Reducing Poverty, Food and Nutrition Insecurity, and Destitution: Does Building Resilience Capacity Matters? Panel Data Evidence from Rural Ethiopia

Presented by

Dereje Haile

March, 2023

Supervisors:

Abrham Seyoum Tsehay (PhD)

Associate Professor of Development Economics, College of Development Studies, Centre for Rural Development, Addis Ababa University, Ethiopia

Alemu Azmeraw Bekele (PhD)

Assistant Professor of Sociology, College of Development Studies, Centre for Rural Development, Addis Ababa University, Ethiopia

Reducing Poverty, Food and Nutrition Insecurity, and Destitution: Does Building Resilience Capacity Matters? Panel Data Evidence from Rural Ethiopia

Dereje Haile

Dissertation to obtain Degree of Doctor of Philosophy (PhD)
in Development Studies (Rural Development)
at Addis Ababa University, College of Development Studies,
Addis Ababa, Ethiopia

Dissertation Approval

Addis Ababa University

School of Graduate Studies

This is to certify that the dissertation prepared by Dereje Haile, entitled: *Reducing Poverty, Food and Nutrition Insecurity, and Destitution: Does Building Resilience Capacity Matters? Panel Data Evidence from Rural Ethiopia* is submitted in fulfillment of the requirements for the Degree of Doctor of Philosophy (PhD) in Development Studies (Rural Development) complies with the regulation of the university and meets the accepted standards with respect to originality and quality.

Approved by Board of Examiners

Chairperson, examining committee	Signature	Date
Examiner	Signature	Date
Examiner	Signature	Date
Advisor	Signature	Date
Advisor	Signature	Date

Chair of Department Graduate Program Coordinator

Declaration

I hereby declare to the College of Development Studies of Addis Ababa University that this dissertation entitled *Reducing Poverty, Food and Nutrition Insecurity, and Destitution: Does Building Resilience Capacity Matters? Panel Data Evidence from Rural Ethiopia* is my account of research. It entails its main content work not fully or partially submitted for a degree at any tertiary education institution. I fully acknowledged the materials and pieces of information used in the study. The reporting procedures do comply with the expected standards and regulations of the university.

Name: Dereje Haile

Signature: _____

Date of Submission: March 2023

College of Development Studies, Addis Ababa University

Acknowledgment

Several individuals and institutions have played vital roles throughout the development of this dissertation. I wish to express my sincere appreciation to them. In particular, I would like to convey my deepest gratitude to my Supervisors Dr. Abrham Seyoum and Dr. Alemu Azmeraw who contributed entirely to this dissertation and my professional development through their intellectual guidance and support. Without their perseverance, it would not have been possible.

I benefited much from all the courses I took at the College of Development Studies, Addis Ababa University. I, therefore, wish to acknowledge all my teachers: Prof Workneh Nigatu (*Nefse yimar*), Prof Degefa Tolossa, Dr. Abrham Seyoum, Dr. Alemu Azmeraw, Dr. Getnet Alemu, Dr. Ali Hussein, Dr. Bamlaku Alamirew, Dr. Nigussie Sime, Dr. Abate Mekuriaw, Dr. Worku Tuffa, and Prof Tegegn Gebregziabhere.

I would like to extend my profound gratitude to the Ethiopian Central Statistical Agency and the World Bank for providing free data access and to Addis Ababa University for their administrative support. I would also like to sincerely recognize the Ethiopian Economics Association for the chance to participate in a few pieces of training that capacitate me of welfare analysis.

My mother Marie Giffomu Fantahun and my sister and brothers have always believed in the power of education and were a big encouragement to me. I would not have made it without their love. This dissertation has benefited from conversations with colleagues. They critically note some of the papers and persuaded me to revise a few points. I would also like to thank my friend Dagne Getachew because I learned a lot and enjoyed working with him. My special thanks also go to Cousin Getnet Tesfa and his family for their kind support. Last but not least, I am deeply thankful for the love, support, and encouragement of my wife Haymanot Asfaw, and my kids Christian and Alazar.

Dereje Haile
March 2023
Addis Ababa, Ethiopia

Publication status

This dissertation is based on two published, one accepted for publication, and one under review articles.

Chapter 2: **Haile, D.,** Seyoum, A., and Azmeraw, A. (2021). Does building the resilience of rural households reduce multidimensional poverty ? Analysis of panel data in Ethiopia. *Scientific African.* Elsevier B.V., 12, e00788. https://doi.org/10.1016/j.sciaf.2021.e00788.

Chapter 3: **Haile, D.,** Seyoum, A., and Azmeraw, A. (2022). Structural and stochastic poverty, shocks, and resilience capacity in rural Ethiopia. *Progress in Development Studies. SAGE Journals.* (Accepted)

Chapter 4: **Haile, D.,** Seyoum, A., and Azmeraw, A. (2022). Food and Nutrition Security Impacts of Resilience Capacity: Evidence from Ethiopia, *Journal of Agriculture and Food Research*. Elsevier B.V., 8 (March), p. 100305. https://doi: 10.1016/j.jafr.2022.100305.

