidence and methodology employed in this study can serve as a valuable framework and reference for researchers investigating similar topics in other developing countries. Ultimately, by providing clear, policy-relevant insights grounded in rigorous empirical evidence, this study aims to directly support Ethiopia's broader poverty alleviation efforts and sustainable development goals, thereby fostering improved livelihoods for millions of its citizens.

1.6. Scope and Limitation of the Study

This study analyzes the impact of financial inclusion on poverty reduction in Ethiopia over a 30-year period, utilizing time series data. key indicators of financial inclusion, including credit availability and utilization, access to financial services, levels of financial literacy, and education. Poverty is measured primarily by using standardized metrics such as the poverty headcount ratio. The study relies on secondary data sourced from credible institutions such as the World Bank and other international financial and development databases. These datasets will be cleaned and standardized to ensure consistency and accuracy. The analysis aims to uncover long-term trends and causal relationships, identify effective financial inclusion channels, and assess the impact of government-led initiatives. This study has a certain limitation due to data

constraints, temporal limitations, and a lack of micro-level data. Time series data may have gaps, while the 30-year timeframe may not fully capture long-term effects of financial inclusion interventions. Additionally, the lack of household-level or community-specific data restricts the ability to assess more nuanced impacts of financial inclusion at the individual or community level. Despite these limitations, this study is expected to make a significant contribution to understanding the evolving relationship between financial inclusion and poverty reduction in Ethiopia, informing the design of targeted and evidence-based policy strategies.

1.7 Organization of the Thesis

This paper examines the impact of financial inclusion on poverty reduction in Ethiopia. The introduction part provides an overview of the global and national context of poverty and financial inclusion, focusing on Ethiopia. The research hypothesis is articulated, objectives are presented, and the research gap is defined. The second chapter explores existing academic literature on the linkages between financial inclusion and poverty, exploring economic theories. An empirical literature review presents findings from previous studies, both globally and in developing countries. The methodology chapter details the research design and analytical approaches. The conclusion summarizes the main findings, provides policy recommendations, and suggests areas for further investigation.

CHAPTER TWO

2. LITERATURE REVIEW

This literature review explores the relationship between financial inclusion and poverty reduction in Ethiopia, focusing on key theoretical frameworks, empirical evidence, and specific research. It identifies gaps in the literature and suggests time series data analysis to further understand this critical relationship.

2.1. Theoretical Literature Review

2.1.1 Key Concept and Definition of Variables

Poverty Reduction

Poverty, on the other hand, is a state of deprivation characterized by a lack of basic needs. Poverty reduction refers to decreasing the number of people living below the poverty line and improving their quality of life. Key measures of poverty include the poverty headcount ratio (the percentage of the population below the poverty line) and the poverty gap (the average distance of poor individuals from the poverty line) (World Bank, 2020).

Financial Inclusion

Financial inclusion is the process of making financial services, like savings accounts, credit, insurance, and payment systems, accessible to everyone, regardless of their income or business size. It empowers individuals and businesses by enabling their participation in the formal financial system, breaking down barriers to access. This means having access to useful and affordable financial products and services, such as transactions, payments, savings, credit, and insurance, delivered responsibly and sustainably. Key aspects of financial inclusion include financial access (the percentage of the population using services like bank accounts or mobile money) and financial literacy (understanding financial concepts). Factors like economic growth and infrastructure development can also influence financial inclusion. Financial inclusion can lead to enhanced savings, promoting financial se-

curity, and facilitated economic activities, as efficient payment systems and digital services reduce transaction costs. (Allen, F. et al, 2016)

2.1.2 Conceptualizing Poverty: A Critical Review of Theories and Indicators

In the fields of social sciences and development economics, poverty is a multifaceted, intricate problem that has changed over time. Numerous frameworks have been established to define and measure poverty, each providing a distinct perspective on what poverty is and how deprivation can be quantified and alleviated. Based on a needs-based framework, the Absolute Poverty approach defines poverty as the inability to provide for one's basic needs, including clean water, food, shelter, and basic medical care. Critics contend that this strategy, which is frequently operationalized through fixed poverty lines, is unduly restrictive and ignores social expectations and differences in living standards among societies. According to the Relative Poverty theory, people who are poor have incomes or resources that are much lower than the median or national average. This viewpoint has drawn criticism for failing to distinguish between deprivation and inequality, especially in societies with unequal income distributions, even though it more accurately depicts inequality and social marginalization (Carina and Jan , 2017).

The 1970s saw the emergence of the Basic Needs Approach, which broadened the definition of poverty to include direct access to necessities like healthcare, education, and sanitation in addition to income. The BNA can still be criticized, though, for being subjective in defining "basic needs" in a variety of cultural and geographic contexts and excessively consumption-focused (Townsend, 1979).

According to the Social Exclusion Theory, poverty is a dynamic process whereby people or groups are excluded from full engagement in political, social, economic, and cultural spheres. Although it is hotly contested in European contexts, its applicability is expanding worldwide, particularly when it comes to tackling the relational and structural aspects of poverty (Silver, 1994).

The Headcount Ratio, a frequently used metric for evaluating poverty, shows the proportion of a population that lives below a set poverty line. Welfarist economic theory, which substitutes income or consumption for well-being, forms its basis. Given that the Headcount Ratio is a threshold-based measure; it is presumed that a person is impoverished when their income falls below a specific threshold. This cutoff point can be either absolute or relative, and it is represented as a percentage

of the median income of a society. The benefits of the HCR include policy clarity, comparability, and simplicity. Because it is easy to compute, understand, and communicate, it is useful for tracking changes in poverty over time or between countries (Foster et. al, 1984).

2.1.3 Foundational Theories of Financial Inclusion

In development economics, the Financial Inclusion Theory (FIT) is an often debated notion that has developed over time through a variety of scholarly publications and reports from international organizations, therefore it does not always have a single authoritative source. Generally speaking, the idea supports the work of institutions such as the World Bank and the International Monetary Fund (IMF), as well as academics and development economists who stress the role that financial services play in lowering poverty and advancing economic growth (Beck T. et al, 2007).

Financial inclusion is a concept that ensures the accessibility and availability of financial services to all individuals and communities, particularly those who are underserved or excluded from the traditional financial system. It allows individuals to save for future needs, manage risks through insurance products, build a safety net against unexpected shocks, protect against falling into poverty, and facilitate recovery from economic setbacks. Access to savings accounts, health, life, crop, and property insurance helps individuals save for education, healthcare, retirement, and emergencies. Financial instruments like savings and insurance also provide financial security and support during difficult times, enabling individuals to cope with economic setbacks and recover more quickly. Financial inclusion plays a vital role in poverty alleviation and economic empowerment, creating a more inclusive financial system that supports sustainable development and improves the overall well-being of individuals and communities (Demirgüç-Kunt and Levine, 2009).

The **Behavioral Finance Theory**, developed by Lusardi and Mitchell (2014), is a psychological and economic approach that aims to understand how individuals make financial decisions. The key aspects of this theory include bounded rationality, heuristics and biases, financial literacy, planning and self-control, and emo-

tional and social factors**.** Individuals have limitations in their cognitive processing capabilities, leading to rational decisions. Heuristics and biases can result from mental short-cuts or heuristics used in financial decisions. Financial literacy helps individuals make informed decisions, reduces reliance on flawed heuristics, and mitigates biases. It also equips individuals with the tools to plan effectively for the future and exercise self-control, avoiding impulsive or risky financial behaviors. Emotional and social factors also play a significant role in financial decision-making, and financial literacy can help individuals recognize and manage these influences better. Enhancing financial literacy can improve decision-making processes, navigate financial complexities with confidence, and achieve better financial outcomes, supporting the principles of behavioral finance.

Atkinson and Messy (2012), discuss the Human Capital Theory, which suggests that investments in education and skills development can boost an individual's productivity and economic outcomes. Financial education is a key human capital investment**,** as it enhances financial decision-making, financial inclusion, poverty reduction, and long-term economic growth. Financial education improves individuals' understanding of financial products and concepts, leading to more informed and effective decisions regarding savings, investments, and credit use. It also increases their ability to access and utilize financial services, promoting greater financial inclusion, especially for low-income households. Financial education empowers individuals to manage their finances better, avoid costly mistakes, and make investments that improve their economic stability and growth potential, reducing poverty levels, especially among vulnerable and low-income groups. Increased financial literacy contributes to a more informed and financially capable population, leading to higher overall economic growth and stability. By investing in financial education, societies can foster greater economic inclusion and reduce poverty, creating a more equitable and prosperous environment for all members.

2.1.4 Mechanisms of Financial Inclusion for Poverty Reduction and Sustainable Development

The World Bank's (2015), report emphasizes the importance of savings and insurance in reducing poverty, particularly in developing countries where income volatility is common. Savings provide a financial cushion, enabling individuals to

manage periods of income loss or unexpected expenses without resorting to high-interest debt or selling essential assets. They also enable investment in income-generating activities, such as starting a small business or purchasing farming tools. Regular saving habits contribute to greater financial stability, enabling households to better plan and manage their economic futures. Insurance products, such as health, life, and crop insurance, provide essential protection against risks that can push families into poverty. They ensure income streams remain stable even when unexpected events occur, preventing significant drops in living standards. Insurance aids in recovery and resilience by mitigating the financial impact of adverse events. Financial inclusion efforts enhance the resilience of low-income households, support sustainable development by enabling individuals to participate more fully in economic activities, and empower individuals, especially those from marginalized communities, to take control of their financial destinies.

Holzmann and Jorgensen (2000), highlight the critical role of social insurance programs in providing a safety net for vulnerable households. Financial security is provided by programs like unemployment insurance and pensions in times of financial hardship, such as old age, job loss, or medical issues. These programs help to ensure that individuals have a stable income during periods when they cannot work, thus preventing them from falling into poverty and reducing overall poverty levels. Social safety nets are programs designed to protect vulnerable populations from poverty and social exclusion, including social insurance, social assistance, and labor market programs. Social protection includes government actions aimed at reducing poverty and increasing resilience, such as social insurance, social assistance, education services, health provisions, and housing support. Social insurance programs play a critical role in human development, providing economic security and reducing poverty, which will consequently improve health and education outcomes. These programs promote equality and social justice, since they ensure that everyone has a guaranteed access to basic economic security and thus will lower inequality within the society. Social insurance programs reduce vulnerability in that they give assurance of financial stability and reduced likelihood of falling into poverty. Further, these programs enhance resilience with their offer of financial guarantees and reduced impacts due to negative shocks. The goal of poverty reduction is to lower the number of people in poverty, and it gives finan-

cial security and lowers the risk of people falling into poverty. In the framework developed by Holzmann and Jorgensen (2000), much emphasis is placed on the importance of social insurance programs in establishing human development, fairness, and social justice.

According to McKinnon (1973), theory state that poor households often face limited access to formal credit due to high transaction costs, information asymmetry, and lack of collateral. Financial inclusion can mitigate these constraints, allowing households to access credit for productive activities, smooth consumption, and invest in education and healthcare, ultimately reducing poverty. This hypothesis posits that limited access to credit acts as a constraint for individuals and households, preventing them from investing in productive assets, expanding their businesses, or smoothing consumption during economic shocks. By increasing access to credit, financial inclusion allows individuals to overcome these constraints, boosting their income potential and mitigating poverty.

Anwar and Zaman (2018), offer an analysis of the effect that financial inclusion has on alleviating poverty. The researchers reason that through its engagement in facilitating credit, insurance, and savings account services, among other financial inclusion services, this program tends to empower individuals and households mostly marginalized ones in traditional financial systems. The outcome will be greater income stability, an increase in entrepreneurship, improvement in consumption smoothing, and comprehensive economic growth. To offer financial services to disadvantaged groups, there is a need for financial institutions, including banks, microfinance organizations, and mobile money providers. The compelling data from the study makes it clear that policy makers ought to zero in on measures designed to improve financial inclusion as part of broader efforts to fight poverty. This includes promoting financial literacy programs and bolstering inclusive financial institutions to empower individuals to use financial services.

In Roodman (2012), study critically examines the contribution that microfinance institutions (MFIs) make to the fight against poverty. By giving people access to loans and other financial services, microfinance may empower people especially women by boosting economic prospects, improving financial stability, and giving them more decision making authority. Roodman does, however, recognize the

shortcomings of microcredit initiatives in reducing poverty, including their limited ability to do so, worries about the sustainability of debt, and their emphasis on credit availability. Microfinance programs' results can vary significantly based on factors like the economy, institution quality, and borrowers' access to additional interventions. Policymakers should prioritize supporting MFIs with diverse financial products and responsible lending, and collaborate with other poverty-addressing programs to ensure they operate within the specific country context. To make sure borrowers can pay back their loans without getting into debt traps, microfinance institutions should promote ethical lending practices and concentrate on offering a variety of financial services beyond credit, such as savings, insurance, and financial education. It is necessary to conduct further study on how microfinance contributes to the elimination of poverty.

The theory brought forth in "The Role of Financial Inclusion in Sustainable Economic Development" by Andrew (2015), highlights the increase in access to and use of financial services by individuals and businesses, more so for those traditionally excluded from formal financial systems. It suggests that financial inclusion is a key driver of economic development as it empowers people and businesses with the means to participate in income generating activities, smooth consumption, manage risks, reduce poverty and inequality, and expand economic opportunities. This means that financial inclusion supports sustainable development by promoting green finance, supporting social enterprises, and ensuring responsible lending practices. The transformational role that technology plays is in the way it expands financial inclusion, because digital financial services, such as mobile banking and digital payments, significantly reduce the cost of offering financial services. The policy implications for governments and policy-makers involve developing and implementing sound financial regulatory frameworks, investing in financial infrastructure, promoting financial literacy, and collaborating with the private sector to expand financial inclusion. Summation theory also provides a strong framework for understanding the core role that financial inclusion plays in supporting sustainable economic development. By empowering people and businesses, reducing poverty and inequality, and promoting sustainable practices, financial inclusion can build a more inclusive and equitable society (Andrew, 2015).

According to National Bank of Ethiopia (2020), posits that financial institutions, such as banks and microfinance institutions, play a crucial role in the economy by acting as intermediaries between savers and borrowers. These institutions facilitate the efficient allocation of resources, support economic growth, and enhance financial inclusion. Key aspects of this theory include resource mobilization, risk management, provision of financial services, economic growth and development, and financial inclusion. Financial intermediaries collect savings from individuals and entities, pooling these resources to provide loans and credit to others. They diversify their portfolios, managing and mitigating risks, and increasing access to financial services for underserved populations. Financial intermediation supports economic development by providing the necessary financial infrastructure for businesses to grow, invest, and create jobs. It also enhances households' ability to manage their finances and invest in opportunities. The progress made in Ethiopia through the expansion of banking services, microfinance institutions, and mobile money platforms reflects the principles of the Financial Intermediation Theory, demonstrating how improved financial infrastructure and services can drive economic growth and enhance financial inclusion.

2.1.5 Policy Considerations, Challenges and Determinants of Financial Inclusion

According to World Bank (2018), the significance of financial inclusion in economic growth is emphasized in "Policy and Pitfalls in Expanding Access." It draws attention to the advantages of financial inclusion, including risk management, human capital investment, company growth, and poverty reduction. Nevertheless, the research also points out obstacles to financial inclusion, including exorbitant transaction costs, information asymmetry, and antiquated laws. In order to encourage financial inclusion, the research offers policy suggestions to governments and stakeholders. These recommendations include enhancing consumer protection, harnessing technology, fostering financial literacy, and improving the regulatory environment. By increasing awareness of the value of financial inclusion, influencing policy discussions, and fostering innovation in the financial industry, the study has had a major influence on global development. The study is

still pertinent today as initiatives to provide access to financial services and promote inclusive growth continue worldwide.

The Zins and Weill (2016), study explores the factors influencing financial inclusion across Africa. Key determinants include economic factors such as GDP per capita, economic growth, demographic factors like population density, age and education, institutional factors like quality of institutions, government policies, and technological factors like mobile phone penetration and internet access. Economic factors include GDP per capita, which correlates with greater access to financial services. Economic growth stimulates demand for financial services, creating opportunities for financial institutions to expand their reach. Demographic factors include population density, age, and education, which affect the likelihood of financial inclusion. Institutional factors include the quality of institutions, government policies, and technological factors like mobile phone penetration and internet access. Technological factors include mobile phone penetration, which has revolutionized financial inclusion in Africa, and internet access, which facilitates online banking and other digital financial services. Financial inclusion has a significant impact on economic growth and poverty reduction in Africa, enabling entrepreneurs to start and grow businesses, improve risk management, enhance savings and investment, and empower marginalized groups. A multifaceted approach is needed to address the various factors influencing financial inclusion in Africa. Policymakers and development practitioners should focus on creating an enabling environment for financial inclusion, including strengthening institutions, promoting financial literacy, and leveraging technology. This study provides valuable insights into the determinants of financial inclusion in Africa and highlights its crucial role in achieving sustainable economic growth and poverty reduction (Smith, 2023).

2.1.6 Financial Inclusion and Poverty Dynamics in Ethiopia

The findings of the study "Financial Inclusion and Economic Growth: Evidence from Ethiopia" by Ayele (2013) regarding the linkage established between financial inclusion and economic growth in Ethiopia is given precedence. The study suggests that increased availability of financial services is associated with higher economic growth rates due to the pronounced increase in household and enterprise

access to savings accounts, loans, and insurances, with a consequential greater stimulation of productive activity. Financial inclusion acts as an ally in the investment endeavor of households and businesses, empowering such institutions to invest in activities such as business expansion, education, and skills training. The study also suggests that mobile banking services offer a new avenue for creating access to finance for rural populations, where traditional banking services are sparse. The arrival of mobile banking platforms, in all their various forms, makes it easy and accessible for people to do business access services such as savings, remittances, and insurance that will allow them to participate in economic activities.

Some theoretical research in Ethiopia has also addressed the role of financial literacy in improving the impact of financial inclusion on poverty reduction. Access to financial services alone may not be sufficient to reduce poverty without a corresponding increase in financial literacy, which enables individuals to make better financial decisions. Sissay and Worku (2018), argue that financial literacy programs in Ethiopia can significantly reduce poverty. They suggest that these programs, when combined with increased access to banking services, can empower households, especially in rural areas, to improve their financial management skills, increase savings rates, enable better investment decisions, and increase financial resilience to shocks. By equipping individuals with knowledge about budgeting, saving, borrowing, and investing, these programs can help households make better financial decisions, save for education, healthcare, and investment, and potentially lead to higher returns and improved economic outcomes. Thus, financial literacy programs can play a crucial role in poverty reduction in Ethiopia.

2.2. Empirical Review

Honohan (2004), explores the relationship between financial access and poverty reduction. His paper emphasizes that financial services, such as savings, credit, insurance, and payment services, are a powerful tool for poverty alleviation. By providing the poor with access to these services, they can manage risks, invest in opportunities, and improve their economic stability. Financial services also support economic activity by enabling individuals and businesses to engage in pro-

ductive ventures, leading to job creation and income generation. Financial inclusion helps reduce vulnerability by providing a safety net during economic shocks or personal emergencies.

He presents empirical evidence showing that financial depth, the extent of financial services available, is negatively correlated with poverty rates. As financial services become more widely available, poverty levels tend to decrease. The paper suggests that policymakers should focus on creating an enabling environment for financial inclusion, including regulatory frameworks that encourage the development of financial institutions, promote financial literacy, and ensure that financial services are accessible to all segments of society. He also works on emphasizes the importance of financial inclusion as a strategy for economic development and poverty reduction. By providing the poor with access to financial services, they can improve their economic well-being and contribute to overall economic growth.

Beck et al. (2007), also found a positive correlation between financial development and poverty reduction, with increased access to credit playing a significant role. Financial development is a crucial aspect of economic growth, aiming to improve services, efficiency, and inclusive. It involves the establishment and growth of financial institutions, markets, and instruments, enhancing the availability and diversity of financial products and services. Access to credit is another key factor, allowing individuals and businesses to borrow money for various purposes, such as starting or expanding businesses, investing in education, and improving living conditions. This reduces liquidity constraints and allows households to smooth consumption during economic hardships. Small and medium enterprises (SMEs) benefit from access to credit, allowing them to invest in productive activities and create jobs. Financial development also reduces poverty by providing essential financial services, empowering marginalized groups, and promoting savings and investment. Studies show that countries with more developed financial systems have lower poverty rates due to better resource allocation, risk management, and economic stability. Regions with increased access to credit often experience higher rates of poverty alleviation. By fostering financial inclusion, economies can ef-

fectively address poverty and promote sustainable development, ultimately leading to improved welfare and economic security.

In review of randomized control-based studies Demirguc-Kunt et al (2017), demonstrate that financial inclusion affects poverty by making payment services, savings, credit, and insurance services available to the poor. These services reduce poverty by increasing the poor's income level or allowing the poor to increase household spending by offering time and cost savings. Aker et. al (2014), show that digital payment of welfare benefits save cost in the form of avoidance of making a physical trip for cash collection or offering bribes to corrupt officials. These cost savings allow the poor to spend the money for other purposes, which help reduce poverty. Similarly, Prina S (2015), shows that account payments enhance women are decision-making in the household, thereby increasing the expenditure on education and food. Brune, et al (2016), demonstrate that savings in a formal financial institution increase private expenditure, business investment, agricultural output, and household expenditures. All these studies have validated how financial inclusion can alleviate poverty; however, the findings of these randomized experimental studies might not be applicable for cross-country analyses due to the considerable variations among countries. Various researchers analyses the impact of financial inclusion on poverty using cross-country analyses. Gutiérrez-Romero and Ahamed (2021), apply the theoretical framework for analyzing the poverty-financial inclusion relationship in 79 low and lower-middle-income countries, finding that financial inclusion primarily reduces poverty through reduction of inequality.

Country-specific studies also find that financial inclusion helps reduce poverty. Swamy (2010), examines priority sector lending in India, finding that financial inclusion through prioritized lending can achieve inclusive growth by reducing the rural poverty rates. Abor et al. (2018), analyses the impact of financial inclusion and mobile telephone penetration on poverty in Ghana using 16,772 Ghanaian households. The study results show that mobile penetration and financial inclusion help smooth consumption and significantly reduce the probability of a household becoming poor and are correlated with an increase in per capita household consumption of food and non-food items. Though these cross-country and country-

specific studies analyses the poverty-financial inclusion relationship from different perspectives, they lack a comprehensive panel data analysis on countries in different stages of development. Moreover, most studies use a limited set of variables when constructing financial inclusion indices. Though previous studies indicate that financial inclusion negatively correlates with poverty, its impact on poverty could be weaker if access to finance fails to reach the targeted group.

Kara et al. (2021) review the growing evidence regarding whether individuals' demographic characteristics (i.e., gender and race) and socioeconomic features (i.e., income and education) affect access to credit. They determine that less education, less financial literacy, lower income, and less wealth correlates with decreased access to credit. Moreover, women, ethnic minorities, disabled people, and immigrants are more likely to be excluded from the formal credit markets. Similarly, in a recent International Monetary Fund (IMF) study, Aslan et al. (2017), find inequality among households, particularly female-led households, in accessing the benefit of financial inclusion. These findings necessitate the investigation of how unequal access to financial services affects the impact of financial inclusion on poverty.

Asfaw and Demissie's (2017), study on financial inclusion in Ethiopia found that it significantly impacts household income and poverty reduction. Financial inclusion refers to the provision of affordable financial products and services to meet individual needs. This can affect household income, which are the total earnings of all members of a household. Poverty reduction is achieved through economic growth and improved resource access. Economic empowerment, also known as socioeconomic development, is achieved through increased economic strength and self-sufficiency. These concepts highlight the importance of financial inclusion in promoting economic stability and reducing poverty, especially in developing countries like Ethiopia. Further improvement in financial inclusion is crucial for achieving these goals.

Gebremedhin et al. (2019), proposed that microfinance can lead to poverty reduction and economic empowerment by providing financial services like small loans and savings opportunities to low-income individuals and households. Key aspects of this theory include access to credit, financial inclusion, poverty alleviation, em-

powerment, and community development. Microfinance institutions offer small loans to individuals without access to traditional banking services, enabling them to invest in income-generating activities. It promotes financial inclusion, allowing more people to participate in the economy. Access to microfinance helps low-income households manage financial risks, increase income, and improve living standards. It empowers individuals, particularly women, by providing them with the financial resources to start and grow their own businesses. The findings support the idea that microfinance can be a powerful tool for poverty reduction, especially in rural areas with limited access to traditional financial services. They found a positive relationship between access to microfinance and poverty reduction among rural households in Ethiopia.

According to Alemu et al.'s (2014), study, microfinance in Ethiopia has the capacity to significantly improve women's standard of living. Low-income people without access to regular banking might benefit from microfinance by receiving financial services including savings accounts and modest loans, which raises household income. Additionally, it encourages the development and growth of small enterprises, which creates jobs for women and their communities. Women's confidence and ability to make decisions are increased when they achieve financial independence and commercial success. In addition to promoting gender equality and wider socioeconomic development, microfinance helps reduce poverty by increasing income and employment. These ideas demonstrate the revolutionary potential of microfinance in promoting Ethiopian women's economic empowerment and general well-being.

Demiralp and Şimşek's (2016), study used panel data analysis to examine the link between financial inclusion, economic growth, and poverty reduction. The research found that increased financial inclusion significantly contributes to economic growth by enabling individuals and businesses to invest in productive activities and stimulate economic activity. Financial inclusion, particularly access to credit, has a direct and positive impact on poverty reduction, as it allows low-income individuals and households to manage risks better, invest in education and health, and enhance their income-generating potential. The study also used panel data analysis to capture the dynamic relationship between financial inclusion and

economic outcomes over time, strengthening the robustness of the findings. The study emphasizes the importance of developing and implementing policies that promote financial inclusion, particularly in underserved areas, to drive economic growth and reduce poverty. The research provides empirical evidence supporting the notion that financial inclusion is a powerful tool for economic development and poverty alleviation, emphasizing the need for inclusive financial systems to achieve sustainable development goals.

The literature review reveals a growing body of evidence supporting the positive relationship between financial inclusion and poverty reduction. However, the specific impact of financial inclusion on poverty in Ethiopia remains understudied, particularly in the context of panel data analysis. This study aims to address these knowledge gaps, providing evidence-based insights to guide policy interventions and contribute to the on-going efforts to promote financial inclusion and accelerate poverty reduction in Ethiopia (Abebe and Tilahun , 2021).

The study aim to address several gaps in understanding the nuances of financial inclusion (FI) on poverty in Ethiopia. These gaps include a lack of comprehensive analysis of various financial services, a reliance on cross-sectional data, a lack of robust longitudinal analysis using time series data, a neglect of complex interactions between different financial instruments, and a limited understanding of the impact of digital financial inclusion at the household level. Examples of gaps include focusing on isolated facets of FI, insufficient empirical evidence specific to Ethiopia, reliance on cross-sectional data, and a lack of robust longitudinal analysis using time series data. Additionally, the research neglects the complex interactions between different financial instruments, such as insurance and digital payments, and the precise relationship between access to these services and poverty reduction at the household level.

In conclusion, the core gaps identified include a lack of comprehensiveness, reliance on cross-sectional data, limited and sometimes conflicting empirical evidence specific to Ethiopia, and insufficient research on the direct impact of digital financial services on household-level poverty reduction. Addressing these gaps is crucial for promoting a more comprehensive understanding of FI's impact on poverty reduction in Ethiopia.

2.3. Conceptual Framework

The study identifies financial inclusion as a central independent variable, while poverty is a dependent variable. The relationship between financial inclusion and poverty is expected to be direct, with increased access to financial services and improved financial literacy contributing to poverty reduction. The **conceptual framework** presents a hierarchical structure, identifying "Financial Inclusion Indicators" as the overarching concept. It then branches out into four specific subcategories: credit, education level, payments, and insurance. Credit refers to access to and usage of credit facilities, such as loans from formal financial institutions or informal credit. Education level is strongly correlated with financial literacy, understanding of financial products, and the ability to engage effectively with financial systems. Efficient payment systems are crucial for economic activity and facilitate financial transactions for individuals and businesses. Insurance provides a safety net against unforeseen risks, helping individuals and businesses manage financial shocks and protect assets, contributing to financial stability and resilience.

The diagram suggests a comprehensive view of financial inclusion, recognizing that it goes beyond just access to credit. It highlights the importance of human capital and financial literacy as critical enablers for effective financial inclusion. Progress needs to be made across these various dimensions for financial inclusion to be effective.

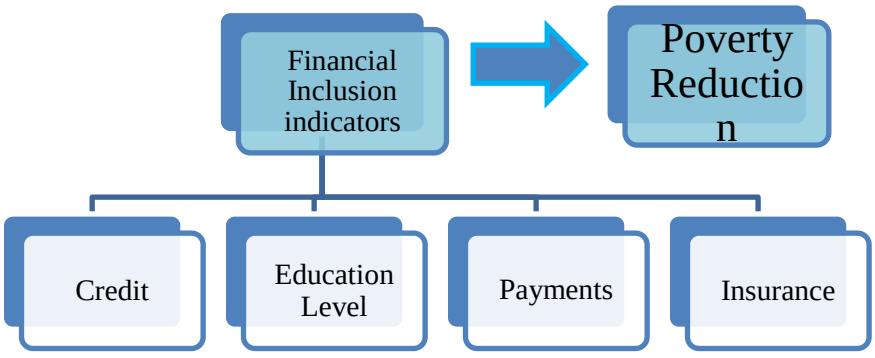


Figure 1: Conceptual Framework of Financial Inclusion on Poverty Reduction

CHAPTER THREE

3. METHODOLOGY

The study examines the relationship between financial inclusion and poverty reduction using annual time series data covering 30 years. It uses a rigorous methodology to investigate trends, causal links, and potential postponed effects of financial inclusion on poverty. Important financial inclusion indicators like bank account accessibility, credit availability, and financial literacy are analyzed in addition to poverty metrics like poverty headcount ratio. By providing useful data for evidence-based policymaking and the expansion of the financial sector, the findings should help Ethiopia implement more effective poverty reduction strategies.

3.1 Research Design and Approach

The purpose of this study is to use time series analysis to examine the predictive relationships between financial inclusion and the reduction of poverty in Ethiopia. Over a specified time period, the study design is concentrate on the temporal dynamics and possible leading-lagging relationships between the total national-level financial inclusion and poverty reduction measures. In the Ethiopian context, the main objective is to ascertain whether historical shifts in financial inclusion metrics can statistically forecast future shifts in measures of poverty reduction, and vice versa.

This study makes use of secondary time series data from credible sources from World Bank databases such as Global Financial Inclusion (Global Findex) and World Development Indicators (WDI) Variables in definition and measurement comprise financial inclusion (Independent Variable) and poverty reduction (Dependent Variable). Considered to account for other macroeconomic factors that might influence both financial inclusion and poverty reduction over time will be control variables.

Unit root tests, lag selection, Granger causality tests is the part of econometric modelling and analysis. The core of the analysis involves conducting Granger

causality Wald tests to examine the predictive relationships between lagged values of financial inclusion indicators and the current values of poverty reduction indicators, and vice versa. The findings will be presented in tables summarizing the Granger causality test results (chi-squared statistics, degrees of freedom, and p-values. The interpretation of these results focus on the implications for understanding the temporal relationship between financial inclusion and poverty reduction in Ethiopia. The results of this study help policymakers understand the possible time lags involved in the impact of financial inclusion policies on poverty reduction and vice versa. This study uses time series analysis and focus on Granger causality to better understand the temporal sequencing and predictive power between financial inclusion and poverty reduction at the national level in Ethiopia.

3.1.1 Data Types and Sources

The purpose of this study is to examine how important measures of poverty and financial inclusion have changed over the course of 30 years in Ethiopia. World Bank databases such as Global Financial Inclusion Findex(GFIF) and World Development Indicators (WDI) is used to gather the data. In order to address missing values, outliers, and temporal consistency, the data is going through a rigorous cleaning, standardization, and analysis preparation process.

A national-level time series indicator, like the annual national poverty headcount ratio, that used to measure the dependent variable i.e. poverty. One or more aggregate time series indicators at the national level will be used to represent the independent variable (financial inclusion), capturing various aspects of financial inclusion over time. The study will incorporate national-level time series control variables, such as Poverty headcount ratio, Primary completion rate, Mobile cellular subscriptions, Insurance in financial sectors and private creditors to account for other macroeconomic factors that change over time. Indicators of poverty and financial inclusion are important variables that allow for the examination of their changing relationship over time. Poverty, as determined by the annual percentage of the population below the national or international poverty line, is the dependent variable. Financial literacy, financial service utilization, and access to financial services are examples of independent variables.

3.2 Methods of Data Analysis

The study examined the relationship between socioeconomic indicators and the poverty headcount ratio between 1994 and 2023 using time-series econometrics. In STATA, the data was identified as time-series data. The Augmented Dickey-Fuller (ADF) test was used to determine the order of integration for each series and to evaluate the stationarity of variables. The ADF test's inconsistent results necessitated a modelling strategy that could manage these integration orders. As the main analytical framework, an Autoregressive Distributed Lag (ARDL) model was selected because it can be used for both short-term and long-term relationships between variables with mixed integration orders. The ARDL model's ideal lag structure, as determined by the Akaike Information Criterion (AIC), was ARDL (3, 3, 0, 3, and 1) for Poverty headcount ratio, Primary completion rate, Mobile cellular subscriptions, private creditors and Insurance, respectively.

The ARDL model was estimated using the Pesaran, Shin, and Smith (2001), ARDL Bounds Test for Co-integration and then re-estimated in its Error Correction Model (ECM) format. The long-term equilibrium relationship between the Poverty Headcount Ratio and independent variables was validated by this test. Short-term dynamics and the rate at which the system returns to its long-term equilibrium after brief deviations were identified and interpreted using the ECM formulation. The significance and direction of the coefficient of the error correction term were investigated.

To make sure the estimated ARDL-ECM model was valid and robust, a number of diagnostic tests were carried out. The Breusch-Godfrey LM test for autocorrelation, White's test for heteroscedasticity, the Breusch-Pagan/Cook-Weisberg test for heteroscedasticity, and Cameron & Trivedi's decomposition of the Information Matrix (IM) test to further evaluate for heteroscedasticity, as well as skewness and kurtosis, were among the tests that were used to determine whether the error distribution was normal. Additionally, Wald Granger Causality to ascertain the direction of the predictive relationships between each of the system's variables, tests were conducted. STATA statistical software was used for all statistical analyses and model estimations.

3.2.1 Model Selection and Estimation Procedure

This research uses ARDL model based on the data characteristics and research objectives in order to examine the relationship between financial inclusion and poverty reduction over a 30-year period and ensure data consistency and address missing values, the estimation process entails gathering annual time-series data for all variables. In applied econometrics, the Granger (1981) and, Engle and Granger (1987)Autoregressive Distributed Lag (ARDL) co-integration technique or bound test of co-integration of Pesaran et al (2001), co-integration techniques have become the solution to determining the long run relationship between series that are non-stationary, as well as reparametrizing them to the Error Correction Model (ECM). Co-integration is a method used to maintain the long-run information of time series. It was first formalized by Engle and Granger (1987), provides tests and estimation procedures to evaluate the existence of long-run relationships between variables within a dynamic specification framework. Co-integration involves a stationary linear combination of non-stationary variables integrated to an order, I(d). Testing for co-integration is crucial to determine if a model exhibits meaningful long-run relationships. If it fails to establish co-integration, it is essential to continue working with variables in differences, as long-run information may be missing.

The reparametrized result gives the short-run dynamics and long run relationship of the underlying variables. However, given the versatility of co-integration technique in estimating relationship between non-stationary variables and reconciling the short run dynamics with long run equilibrium. The model is estimated using statistical software like Stata for parameter estimates and statistical significance.

The Autoregressive Distributed Lag (ARDL) Model is easier to estimate and interpret than VECM/VAR models, especially when there is a clear dependent variable. Unit root tests are used to determine if a variable is stationary or non-stationary. The Augmented Dickey-Fuller (ADF) Test and the Phillips-Perron (PP) Test are useful tools for identifying non-stationary variables. The order of integration is determined using Stata's ADF test, which provides the time series' mean, variance, and auto covariance. The Pesaran et al(2001), bounds test for co-integration is used to conduct the co-integration test. Two sets of critical values are compared to the F-statistic derived from this test: one assuming all variables are I (0), and another assuming all are l (1).

- If F-statistic > upper bound critical value: Conclude co-integration (long-run relationship exists).
- If F-statistic < lower bound critical value: Conclude no co-integration.
- If F-statistic falls between bounds: The test is inconclusive.

Lag selection criteria like AIC, HQIC and BIC Test are used to determine the right number of lags. Stability tests, autocorrelation tests, normality tests, and heteroscedasticity tests are used to ensure the ARDL model is well-specified. Diagnostic tests such as heteroscedasticity, normality, stability, residual autocorrelation, and coefficient analysis are run to ensure the model is adequate. The dynamic effects of a shock on other variables over time are tracked through estimated coefficients, Granger causality tests, and Impulse Response Functions (IRFs). If the model is judged sufficient, forecasts for the system's variables are created.

The Johansen and Juselius cointegration procedure cannot be applied when one cointegrating vector exists. Instead, the Autoregressive Distributed Lag (ARDL) approach is used for long-run relationships, regardless of the underlying variables. This method helps identify cointegrating vectors, which are single long-run relationship equations. If one cointegrating vector is identified, the ARDL model is reparameterized into the ECM providing short-run dynamics and long-run relationships of variables in a single model. The Distributed Lag Model includes unrestricted lag of regressors in a regression function, helping determine if underlying variables are cointegrated or not.

This helps to avoid the pretesting problems associated with standard cointegration analysis which requires the classification of the variables into I(0) and I(1). This means that the bound cointegration testing procedure does not require the pretesting of the variables included in the model for unit roots and is robust when there is a single long run relationship between the underlying variables,

• If the F-statistics (Wald test) establishes that there is a single long run relationship and the sample data size is small or finite, the ARDL error correction representation becomes relatively more efficient.

• If the F-statistics (Wald test) establishes that there are multiple long-run relations, ARDL approach cannot be applied. Hence, an alternative approach like Johansen and Juselius (1990), can be applied. That is, if the various single expression/equation of the underlying individual variable as dependent variable

shows a feedback effect(multiple long run relationships) between the variables, then a multivariate procedure need to be employed.

The general form of an ARDL(p, q_1, q_2, …, q_k) model would be:

$Y_t = \beta_0+\beta_1 y_{t-1}+\ldots\cdots+\beta_k y_{t-p}+\alpha_0 x_t+\alpha_1 x_{t-1}+\alpha_2 x_{t-2}+\ldots\ldots\cdots+\alpha_q x_{t-q}+\varepsilon_t$

Where ε_t is the random disturbance term which is serially independent and assumed to be well behaved or constant.

An Autoregressive Distributive Lag model is considered as an ARDL (p q) model whose reduced form is presented as

$Y_t=\mu \sum_{i=0}^{p} \alpha\ \Delta Y_{t-i}+ \sum_{i=0}^{p} \beta\ \Delta X_{t-i}+ \varepsilon_t$

Where, Y_t is the dependent variable with its lags as independent variables.

X_t is the lagged independent variables and

ϵ_t being the white noise.

Generally, using the lag operator L applied to each component of a vector.

$L_k\ X_t = X_{t-k,}$ it is easy to defined the lag polynomial A(L) and the polynomial vector B(L).

The ARDL (p, q) is

$A(L)Y_t=\mu+B(X_t)+\mu\ A(L)=1-\alpha_1 L- \alpha_2 L_2 \ldots- \alpha_p L_p$

$B(L)=1-B_1 L-B_2 L_2 \ldots - B_p L_p$

$A(L)Y_t= \mu+B_1(L)X_{it}+ B_2(L)X_{2t}+\ldots B_k(L)X_{kt}+ \mu_t$

A detail specification of the model with respect to the variables of this study is presented below.

$\Delta Yt= \alpha_o + \sum_{i=1}^{p} \alpha\ Y_{t-i} + \sum_{j=1}^{q} \beta_1 \Delta P_{t-1} + \sum_{j=1}^{q} \beta_2 \Delta M_{t-1} + \sum_{j=1}^{q} \beta_3 \Delta C_{t-1} +\sum_{j=1}^{q} \beta_4 \Delta I_{t-1}+\varepsilon_t$

Where:

- t is the time index (year).
- α_o is the intercept.
- Y_{t-I} are lagged values of the dependent variable.
- P_{t-1} , $M_{t-1,}$ C_{t-1} I_{t-1} current and lagged values of the independent variables.
- q are the number of lags for each independent variable.
- β_1 … β_4 are coefficients to be estimated.
- Δ refers to the first difference operator
- ε_t is the error term, assumed to be white noise.

After the estimation of the above model, the long-run causality test is carried out by comparing the results from the F-statistics of the Wald test. Implying the null hypothesis of the test will be: $\mu 1 = \mu 2 = 0$(no long-run relationship). Against the alternative hypothesis. $\mu 1 \neq \mu 2 \neq 0$ (a long-run relationship exists thus co-integration).

The long-run coefficients can be derived from the estimated ARDL model. The long-run relationship looks like:

$Yt = \alpha + \beta_1 Pt + \beta_2 M_t + \beta_3 C_t + \beta_4 I_t + \mu_t$

where $\beta_{1\ldots} \beta_4$ are the long-run multipliers.

An ECM version of the ARDL model can be estimated to capture short-run dynamics and the speed of adjustment towards long-run equilibrium.

$\Delta Y_t = c_0 + \sum_{i=1}^{p-1} \gamma_i Y_{t-i} + \sum_{j=0}^{q1-1} \beta_1 \Delta P_t + \sum_{j=0}^{q1-1} \beta_2 \Delta M_t + \sum_{j=1}^{q1-1} \beta_3 \Delta C_t + \sum_{j=1}^{q1-1} \beta_4 \Delta I_{t-1} + \lambda \cdot ECT_{t-1} + \varepsilon_t$

Where: ΔY_t first difference of the dependent variable (short-run change in Y

$\sum_{j=0}^{q1-1} \beta_1 \Delta P_t$, $\sum_{j=0}^{q1-1} \beta_2 \Delta M_t$, $\sum_{j=1}^{q1-1} \beta_3 \Delta C_t$, $\sum_{j=1}^{q1-1} \beta_4 \Delta I_{t-1}$ is Lags of first-differenced independent variable(s),

- c_0 constant term
- λ Adjustment coefficient of the ETC_{t-1} (speed of adjustment). It should be negative, statistically significant, and between -1 and 0 for convergence to equilibrium.
- Δ denotes the first difference.
- ECT_{t-1} is the Error Correction Term, which is the lagged residual from the long-run cointegrating relationship. It represents the deviation from long-run equilibrium in the previous period.

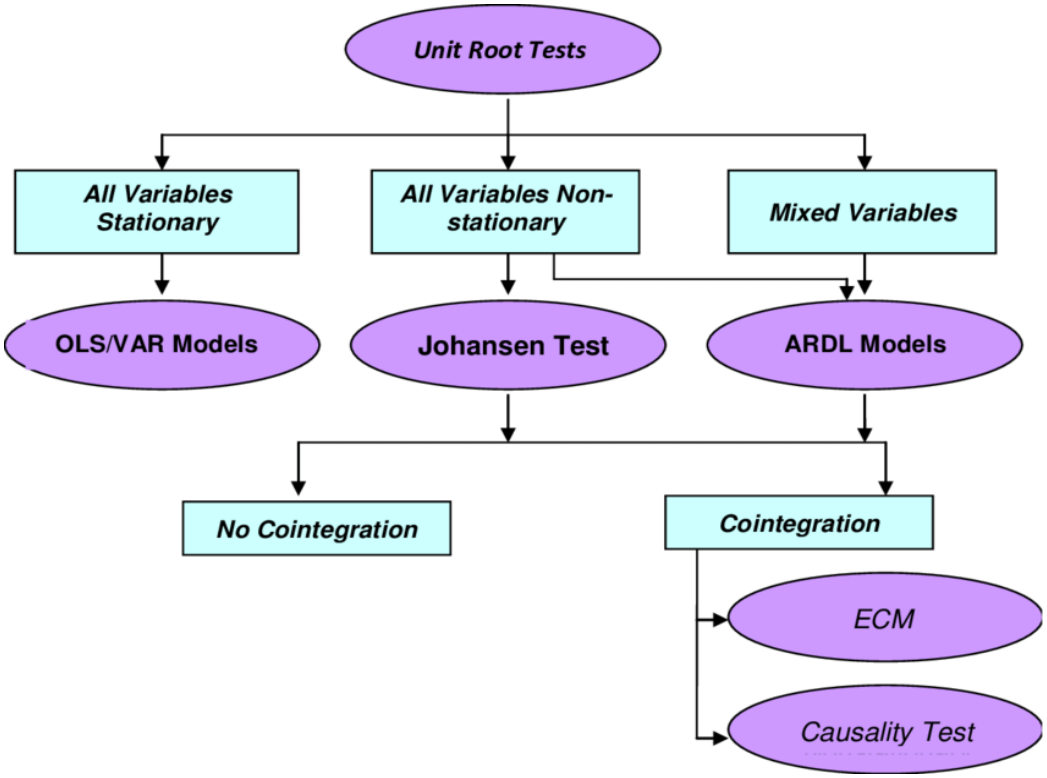


Figure 2: Model selection Framework for Time Series Data Analysis

(Source: Research Gate GmbH)

3.2.2 Definition of variables, measurements and hypothesis

Dependent Variable

Poverty: This is the primary outcome of interest, representing the level of poverty within a household or community. According to the International Labor Organization's(ILO) definition of poverty, the poverty headcount ratio, which stands at $2.15 per day (2017 PPP), is a global indicator of extreme poverty. It shows the proportion of a nation's population that makes less than $2.15 per day, the international poverty level. Around the world, extreme poverty is frequently measured using this threshold. Household surveys, PPP conversion, and the application of the poverty line are all part of measurement (World Bank).

Poverty Headcount Ratio: is a way to measure the proportion of a population living below the national or international poverty. The World Bank – World Development Indicators (WDI) provides consistent, internationally comparable time series data on poverty headcount ratios (World Bank).

Independent Variable

The primary education completion rate is a measure of the percentage of children or young people who successfully completed the last grade of primary education. It is calculated by dividing the number of new entrants to the last grade by the theoretical entrance age. The rate indicates the number of children who finish primary school, considering a specific age group and indicating system efficiency. A high rate suggests effective retention of students through the primary cycle (World Bank).

The Number Cellular Subscriptions is the total number of active subscriptions to public mobile telephone services using cellular technology. It includes postpaid subscriptions, where users pay for services after using them, and active prepaid accounts, where users pay in advance and use the account within the last three months. The number of public mobile phone service subscriptions per 100 population members is known as mobile cellular subscriptions (per 100 people) (World Bank).

Private creditors are entities that lend money or extend credit to individuals, businesses, or governments without being affiliated with government agencies or public sector institutions. They include private banks, bondholders, hedge funds, asset managers, and other private financial institutions. Public and publicly guaranteed debt from private creditors includes bonds issued or privately placed, commercial bank loans from private banks and financial institutions, and other private credits from manufacturers, exporters, and suppliers of goods. Net flows received by the borrower during the year are disbursements minus principal repayments (World Bank).

Insurance is a contract where an individual pays a premium to an insurer, who promises to provide financial protection or reimbursement for specified losses, damages, or injuries due to unforeseen events. Key aspects of insurance include risk mitigation, financial protection, investment components, and a wide array of products tailored to different needs and risks, such as life, health, auto, homeowners, and business insurance (World Bank).

CHAPTER FOUR

4. RESULT AND DESCUSSIONS

A dataset covering the years 1994–2023 is declared as time-series data in Stata. When working with time-series data. The 30-year dataset is helpful for examining long-term relationships and the frequency of data determines which time-series models, like regression are used.

4.1 Results of Descriptive statistics

Table 1 Descriptive statistics test

variables	Obs	Mean	Std. dev.	Min	Max
Poverty headcount ratio	30	37.84467	15.80734	20.92	72
Primary education completion rate	30	42.47315	17.05583	14.2779	64.09296
Insurance in financial services	30	1.233243	1.299363	.0005334	5.213602
private creditors	30	1.55e+08	4.69e+08	-6.39e+08	1.40e+09
Mobile cellular subscriptions,	30	17.27559	20.72163	0	58.42554

The table presents a comprehensive analysis of poverty, education, insurance, and mobile subscriptions across 30 years. The data shows significant disparities in socio-economic well-being, human capital development, financial sector development, financial vulnerability/debt, and technological adoption. The poverty headcount ratio is high, with nearly 38% of the population living below the poverty line. Primary education completion rate is low, with an average of 42.5%. Insurance in financial services is low, with a mean of 1.23, suggesting that insurance services are not widely developed or utilized. The negative minimum value of $1.55 indicates extreme variability in private creditor exposure, suggesting that some entities have large private sector debt. Mobile cellular subscriptions are low, with a wide range, indicating a digital divide.

The table suggests that policy recommendations or interventions should be tai-

lored to the specific circumstances of each entity, as a "one-size-fits-all" approach would likely be ineffective. The data also hints at potential correlations between these variables, such as lower education and mobile penetration potentially linked to higher poverty.

4.2 Econometrics Results

4.2.1 Stationary Test

Augmented Dickey-Fuller (ADF) test helps to determine the stationarity of a univariate time series. Here are the detailed rules and procedures specifically focused on the ADF test for stationarity:

- **Reject H_0**: If the test statistic is less than the critical value (more negative). This indicates that the time series is stationary.
- **Fail to Reject H_0**: If the test statistic is greater than the critical value. This indicates that the time series has a unit root and is non-stationary.

The Dickey-Fuller test indicates that the poverty headcount ratio and insurance variable are stationary at all significance levels, suggesting potential trends or shocks. However, variables like Primary education completion rate, private creditors and mobile cellular subscriptions are non-stationary, meaning their variance and mean do not remain constant over time. This information can be used to better understand and forecast future trends and shocks in time-series models by modifying the test statistic.

Table 2: Stationary Test: Augmented Dickey-Fuller (ADF) test result

Variable	Test Statistic	5% Critical Value	p-value	Stationarity
Poverty headcount ratio	-5.220	-2.989	0.000	stationary
Insurance in financial services	-2.995	-2.989	0.0354	Stationary
Primary education completion rate	-1.769	-2.989	0.3960	Non-stationary
Mobile cellular subscriptions,	0.860	-2.989	0.9925	Non-stationary
private creditors	-2.820	-2.989	0.0555	Non-stationary

4.2.2 Optimal Lag Selection

The ARDL model is a data-driven dynamic model that considers the impact of variables on the dependent variable i.e. Poverty headcount ratio. It includes a number of lags for each variable, including the dependent variable. The model output indicates the number of lags included in the final model, based on the Akaike Information Criterion (AIC). The model's flexibility allows each variable to have a different lag length, improving model accuracy without overfitting. The variables being analyzed Poverty headcount ratio, Primary education completion rate, Mobile cellular subscriptions, private creditors and Insurance in financial services. The numbers (3, 3, 0, 3, 1) represent the number of significant lags within the specified range (1 to 5), the number of times a certain variable at a past lag (1-5) significantly influences another variable, or a p-value or test statistic. The lag structure is crucial for capturing dynamics, supporting bounds testing, and avoiding overfitting. It reveals that Poverty headcount ratio is highly persistent, with past values explaining current Poverty headcount ratio up to 3 years. Variables Primary education completion rate, and private creditors have delayed effects, while Mobile cellular subscriptions has immediate effects without lags, and Insurance in financial services has a short-run effect with only one-year lag. This structure helps assess long-run relationships and co-integration.

4.2.3 ARDL Bounds Test for Co-integration

The Pesaran, Shin, and Smith (2001), ARDL Bounds Test is a statistical method used to determine the long-run relationship between a dependent variable (Poverty headcount ratio) and its repressors (Primary education completion rate, Mobile cellular subscriptions, private creditors and Insurance in financial services). The test has two hypotheses: the null hypothesis (H_0) suggests no long-run relationship, and the alternative hypothesis (H_1) suggests a long-run relationship. The F-statistic is calculated using the I (0) and I(1) bounds at 5% and 10%, with the decision rule being to reject the null hypothesis the output is presented in the Error Correction Model (ECM) format, which is useful for interpreting both short-run and long-run relationships. The model's R-squared and Adjusted R-squared values indicate a good fit to the data, with a high R-squared indicating 94.6% of the dependent variable's variation being explained by the independent variables. The

Adjusted R-squared is also high at 88.3%, indicating a good fit. The Log likelihood value is used for model comparison but not directly interpretable. The Root MSE value, which is the standard deviation of residuals, indicates a better fit relative to the scale of Poverty headcount ratio.

Table 3: Bound test for co-integration analysis

F-statistics	Critical value			
	10%		5%	
4.178	I(0)	I(1)	I(0)	I(1)
	2.45	3.52	2.86	4.01

An above table indicate that the researcher can rejects the null hypothesis of no levels relationship at 5% and 10% significance levels, indicating a strong co-integrating relationship between Poverty headcount ratio and independent variables. The F-statistic (4.178) is compared with the critical values at 10%, it is 2.45, while at 5% it is 2.86. Since 4.178 is greater than the I1 upper bound critical value for 5% and 10%, the null hypothesis of no levels relationship can be rejected at these significance levels, indicating a long-run co-integrating relationship between Poverty headcount ratio and the independent variables.

4.2.4 Testing the Long Run and Short Run Relationship using the ARDL model

The ARDL Error Correction Model (ECM) is a re-parameterized version of the previous ARDL model, used to analyze short-run dynamics and the adjustment process towards long-run equilibrium. The model's output, which includes 27 observations from 1997 to 2023, shows a high R-squared value of 0.9459 for the differenced dependent variable (Δ Poverty headcount ratio), indicating a strong fit for short-run dynamics. The adjusted R-squared value is 0.8827, suggesting a more plausible model. The log likelihood is -11.076126, similar to the levels model, as the ECM is a re-parameterization of the levels ARDL model. The root MSE is also the same as the levels model. This analysis is crucial for separating short-run dynamics from long-run equilibrium relationships when variables are co-integrated.

The output of the ECM analysis is divided into three sections: Adjustment/Error Correction Term, Long-Run Coefficients (LR), and Short-Run Coefficients (SR). The Adjustment of Poverty headcount ratio first lag (ECM term) is a crucial finding, representing the speed of adjustment of Poverty headcount ratio towards its long-run equilibrium. The p-value of 0.023 is less than 0.05, indicating statistical significance. However, the positive coefficient in this output suggests that the system is moving away from equilibrium instead of correcting deviations from equilibrium. The coefficient of 0.2408902 means that about 24.09% of the disequilibrium from the long-run relationship in the previous period is corrected in the current period.

4.2.5 ARDL Model Long Run Estimation Results

The study reveals a significant negative long-run relationship between Poverty headcount ratio and independent variables, as indicated by the estimated levels model.The analysis reveals a long-run relationship between variables Poverty headcount ratio, Primary education completion rate, Mobile cellular subscriptions, private creditors, and Insurance in financial services, with a statistically significant "ADJ Poverty headcount ratio L1." term (p=0.023) supporting this relationship. Both Primary education completion rate and Insurance in financial services have statistically significant long-run impacts on Poverty headcount ratio, but both are negative. Mobile cellular subscriptions have no statistically significant long-run impact on Poverty headcount ratio, and private creditors has no practically significant long-run impact.

Table 4: ARDL Coefficients long run results

variables	Coefficient	Std. err	t-statistic	p-value
Primary education completion rate	-1.515762	0.1435507	-10.56	0.000
Mobile cellular subscriptions,	0.0434211	0.0617098	0.70	0.495
private creditors	$-6.57e^{-09}$	2.00e-09	-3.28	0.007
Insurance in financial services	-4.582103	1.07909	-4.25	0.001

R-squared	0.9459		
Adj R-squared	0.8827		
Log likelihood	-11.076126		

The table show that A one-unit increase in Primary education completion rate is associated with a 1.52-unit decrease in Poverty headcount ratio, holding other factors constant. This is a highly statistically significant negative long-run relationship, while Mobile cellular subscriptions do not have a significant impact on Poverty headcount ratio (p-value = 0.495 > 0.05). The coefficient for private creditors has a statistically significant (-0.00000000657) but practically zero negative impact on Poverty headcount ratio, indicating that its economic relevance is negligible. The coefficient for Insurance in financial services is also highly significant, with a one-unit increase in Insurance in financial services is associated with a 4.58-unit decrease in Poverty headcount ratio, holding other factors constant. This is a highly statistically significant negative long-run relationship.

4.2.6 Short Run Error Correlation Model Results

The study examines the short-run impact of changes in independent variables and lagged changes in the dependent variable on the current change in Poverty headcount ratio. The coefficients for SR (Short-Run Coefficients) are not statistically significant, but Lagged Change in Poverty headcount ratio): Coefficient = -0.6531561, p = 0.009: Statistically significant negative impact. A one-unit change in Poverty headcount ratio two periods ago (in differenced form) leads to a 0.65-unit decrease in current change in Poverty headcount ratio.

The current change in Primary education completion rate is not statistically significant at 5% but marginally significant at 10%. Lagged Change in Primary education completion rate Coefficient = -0.3143956, p = 0.003 is statistically significant negative impact. A one-unit change in Primary education completion rate one period ago leads to a 0.31-unit decrease in current change in Poverty headcount ratio. Second Lagged Change in Primary education completion rate Coefficient = -0.1464671, p = 0.068: Not statistically significant at 5%, but marginally significant at 10%.

The current change in private creditors and Insurance in financial services is not statistically significant, but the constant term in the ECM represents the expected value of the change in Poverty headcount ratio when all short-run variables and the ECM term are zero. The study concludes that the short-run changes in private creditors are not statistically significant.

Table 5: ARDL Coefficients Short run results

variables	Lag difference	Coefficient	Std. err	t-statistic	p-value
Poverty headcount ratio	LD	0.1669698	0.3128522	0.53	0.603
	L2D	-0.6531561	.210084	-3.11	0.009
Primary education completion rate	D1	-0.2438965	0.1149625	-2.12	0.055
	LD	-0.3143956	.0848439	-3.71	0.003
	L2D	-0.1464671	.0730252	-2.01	0.068
private creditors	D1	-6.18e-10	5.45e-10	-1.13	0.279
	LD	-3.82e-10	4.01e-10	-0.95	0.361
	L2D	4.37e-10	3.48e-10	1.26	0.233
Insurance in financial services	D1	-.258409	.2366532	-1.09	0.296
R-squared	0.9459				
Adj R-squared	0.8827				
Log likelihood	-11.076126				

Short-run dynamics show that the second lag of the change in Poverty headcount ratio has a significant negative effect on current change in Poverty headcount ratio. The first lag of the change in Primary education completion rate has a significant negative short-run impact on the change in Poverty headcount ratio. Other short-run variables do not show strong statistical significance in the short. The model fit is high, indicating that the short-run dynamics and adjustment process are well-explained by the model.

4. 2.7 Granger Causality Test, Interpretation and Analysis

The results of Granger Causality Wald Tests, which evaluate whether past values of one variable predict future values of another. The table includes the dependent variable, excluded variables, chi2 statistic, degrees of freedom, and p-value. The null hypothesis (H0) is that the excluded variable does not Granger-cause the dependent variable. If Prob > chi2 is less than the chosen significance level (e.g., 0.05 or 0.10), the null hypothesis is rejected, indicating that the excluded variable does Granger-cause the equation variable. Let's interpret each block:

1. **Equation Poverty headcount ratio:** Since p=0.002 < 0.05, we reject H_0. The study reveals that past values of Primary education completion rate significantly predict future values of Poverty headcount ratio, indicating that Primary education completion rate Granger-causes Poverty headcount ratio. Since p=0.053 is marginally above 0.05 but below 0.10, there is weak evidence to suggest that Mobile cellular subscriptions Granger-causes Poverty headcount ratio at the 10% significance level, and at the 5% level, it would not be concluded Granger causality. The study also finds that private creditors (p=0.003 < 0.05, we reject H_0) Granger-causes Poverty headcount ratio significantly, and I (p=0.000 < 0.05, we reject H_0) Granger-causes Poverty headcount ratio significantly. The total of Primary education completion rate, Mobile cellular subscriptions, private creditors, and Insurance in financial services Granger-cause Poverty headcount ratio is rejected, indicating that they jointly significantly Granger-cause Poverty headcount ratio.

2. **Equation Primary education completion rate**: the study found that Poverty headcount ratio significantly Granger-causes Primary education completion rate, followed by Mobile cellular subscriptions, private creditors, and Insurance in financial services. All (Poverty headcount ratio, Mobile cellular subscriptions, private creditors, and Insurance in financial services) Granger-cause Primary education completion rate were significantly Granger-cause Primary education completion rate, with Poverty headcount ratio, Mobile cellular subscriptions, private creditors, and Insurance in financial services significantly Granger-cause Primary education completion rate jointly.

3. **Equation Mobile cellular subscriptions:** The study found that Poverty headcount ratio, Primary education completion rate, private creditors, and Insurance in

financial services all significantly Granger-cause Mobile cellular subscriptions, with Poverty headcount ratio not significant at 10% or 5%. Primary education completion rate did not significantly Granger-cause Mobile cellular subscriptions. Private creditor's significantly Granger-caused Mobile cellular subscriptions, while Insurance in financial services did not. All variables, including Poverty headcount ratio, Primary education completion rate, private creditors, and Insurance in financial services, significantly Granger-caused Mobile cellular subscriptions.

4. **Equation private creditors**: the study found that Poverty headcount ratio, Primary education completion rate, Mobile cellular subscriptions, and Insurance in financial services did not significantly Granger-cause private creditors, and the other variables significantly Granger-caused private creditors. The other variables were not significant, and the overall effect was not significant. The findings suggest that other variables may play a role in Granger-cause private creditors.

5. **Equation Insurance in financial services:** the study found that Poverty headcount ratio significantly Granger-causes Insurance in financial services, Primary education completion rate significantly Granger-causes Insurance in financial services, Mobile cellular subscriptions marginally significant at 10%, and private creditors significantly Granger-causes Insurance in financial services. All other variables were jointly significantly Granger-cause Insurance in financial services, with Poverty headcount ratio, Primary education completion rate, Mobile cellular subscriptions, and private creditors being the most significant.

The Granger causality tests reveal a complex web of predictive relationships among variables. Primary education completion rate, private creditors, and Insurance in financial services are strong Granger-causes of Poverty headcount ratio, meaning their past values are highly effective in predicting Poverty headcount ratio's future movements. Mobile cellular subscriptions provide weak evidence of Granger causality on Poverty headcount ratio at the 10% level, but not at 5%. Collectively, Primary education completion rate, Mobile cellular subscriptions, private creditors, and Insurance in financial services jointly Granger-cause Poverty headcount ratio, aligning with the ARDL model's findings of long-run relationships. Primary education completion rate is strongly Granger-caused by all other variables, indicating that Primary education completion rate's future movements are significantly influenced by the past of all other variables in the system. Mobile

cellular subscriptions are primarily Granger-caused by private creditors, and private creditors is not Granger-caused by any individual variable. Insurance in financial services is strongly Granger-caused by Poverty headcount ratio, Primary education completion rate, and private creditors, with Mobile cellular subscriptions providing weak evidence of Granger causality on Insurance in financial services.

The ARDL model positions Poverty headcount ratio as the dependent variable, with Poverty headcount ratio receiving Granger causality from Primary education completion rate, private creditors, and Insurance in financial services. Primary education completion rate is highly endogenous and Granger-caused by all other variables, while private creditors is relatively exogenous but influenced by the collective past of other variables. The relationships between Poverty headcount ratio and Mobile cellular subscriptions are predominantly unidirectional, while Primary education completion rate and Insurance in financial services are involved in bidirectional or multi-directional causal flows. This suggests a feedback loop between Poverty headcount ratio and Primary education completion rate, as Primary education completion rate is also caused by Poverty headcount ratio.

Table 6 Granger causality Wald tests

Equation	Excluded	chi2	df	Prob> chi2
Poverty headcount ratio	Primary education completion rate	15.05	3	0.002
	Mobile cellular subscriptions	7.688	3	0.053
	private creditors	14.19	3	0.003
	Insurance in financial services	17.819	3	0.000
	ALL	23.342	9	0.005
Primary education completion rate	Poverty headcount ratio	61.374	3	0.000
	Mobile cellular subscriptions	44.226	3	0.000
	private creditors	10.546	3	0.014
	Insurance in financial services	34.673	3	0.000
	ALL	118.76	12	0.000
Mobile	Poverty headcount ratio	5.0456	3	0.168

cellular subscrip scrip-tions	Primary education completion rate	2.6586	3	0.447
	private creditors	10.56	3	0.014
	Insurance in financial services	3.6835	3	0.298
	ALL	30.131	12	0.003
private creditors	Poverty headcount ratio	1.0988	3	0.777
	Primary education completion rate	2.153	3	0.541
	Mobile cellular subscriptions	5.7183	3	0.126
	Insurance in financial services	3.7198	3	0.293
	ALL	25.132	12	0.014
Insur-ance in financial services	Poverty headcount ratio	40.404	3	0.000
	Primary education completion rate	45.852	3	0.000
	Mobile cellular subscriptions	6.7537	3	0.080
	private creditors	35.619	3	0.000
	ALL	69.117		0.000

4.3 Diagnostic results

The results of the diagnostic tests are performed to make sure that the data satisfied the basic assumptions of the classical linear regression model and are shown in this section.

4.3.1 Autocorrelation: Breusch-Godfrey LM Test

The Breusch-Godfrey LM test for autocorrelation shows results for testing serial correlation up to 3 lags in the residuals of an ARDL model. The table shows the test results for different lag lengths (1 through 3). Each row represents a test with a different number of lagged residuals included: The Breusch-Godfrey test provides little evidence of significant autocorrelation in the residuals of your regression model. The p-values for lags 1, 2, and 3 are all well above typical significance levels. Therefore, the researcher can conclude that autocorrelation is not a major concern in this model, at least based on this test for the considered lags.

4.3.2 Heteroscedasticity Test

The White's test for Heteroscedasticity provide insights into the homoscedasticity (constant variance) of the regression model's residuals. The p-value for White's test is 0.4093, which is significantly higher than conventional significance levels, indicating that the null hypothesis of homoscedasticity is accepted. This suggests that there is no statistically significant evidence of heteroscedasticity in the residuals of the ARDL model.

Cameron & Trivedi's Decomposition of the Information Matrix (IM-test) is a statistical method that breaks down the IM-test into components related to heteroscedasticity, skewness, and kurtosis. The IM-test confirms the overall White's test result, with no evidence of heteroscedasticity. The high p-values Skewness (chi2 (14) = 7.09, p = 0.9311, indicate that the null hypothesis of symmetrical errors is not rejected, and the high p-values Kurtosis (chi2 (1) = 0.02, p = 0.8770) indicate that the null hypothesis of normal kurtosis is not rejected. The overall IM test also fails to reject the null hypothesis that the model is correctly specified.

The Breusch-Pagan/Cook-Weisberg Test for Heteroscedasticity is a statistical test that examines heteroscedasticity based on the fitted values of the dependent variable. It assumes normal error terms and is sensitive to the assumption of normality. The test's p-value is 0.0956, which is marginally significant at the 10% level but not significant at the 5% level. This suggests weak evidence of heteroscedasticity, but not strong enough to reject homoscedasticity at a stricter confidence level.

The diagnostic tests for your ARDL model, including White's test and Breusch-Pagan test, support the validity of your model. White's test provides strong evidence of homoscedasticity, while Breusch-Pagan test shows marginal heteroscedasticity. The IM test decomposition confirms normality and skewness of errors, and the total p-value of the Information Matrix test indicates no significant misspecification.

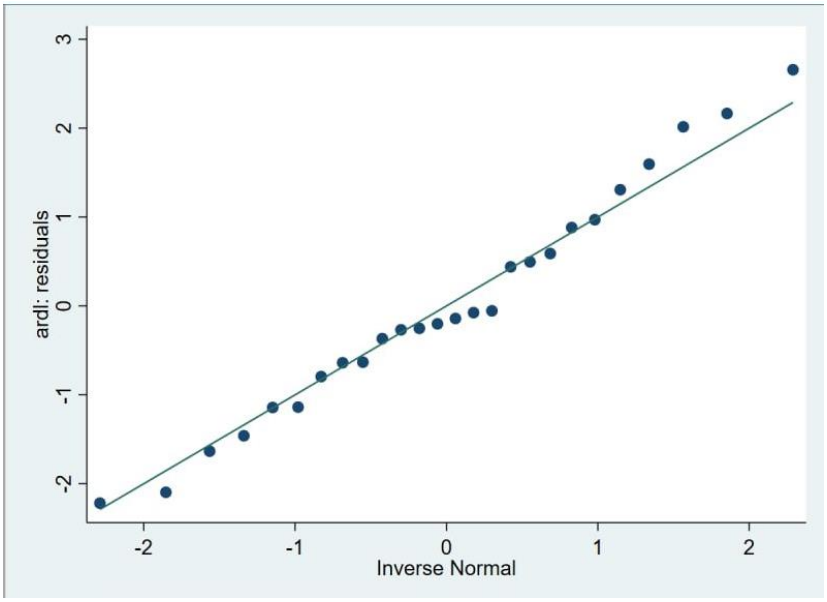
4.6.3 Normality Test

The Q-Q plot is a graphical method used to compare two probability distributions by plotting their quantiles against each other. The graph shows the theoretical quantiles of a standard normal distribution and the observed quantiles of the residuals from a statistical model. The data points are blue dots, plotting the observed

residual quantiles against the theoretical normal quantiles. A green line represents the plot if the residuals were perfectly normally distributed.

The plot shows that the residuals are approximately normally distributed, with the blue data points following a green straight line. However, there are slight deviations at the tails, suggesting that there might be more negative residuals than expected or that the smallest residuals are more extreme. The overall pattern suggests that the normality assumption is largely met for the 'ardi' residuals, with the deviations at the tails being relatively minor and not a significant concern depending on the statistical analysis sensitivity.

Figure 3: Q-Q plot Test



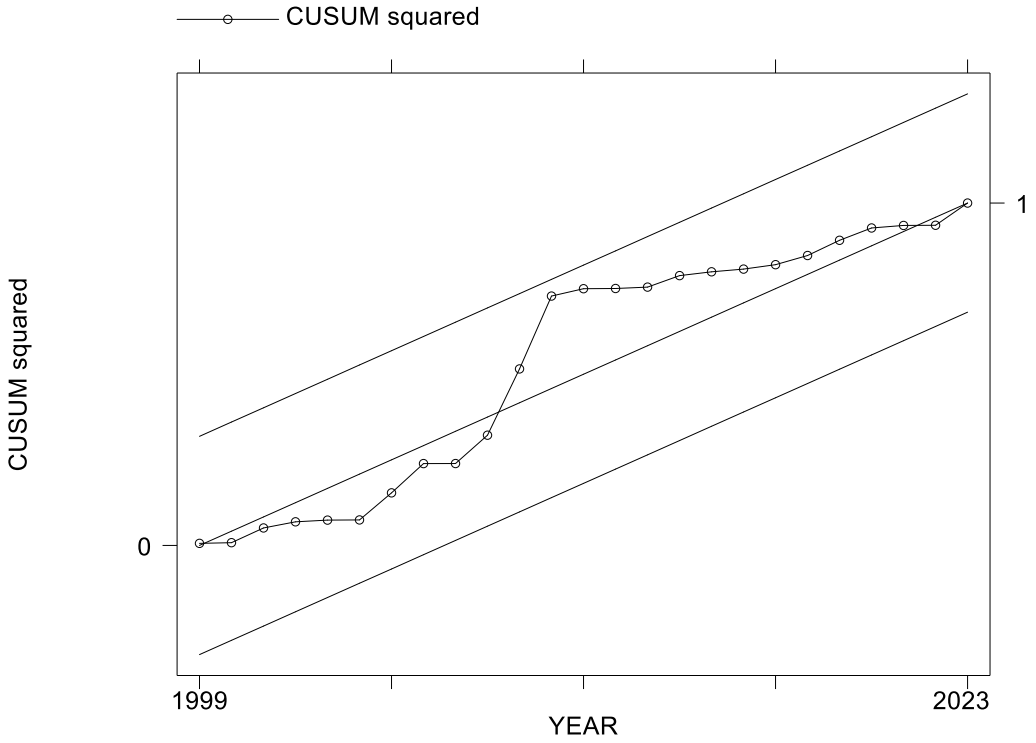
4.3.4 Stablity Test

The stability of a model is examined using the CUSUM of Squares (CUSUMSQ) test between 1999 and 2023. According to the test, the CUSUMSQ line stays inside the confidence bands, with neither the upper nor lower bounds being crossed or touched.

- Null Hypothesis (H_0): The model is stable (no structural change in parameters).
- Alternative Hypothesis (H_1): The model is unstable (parameters have changed over time).

Throughout the examined time period, the regression results can be regarded as reliable, and there is no significant evidence of structural instability.

Figure 4 CUSUM stability test



CHAPTER FIVE

5.1 SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Summary

The study examined the relationship between poverty headcount ratio and financial inclusion and financial inclusion in Ethiopia using a 30-year time-series dataset from 1994-2023. The results showed that the Poverty Headcount Ratio and Insurance in Financial Services variables were stationary at all significance levels, while Primary Education Completion Rate, Mobile Cellular Subscriptions, and Private Creditors were non-stationary. The Poverty Headcount Ratio showed high persistence with past values explaining current values up to 2 years. The ARDL Bounds Test for Co-integration confirmed a strong co-integrating relationship between the Poverty Headcount Ratio and the independent variables, with an R-squared of 0.946 and an Adjusted R-squared of 0.883.

The ARDL model successfully established a significant long-run co-integrating relationship between the poverty headcount ratio and independent variables in Ethiopia. Primary education completion rate, private creditors, and insurance in financial services were found to be crucial long-run drivers of poverty reduction. A one-unit increase in primary education completion rate was associated with a 1.52-unit reduction in poverty. Insurance in financial services also had a highly statistically significant negative long-run impact on poverty headcount ratio which means that one-unit increase in Insurance in financial services helped reduction of poverty by 4.58-unit by holding other factors constant. Mobile cellular subscriptions did not have a statistically significant long-run impact. Private creditors had a statistically significant but practically negligible negative long-run impact.

The paper also investigates the short-run impact of changes in independent variables and lagged changes in the dependent variable on the current change in Poverty head-count ratio. The coefficients for SR are not statistically significant, but the Lagged Change in Poverty head-count ratio has a statistically significant nega-

tive impact. A one-unit change in Poverty headcount ratio two periods ago leads to a 0.65-unit decrease in the current change in Poverty head-count ratio. The current change in Primary education completion rate is not statistically significant at 5% but marginally significant at 10%. Primary education completion rate is also statistically significant, with a one-unit change two periods ago leading to a 0.31-unit decrease in the current change in Poverty head-count ratio. The current change in private creditors and Insurance in financial services is not statistically significant, but the constant term in the ECM represents the expected value of the change in Poverty headcount ratio when all short-run variables and the ECM term are zero. The study concludes that the short-run changes in private creditors are not statistically significant.

The Granger Causality Test revealed a complex web of predictive relationships, with primary education completion rate, private creditors, and insurance in financial services strongly granger-causing the poverty headcount ratio. Mobile cellular subscriptions showed weak evidence of Granger causality on the Poverty Headcount Ratio at the 10% level but not at 5%.

Generally the ARDL model successfully established a significant long-run co-integrating relationship between the poverty headcount ratio and independent variables in Ethiopia. Primary education and insurance in financial services were found to be crucial long-run drivers of poverty reduction. While short-run dynamics were observed, particularly for lagged changes in poverty and education, the positive sign of the ECM term requires further attention.

5.2 Conclusion

The ARDL model confirms the existence of a significant long-run co-integrating relationship between the poverty headcount ratio and key independent variables in Ethiopia. Among these, the primary education completion rate and insurance in financial services emerged as the most impactful long-run drivers of poverty reduction. There is an inverse relationship between education and poverty, which means that increasing access to and completion of education leads to a decrease in poverty. Therefore, education is crucial to attaining long-term poverty eradication. Additionally, insurance in financial services showed a negative long-term impact on poverty that was highly statistically significant, highlighting the importance of

risk mitigation and financial inclusion in lowering poverty levels. While private creditors had a statistically significant influence, their actual impact on poverty reduction was quite small. This suggests that simply providing access to credit isn't enough on its own to significantly reduce poverty. Unlike other factors, mobile cellular subscriptions didn't exhibit a statistically significant long-run impact on poverty. This indicates that simply providing access to mobile technology might not be enough to directly influence long-term poverty outcomes. Overall, the findings emphasize that structural improvements in education and access to financial services are key to sustainable poverty reduction in Ethiopia.

The paper reveals that current poverty levels are not substantially impacted by short-term changes in variables like insurance, private creditors, and the rate of primary school completion. Rather, there appears to be a momentum in poverty reduction, especially those from two periods ago having significant and negative impact on current changes in poverty. The main conclusion is that the second lag of the change in the poverty headcount ratio had a significant negative impact. This suggests that the reductions in poverty that were achieved two periods ago are still driving further reductions in the current period.

Lagged improvements in primary education completion rates play a statistically significant role in reducing current poverty by highlighting the benefits of education with a time lag. Primary education completion rate shows marginal significance, but the first and second lags of the change are statistically significant and have a negative impact on current poverty changes. This suggests that investments in education take time to yield tangible results in poverty alleviation. In contrast, current changes in private creditors and insurance in financial services do not exhibit statistically significant short-run impacts on poverty, indicating that credit access alone is not immediately solving the poverty issue.

The paper revealed the result of Granger causality tests, which determine if one variable can predict another. The tests found that Primary Education Completion Rate, Private Creditors, and Insurance in Financial Services can help to forecast future changes in poverty. There was only weak evidence that mobile cellular subscriptions could predict poverty. However, when all the independent variables (education, creditors, insurance, and mobile subscriptions) were considered together, they jointly predicted changes in Poverty.

5.3 Recommendations

Here are some important policy recommendations for Ethiopia's sustainable poverty reduction based on the thorough analysis conducted using the Granger causality tests and the ARDL model:

- In order to reduce poverty, policy efforts should intensely focus on increasing the access to education, especially primary school. Those include addressing barriers to completion such as school fees, distance, safety, and cultural factors. Beyond access of education, ensure the quality of education which helps to maximize its human capital development potential, which in turn fuels for long-term poverty reduction and acknowledge the benefits of education investments will manifest with a time lag. Policymakers should prepare for and communicate that tangible poverty alleviation results from educational reforms will take several periods to fully alleviate poverty.
- Additionally, the research suggests advocating the use of a risk mitigation scheme. Insurance's critical function in shielding weak financial sectors from economic shocks is shown by the substantial long-term negative impact on poverty. Policies should work to lower the cost and increase the accessibility of different types of insurance. Along with the expansion of insurance products, the study suggests improving financial literacy to guarantee that individuals have the best possible knowledge and use of financial instruments.
- While private creditors had a statistically significant influence, their actual impact on poverty reduction was quite small; it simply suggests various enhancements to credit access strategies in order to increase the importance of credit in reducing poverty. Instead of concentrating only on lending, place more emphasis on productive use: Private creditors have minimal practical impact on poverty reduction, despite their statistically considerable influence, suggesting that credit alone is insufficient. Policy should ensure that credit is used effectively to generate assets and generate revenue, rather than just making it available. Encourage all-inclusive assistance and focused lending: Promote loans for profitable ventures such as skill development, small enterprises, or agricultural inputs. To increase the chances of success loan strateges, this extends beyond consumption-based finance and should be combined with crucial support services like mentorship, company growth, and financial

management training. Ensuring that borrowers can repay loans in a sustainable manner is another benefit of strengthening borrower risk management. This will protect people and households from possible financial difficulty by preventing them from accruing further debt.

- According to the study mobile technology as a critical enabler for other poverty reduction strategies. It can facilitate financial inclusion (mobile banking), health services Instead of considering mobile technology as a stand-alone solution, the emphasis should be on how it can enhance the effects of insurance, education, and productive credit.
- In order to maximise educational attainment, the Granger Causality conclusion recommends an integrated strategy that takes into account elements such as insurance, private creditors, cellphone subscriptions, and poverty. This method places a strong emphasis on the connections between financial inclusion, education, and other socioeconomic elements. The study also highlights the necessity of cross-sectoral cooperation, incorporating technology, finance, and education strategies to successfully fight poverty.

The study makes recommendations for lowering poverty in Ethiopia with a focus on education, risk mitigation, credit access strategies, mobile technology, and integrated strategy. These recommendations are similar with the body of empirical research that has already been conducted and emphasise the importance of education in lowering poverty. The study acknowledges that impact takes time to materialise and tackles challenges like expenses, distance, and cultural considerations. It also highlights how insurance helps protect vulnerable financial sectors and fight poverty by promoting lower rates, increased accessibility, and improved financial literacy. By enhancing the benefits of productive credit, insurance, and education, mobile technology is viewed as a critical enabler that promotes health services and financial inclusion. The study is in line with earlier research because it recognises the potential of mobile technology and carefully emphasises how it can be used in conjunction with other interventions rather than as a panacea. This comprehensive viewpoint is more useful and realistic.

By linking financial inclusion indicators (insurance, private creditors, and mobile subscriptions) with poverty and education, the study highlights cross-sectoral collaboration across technology, finance, and education and promotes an integrated

approach based on Granger Causality findings. This approach provides additional empirical and methodological support for the literature's overall call for holistic approaches. Overall, the recommendations largely reinforce and build upon the corpus of empirical studies on financial inclusion and poverty reduction. They back up established findings regarding the value of financial literacy and education as well as the advantages of financial services (credit, insurance, and payments methods). The study contributes significant nuance and practical depth to the current conversation by concentrating on the quality of education and the time lag for its effects. Along with necessary support services and borrower risk management, it shifts the emphasis from merely having access to credit to using it effectively.

Generally, the paper advocates for long-term, structural investments in key sectors to address poverty reduction, focusing on innovative delivery channels like partnerships with mobile operators, community groups, and local financial institutions. They emphasise the need for policies designed for long-term implementation and commitment. By focusing on these strategic recommendations, Ethiopia can build upon its current progress and establish a more sustainable path towards significant poverty reduction.

REFERENCE

Abebe and Tilahun . (2021). Financial Inclusion and Poverty Reduction in Ethiopia: Evidence from Microfinance Institutions. *Journal of African Development Studies,*, 8(2), 45–62.

Abor J, et al. (2018). *Mobile telephony, fnancial inclusion and inclusive growth.* Retrieved from J Afr Bus: https://doi.org/10.1080/15228916.2017.1419332

Aker et. al. (2014). *Payment mechanism and anti-poverty programs: evidence from a mobile money cash transfer experiment in Niger.* Retrieved from Tufts University Working Paper: http://sites.tufts.edu/jennyaker/fles/2010/02/Zap_-2

Alemu et al. (2014). The Role of Microfinance in Improving the Livelihoods of Women in Ethiopia: A Case Study of Oromia Region. *Journal of Economics and Sustainable Development*, 5(2), 122-130.

Allen, F. et al. (2016). The Foundations of Financial Inclusion: Understanding Ownership and Use of Formal Accounts. *Journal of Financial Intermediation,*, 27, 1–30.

Andrew, G. (2015). The Role of Financial Inclusion in Sustainable Economic Development. *World Bank Policy Research Working*.

Anwar and Zaman. (2018). The Impact of Financial Inclusion on Poverty Reduction. *A Cross-Country Analysis*.

Arebo, M. et al. (2024). *Financial inclusion and stability in Ethiopia using bank-level data: A two-step system GMM estimation.* F1000Research.

Aredo, D. (2019). The Role of Microfinance Institutions in Financial Inclusion: Evidence from Ethiopia. *Journal of African Development Studies,.*, 6(2), 45–60.

Asfaw and Demissie. (2017). The Impact of Financial Inclusion on Household Income and Poverty Reduction in Ethiopia: A Case Study of Amhara Region. *Journal of Economics and Sustainable Development*, 8(11), 210-219.

Aslan G. et al. (2017). Inequality in fnancial inclusion, gender gaps, and income inequality.

Atkinson and Messy. (2012). The distribution of wealth and income in developed countries. *Oxford University Press*.

Beck T. et al. (2007). Finance, inequality, and poverty: Cross-country evidence. *Journal of the European Economic Association*, 5(2-3), 538-563.

Boateng, Y. A. (2023). deepening-financial-inclusion-at-the-last-mile-with-agency-banking-training-in-ethiopia. *UN Capital Development Fund*. Retrieved from https://www.uncdf.org/article/8520/deepening-financial-inclusion-at-the-last-mile-with-agency-banking-training-in-ethiopia

Carina and Jan . (2017). The Social Consequences of Poverty: An Empirical Test on Longitudinal Data. *national library of medicine* . doi: 10.1007/s11205-015-0983-9

Central Statistical Agency. (2019). *Ethiopia Socioeconomic Survey 2018.* Addis Ababa, Ethiopia: CSA and World Bank.

Demiralp and Şimşek. (2016). Financial inclusion and economic growth. *Evidence from panel data analysis. Economic Modelling*, 56, 109-118.

Demirgüç-Kunt A. et al. (2022). Financial Inclusion, Digital Payments and Resilience in the Age of COVID-19. World Bank. *The Global Findex Database*. Retrieved from https://ideas.repec.org/b/wbk/wbpubs/37578.html

Demirguc-Kunt A, Klapper L, Singer D. (2017). *Financial inclusion and inclusive growth: a review of recent empirical evidence.* . Retrieved from Policy research working paper. No. 8040. World Bank. : https://openk nowledge.worldbank.org/handle/10986/26479

Demirgüç-Kunt and Levine. (2009). Finance, institutions, and financial development. *Journal of Economic Perspectives*, 23(4), 21-42.

Desalegn and Yemataw. (2017). Understanding financial inclusion in Ethiopia. *African Journal of Economic and Management Studie, 9(2)*, 200-217. Retrieved from https://www.tandfonline.com/doi/full/10.1080/23322039.2022.2071385

Dupas. P. (2016). *Facilitating savings for agriculture: feld experimental evidence from Malawi.* Retrieved from Econ Develop Cultural Chang: https://doi.org/10.1086/684014

Engle R & Granger C. (1987). Co-integration and error correction: Representation, estimation, and testing. Econometrica,. *Journal of Econometrics, 55(2)*, 251–276. Retrieved from https://www.econometricsociety.org/publications/econometrica/1987/03/01/co-integration-and-error-correction-representation-estimation#:~:text=APA,2)%2C%20251%2D276.

Falsini, S. (2023). ASSESSING PROGRESS AND PRIORITIES: ETHIOPIA'S FINANCIAL INCLUSION JOURNEY 2011-2022. . *UNCDF Ethiopia Country Office & UNCDF Policy Accelerator*.

Fikre K. (2021). THE EFFECT OF FINANCIAL INCLUSION ON POVERTY REDUCTION IN ETHIOPIA. *Global Scientific Journal*.

Foster et. al. (1984). A Class of Decomposable Poverty Measures. *The Economic Journal*, 52(3), 761–766. Retrieved from https://doi.org/10.2307/2233906

Galor and Zeira. (1993). Income Distribution and Macroeconomics. *The Review of Economic Studies*.

Gebremedhin et al. (2019). The Impact of Microfinance on Rural Household Income and Poverty Reduction: Evidence from Ethiopia. *Journal of Economics and Sustainable Development,*, 10(1), 168-178.

Granger, C. (1981). Some properties of time series data and their use in econometric model specification. *Journal of Econometrics, 16(1)*, 121–130. Retrieved from https://doi.org/10.1016/0304-4076(81)90079-8

Gutiérrez-Romero and Ahamed . (2021). *COVID-19 response needs to broaden fnancial inclusion to curb the rise in poverty.* Retrieved from https://doi.org/10.1016/j.worlddev.2020.105229

Hasan and Khan. (2013). The impact of financial development on poverty reduction. *Evidence from developing countries. Empirical Economics*, 44, 1723-1762.

Holzmann and Jorgensen. (2000). Social Risk Management. *A New Conceptual Framework for Social Protection, and Beyond.Social Protection Discussion*.

Honohan, P. (2004). Financial Sector Policy and the Poor. *World Bank Policy Research Working Paper*, 43.

ITU. (n.d.). International Telecommunication Union (ITU) World Telecommunication/ICT Indicators Database.

Johansen S & Juselius. (1990). Maximum likelihood estimation and inference on cointegration—With applications to the demand for money. Oxford Bulletin of Economics and Statistics. *52(2)*, 169–210. Retrieved from https://doi.org/10.1111/j.1468-0084.1990.mp52002003.x

Kara A. et al. (2021). *Achieving the United Nations' sustainable development goals through fnancial inclusion:* . Retrieved from a systematic literature review of access to fnance across the globe.Int Rev Financial Anal : https://doi.org/10.1016/j.irfa.2021.101833

Lokshin, M & Sajaia Z. (2004). Impact evaluation of social programs using the switching regression model. Retrieved from https://www.researchgate.net/publication/24096599_Maximum_Likelihood_Estimation_of_Endogenous_Switching_Regression_Models

Lokshin, M., & Sajaia, Z. (2004). Impact evaluation of social programs using the switching regression model.

Lopez-Castaño. (2019). Financial inclusion and human capital: Evidence from developing economies. . *Journal of Financial Economic Policy*.

Lusardi and Mitchell. (2014). The Economic Importance of Financial Literacy: Theory and Evidence. *Journal of Economic Literature*, 52(1), 5-44.

McKinnon, R. (1973). Money and capital in economic development. *Brookings Institution Press*.

Melesse, S. et al. (2017). *Financial Inclusion in Ethiopia: Evidence from the Global Financial Inclusion Index 2017.* SSRN. Retrieved from https://ssrn.com/abstract=4538267

Mohamed .S. (2023). Impact of financial inclusion on household welfare in Ethiopia. *Future Business Journal*,, 9(1), 67. Retrieved from https://ideas.repec.org/a/spr/futbus/v9y2023i1d10.1186_s43093-023-00243-y.html

Mohammed A & Kazuo I. (2017). Does financial inclusion reduce poverty and income inequality in developing countries? *Journal of Economic Structures, 9*.

Morduch, J. (1995). Income smoothing and consumption smoothing. *Journal of Economic Perspectives, 9(3),* , 103-114. Retrieved from https://www.aeaweb.org/articles?id=10.1257/jep.9.3.103

National Bank of Ethiopia. (2020). Annual Report. Addis Ababa: . *National Bank of Ethiopia.*

Pesaran et al. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics, 16(3)*, 289–326. Retrieved from https://doi.org/10.1002/jae.616

Roodman, D. (2012). The Role of Microfinance in Financial Inclusion and Poverty Reduction. *Center for Global Development*, 288.

S., P. (2015). *Banking the poor via savings accounts: evidence from a feld experiment. J Develop Econ*. Retrieved from https://doi.org/10.1016/j.jdeveco.2015.01.004

Silver, H. (1994). Social Exclusion and Social Solidarity: Three Paradigms. *International Labour Review* , 133(5-6), 531–578.

Sissay and Worku. (2018). Financial Literacy and Its Impact on Financial Inclusion: Evidence from Ethiopia. *Journal of Economics and Sustainable Development*, 9(3), 101-110.

Smith, J. (2023). Technological factors and financial inclusion in Africa: Impacts and strategies. *African Economic Review.* Retrieved from https://www.examplejournal.com

Swamy. V. (2010). *Financial development and inclusive growth.* Retrieved from The SDGS in Action: UNDP website. https://www.undp.org/sustainable-development-goal .impact of government intervention in prioritized credit Zagreb international review of economics and business: https://ideas. repec.org/a/zag/zirebs/v12y2010i2p55-72.html

Tesema, T. (2023). The Effects of Financial Inclusion on Poverty in Ethiopia: Micro Data Analysis. *International Journal of Health Economics and Policy, 8(4),* 89-100. Retrieved from Milkano, T. (2023). The Effects of Financial Inclusion on Poverty in Ethiopia: Micro Data Analysis. International Journal of Health Economics and Policy, 8(4), 89-100.

Townsend, P. (1979). *Poverty in the United Kingdom: A Survey of Household Resources and Standards of Living.* Penguin Book.

World Bank. (2015). Measuring financial inclusion around the world. *Global Findex database 2014*.

World Bank. (2020). *Measuring Financial Inclusion and the Fintech Revolution.*. Washington, DC: World Bank: Global Findex Database 2017. Retrieved from https://www.worldbank.org/en/topic/financialinclusion/overview

World Bank. (2023). *Escape from Poverty in a Multipolar World. .* Washington DC: World Bank.

World Bank Group. (2023). *Escape from Poverty in a Multipolar World.* Washington DC: World Bank. Retrieved from https://openknowledge.worldbank.org/entities/publication/fefabf5e-2c39-443e-a21c-f0a4b3e949ef

World Bank. (n.d.). *World Development Indicators (WDI).* Retrieved from https://databank.worldbank.org/source/world-development-indicators

World Bank. (2018). Ethiopia: A Diagnostic Assessment of Financial Inclusion.

Zins and Weill. (2016). The Determinants of Financial Inclusion in Africa. *Review of Development Finance*, 6(1), 46-57.

Appendex

appendex 1 descriptive analysis

```
. sum Y P I C M

    Variable |        Obs        Mean    Std. dev.       Min        Max
-------------+---------------------------------------------------------
           Y |         30    37.84467    15.80734      20.92         72
           P |         30    42.47315    17.05583    14.2779   64.09296
           I |         30    1.233243    1.299363   .0005334   5.213602
           C |         30    1.55e+08    4.69e+08  -6.39e+08   1.40e+09
           M |         30    17.27559    20.72163          0   58.42554
```

Appendex 2: Astationarity Test

```
. dfuller Y

Dickey-Fuller test for unit root           Number of obs  = 29
Variable: Y                                Number of lags =  0

H0: Random walk without drift, d = 0

                                       Dickey-Fuller
                   Test      -------- critical value ---------
              statistic           1%           5%          10%
--------------------------------------------------------------
 Z(t)            -5.220       -3.723       -2.989       -2.625
--------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0000.

. dfuller P

Dickey-Fuller test for unit root           Number of obs  = 29
Variable: P                                Number of lags =  0

H0: Random walk without drift, d = 0

                                       Dickey-Fuller
                   Test      -------- critical value ---------
              statistic           1%           5%          10%
--------------------------------------------------------------
 Z(t)            -1.769       -3.723       -2.989       -2.625
--------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.3960.
```

```
. dfuller C

Dickey-Fuller test for unit root          Number of obs  = 29
Variable: C                               Number of lags =  0

H0: Random walk without drift, d = 0

                                       Dickey-Fuller
                   Test        ──────── critical value ─────────
                 statistic          1%           5%          10%
──────────────────────────────────────────────────────────────
 Z(t)              -2.820       -3.723       -2.989       -2.625
──────────────────────────────────────────────────────────────
MacKinnon approximate p-value for Z(t) = 0.0555.


. dfuller M

Dickey-Fuller test for unit root          Number of obs  = 29
Variable: M                               Number of lags =  0

H0: Random walk without drift, d = 0

                                       Dickey-Fuller
                   Test        ──────── critical value ─────────
                 statistic          1%           5%          10%
──────────────────────────────────────────────────────────────
 Z(t)               0.860       -3.723       -2.989       -2.625
──────────────────────────────────────────────────────────────
MacKinnon approximate p-value for Z(t) = 0.9925.
. dfuller I

Dickey-Fuller test for unit root          Number of obs  = 29
Variable: I                               Number of lags =  0

H0: Random walk without drift, d = 0

                                       Dickey-Fuller
                   Test        ──────── critical value ─────────
                 statistic          1%           5%          10%
──────────────────────────────────────────────────────────────
 Z(t)              -2.995       -3.723       -2.989       -2.625
──────────────────────────────────────────────────────────────
MacKinnon approximate p-value for Z(t) = 0.0354.
```

Appendix 3 Optimal Lag Selection Result

```
. ssc install ardl
checking ardl consistency and verifying not already installed...
all files already exist and are up to date.

. ardl Y P M C I, maxlags(3) aic

ARDL(3,3,0,3,1) regression

Sample:     1997 thru     2023                  Number of obs =     27
                                                F(14, 12)     = 942.81
                                                Prob > F      = 0.0000
                                                R-squared     = 0.9991
                                                Adj R-squared = 0.9980
Log likelihood = -11.076126                     Root MSE      = 0.5470
```

Y	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
Y						
L1.	1.40786	.255024	5.52	0.000	.8522103	1.96351
L2.	-.8201259	.3457557	-2.37	0.035	-1.573463	-.0667888
L3.	.6531561	.210084	3.11	0.009	.1954223	1.11089
P						
--.	.1212355	.0610762	1.98	0.070	-.011838	.254309
L1.	-.0704991	.0915731	-0.77	0.456	-.2700197	.1290215
L2.	.1679285	.0881331	1.91	0.081	-.0240971	.3599541
L3.	.1464671	.0730252	2.01	0.068	-.0126411	.3055754
M	-.0104597	.0140616	-0.74	0.471	-.0410973	.0201778
C						
--.	9.65e-10	4.43e-10	2.18	0.050	-6.47e-13	1.93e-09
L1.	2.36e-10	3.76e-10	0.63	0.542	-5.84e-10	1.06e-09
L2.	8.19e-10	3.95e-10	2.07	0.061	-4.31e-11	1.68e-09
L3.	-4.37e-10	3.48e-10	-1.26	0.233	-1.19e-09	3.21e-10
I						
--.	.8453745	.1796481	4.71	0.001	.453955	1.236794
L1.	.258409	.2366532	1.09	0.296	-.257214	.774032
_cons	-28.10618	9.364519	-3.00	0.011	-48.50972	-7.702649

```
. matrix list e(lags)

e(lags)[1,5]
    Y  P  M  C  I
r1  3  3  0  3  1
```

Appendix 4 ARDL Bounds Test for Co-integration Result

```
. ardl Y P M C I, lags(3 3 0 3 1) ec btest

ARDL(3,3,0,3,1) regression

Sample:     1997 thru     2023                      Number of obs =     27
                                                    R-squared     = 0.9459
                                                    Adj R-squared = 0.8827
Log likelihood = -11.076126                         Root MSE      = 0.5470
```

D.Y	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
ADJ						
Y						
L1.	-.2408902	.0921619	2.61	0.023	.0400867	.4416936
LR						
P	-1.515762	.1435507	-10.56	0.000	-1.828532	-1.202991
M	.0434211	.0617098	0.70	0.495	-.0910331	.1778753
C	-6.57e-09	2.00e-09	-3.28	0.007	-1.09e-08	-2.20e-09
I	-4.582103	1.07909	-4.25	0.001	-6.933239	-2.230967
SR						
Y						
LD.	.1669698	.3128522	0.53	0.603	-.5146767	.8486162
L2D.	-.6531561	.210084	-3.11	0.009	-1.11089	-.1954223
P						
D1.	-.2438965	.1149625	-2.12	0.055	-.4943783	.0065853
LD.	-.3143956	.0848439	-3.71	0.003	-.4992545	-.1295367
L2D.	-.1464671	.0730252	-2.01	0.068	-.3055754	.0126411
C						
D1.	-6.18e-10	5.45e-10	-1.13	0.279	-1.81e-09	5.70e-10
LD.	-3.82e-10	4.01e-10	-0.95	0.361	-1.26e-09	4.93e-10
L2D.	4.37e-10	3.48e-10	1.26	0.233	-3.21e-10	1.19e-09
I						
D1.	-.258409	.2366532	-1.09	0.296	-.774032	.2572139
_cons	-28.10618	9.364519	-3.00	0.011	-48.50972	-7.70265

```
note: estat btest has been superseded by estat ectest
      as the prime procedure to test for a levels relationship.
      (click to run)

Pesaran/Shin/Smith (2001) ARDL Bounds Test
H0: no levels relationship            F =  2.199
                                      t = 0.139

Critical Values (0.1-0.01), F-statistic, Case 3
```

	[I_0] L_1	[I_1] L_1	[I_0] L_05	[I_1] L_05	[I_0] L_025	[I_1] L_025	[I_0] L_01	[I_1] L_01
k_4	2.45	3.52	2.86	4.01	3.25	4.49	3.74	5.06

```
accept if F < critical value for I(0) regressors
reject if F > critical value for I(1) regressors

Critical Values (0.1-0.01), t-statistic, Case 3
```

	[I_0] L_1	[I_1] L_1	[I_0] L_05	[I_1] L_05	[I_0] L_025	[I_1] L_025	[I_0] L_01	[I_1] L_01
k_4	-2.57	-3.66	-2.86	-3.99	-3.13	-4.26	-3.43	-4.60

```
accept if t > critical value for I(0) regressors
reject if t < critical value for I(1) regressors

k: # of non-deterministic regressors in long-run relationship
Critical values from Pesaran/Shin/Smith (2001)
```

Appendex 5 ARDL model Long Run Relationship Result

```
. ardl Y P M C I, lags(3 3 0 3 1) ec

ARDL(3,3,0,3,1) regression

Sample:     1997 thru     2023                  Number of obs =     27
                                                R-squared     = 0.9459
                                                Adj R-squared = 0.8827
Log likelihood = -11.076126                     Root MSE      = 0.5470
```

D.Y	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
ADJ						
Y						
L1.	_ .2408902	.0921619	2.61	0.023	.0400867	.4416936
LR						
P	-1.515762	.1435507	-10.56	0.000	-1.828532	-1.202991
M	.0434211	.0617098	0.70	0.495	-.0910331	.1778753
C	-6.57e-09	2.00e-09	-3.28	0.007	-1.09e-08	-2.20e-09
I	-4.582103	1.07909	-4.25	0.001	-6.933239	-2.230967
SR						
Y						
LD.	.1669698	.3128522	0.53	0.603	-.5146767	.8486162
L2D.	-.6531561	.210084	-3.11	0.009	-1.11089	-.1954223
P						
D1.	-.2438965	.1149625	-2.12	0.055	-.4943783	.0065853
LD.	-.3143956	.0848439	-3.71	0.003	-.4992545	-.1295367
L2D.	-.1464671	.0730252	-2.01	0.068	-.3055754	.0126411
C						
D1.	-6.18e-10	5.45e-10	-1.13	0.279	-1.81e-09	5.70e-10
LD.	-3.82e-10	4.01e-10	-0.95	0.361	-1.26e-09	4.93e-10
L2D.	4.37e-10	3.48e-10	1.26	0.233	-3.21e-10	1.19e-09
I						
D1.	-.258409	.2366532	-1.09	0.296	-.774032	.2572139
_cons	-28.10618	9.364519	-3.00	0.011	-48.50972	-7.70265

Appendix 6 Granger causality Wald tests

```
. vargranger
```

Granger causality Wald tests

Equation	Excluded	chi2	df	Prob > chi2
Y	P	15.05	3	0.002
Y	M	7.688	3	0.053
Y	C	14.19	3	0.003
Y	I	17.819	3	0.000
Y	ALL	23.342	9	0.005
P	Y	61.374	3	0.000
P	M	44.226	3	0.000
P	C	10.546	3	0.014
P	I	34.673	3	0.000
P	ALL	118.76	12	0.000
M	Y	5.0456	3	0.168
M	P	2.6586	3	0.447
M	C	10.56	3	0.014
M	I	3.6835	3	0.298
M	ALL	30.131	12	0.003
C	Y	1.0988	3	0.777
C	P	2.153	3	0.541
C	M	5.7183	3	0.126
C	I	3.7198	3	0.293
C	ALL	25.132	12	0.014
I	Y	40.404	3	0.000
I	P	45.852	3	0.000
I	M	6.7537	3	0.080
I	C	35.619	3	0.000
I	ALL	69.117	10	0.000

Appendix 7 Autocorrelation: Breusch-Godfrey LM Test Result

```
. . estat bgodfrey, lags(1/3)

Breusch-Godfrey LM test for autocorrelation
```

lags(*p*)	chi2	df	Prob > chi2
1	0.002	1	0.9615
2	4.422	2	0.1096
3	5.712	3	0.1265

H0: no serial correlation

Appendix 8 Heteroscedasticity Test Result

```
. estat imtest, white

White's test
H0: Homoskedasticity
Ha: Unrestricted heteroskedasticity

   chi2(26) =  27.00
Prob > chi2 = 0.4093

Cameron & Trivedi's decomposition of IM-test
```

Source	chi2	df	p
Heteroskedasticity	27.00	26	0.4093
Skewness	7.09	14	0.9311
Kurtosis	0.02	1	0.8770
Total	34.12	41	0.7681

```
. estat hettest

Breusch-Pagan/Cook-Weisberg test for heteroskedasticity
Assumption: Normal error terms
Variable: Fitted values of D.Y

H0: Constant variance

    chi2(1) =   2.78
Prob > chi2 = 0.0956
```