Chapter 5: **Haile, D.,** Seyoum, A., and Azmeraw, A. (2022). Resilience capacities and multidimensional destitution in the presence of shocks: Unmasking the spatiotemporal patterns in rural Ethiopia. *Humanities and Social Science. Elsevier* (Under review)

Table of contents

List of abbreviations

ABS – Access to Basic Services
AC – Adaptive Capacity
AST – Assets
CBN – Cost of Basic Needs
CSA – Central Statistical Agency
DASP – Distributive Analysis Stata Package
DDS – Dietary Diversity Score
EA – Enumeration Area
ETB – Ethiopia Birr
ESS – Ethiopian Socioeconomic Survey
FCS – Food Consumption Score
FEI – Food Energy Intake
FGT – Foster Greer Thorbecke
LSMS – Living Standard Measurement Study
MIMIC – Multiple Indicators Multiple Causes
MRA – Meta Regression Analysis
NDVI – Normalized Difference Vegetation Index
PCA – Principal Component Analysis
PFE – Per capita Food Expenditure
PSNP – Productive Safety Net Program
RIMA – Resilience index measurement approach
SSNP – Southern Nations and Nationalities and People
SSA – Sub-Saharan Africa
SDG – Sustainable development goals
RCI – Resilience Capacity Index
SSN – Social Safety Net
TLU – Tropical Livestock Unit
TT – Treelet Transformation
UNDP – United Nations Development Program

Abstract

While there are assumptions that resilience has led to curbing poverty, food and nutrition insecurity, and destitution, the empirics are limited to ascertain the linkages and finding out implications for policy uptake in Ethiopia. In light of this, this dissertation examine the role of resilience on reducing welfare problems in rural Ethiopia. The data comes from the three rounds of the Ethiopian Socioeconomic Survey (2011/12-2015/16). Resilience is estimated using the resilience index measurement analysis (RIMA–II) approach. The Alkire and Foster's methodology, on the other hand, is employed to compute multidimensional poverty and destitution. We also attempted to use the third generation poverty measures: structural and stochastic poverty. Furthermore, the study compute food and nutrition insecurity using kilocalories, food poverty, dietary diversity and food consumption scores, and multidimensional perspectives. The data were analyzed using different micro-econometrics techniques in four self-contained but closely related articles. Since alternatives measures have low static correlation and dynamic mismatch, exclusive reliance on a single measure may send inaccurate signal to policymaking. Dominance of transitory escape and impoverishment implies that lifting people out of the pool of welfare problems will not be enough unless descents are simultaneously addressed. The econometric results reveals that climate induced, price and production related shocks and conflict come up as household stressors that exacerbate welfare problems. The other strand of challenge that contributes to the growing welfare problems are dependence on rain-fed farming accompanied with land fragmentation, old-age and female headship, dependency ratio, wage labor participation, loan, and poor road and marketing networks. In contrast, households experienced steady declines in poverty, food insecurity, and destitution as a response to slight growth in resilience. Resilience also serves as a mechanism to deal with welfare problems in the face of shocks. However, resilience is not a panacea. There exists a potential for farming to be an integral part in the process. The farming potential, however, is expected to be tapped through improving commercialization, irrigation, extension, roads, and marketing networks. Currently, it is unlikely to continue as land pressure is increasing due to population growth. Thus, fostering the non-farm economy, good vegetation cover, and human capital formation are imperative. Interventions aimed at eradicating those welfare problems would do well when focusing on enabling factors that can enhance resilience as a conduit mechanism. Besides, more support to should be given to the farming economy. The farming potential is tapped through improving commercialization, investment in irrigation, extension, and road and market networks. Nevertheless, the sector is fraught and less remunerative. Thus, the finding accentuate the need for policy interventions that reinforce productive farming and the non-farm economy. An emerging line of enquiry for the viability and development of rural households generally, and reducing those welfare problems, specifically highlighted the vital role of growth from below and rural revitalization.

Keywords *– Resilience, poverty, food insecurity, destitution, micro-econometrics, Ethiopia*

Chapter 1: Introduction

1.1. Background

The fight against poverty, food and nutrition insecurity, and destitution are dreadful challenges facing the world. Global initiatives have sought to put a spotlight on the problem of persistence of these problems. Embodying a universally shared vision of a safe and sustainable space for all to live with a moral principle of no one left behind and eliminating hunger and malnutrition drives the emergence of sustainable development goals (SDGs) (World Bank, 2017). Following the SDGs commitments, poverty has substantially fallen in many developing countries (OPHI, 2019). In contrast, recent estimates revealed that 1.6 billion people in the world remains poor, of which 43% are in Africa (Beegle et al., 2016). Sub-Saharan Africa (SSA) entails nearly 30% of the poor in Africa (Alkire et al., 2017; Alkire and Hosseini, 2014). Though progress has been made in SSA at a modest rates (McKay, 2017), the region still reflects more disappointing patterns. East Africa in turn is experiencing pervasive poverty because of recurrent and concurrent shocks (Alkire and Hosseini, 2017).

The poor are often vulnerable to food and nutrition insecurity. Achieving SDG 2 - ensuring access to safe, nutritious, and sufficient food for all people all year round, eradicating all forms of malnutrition, and achieving zero hunger - are arguably the most difficult challenges. Globally, between 702 and 828 million people suffer from hunger, and approximately 9.8% experience undernourishment. Projections also reveal that 8% of the world population will be hungry at the end of 2030 compared to what has been there in 2015 (FAO, IFAD, UNICEF, 2022). On the other hand, out of the nearly 150 million stunted children globally, more than 90% subsist in Africa and Asia (WHO, 2021). While most food and nutrition insecure people live in Asia, the incidence is highest in Africa. Nevertheless, the problems remain wicked in SSA (Giller, 2020).

In developing countries, destitution – an extreme form of poverty – is also a more debilitating problem. The destitute are people usually left behind during poverty alleviation efforts. Globally, more than 53% of poor people are identified as destitute (Alkire and Hosseini, 2017). While the overall figure has been declining over the past decades, progress has been slow in SSA. Yet the region still harbors nearly 200 million destitute (Alkire et al., 2014).

Ethiopia is registered to be the poorest in SSA having a multidimensional poverty index of 0.687 with a last rank next to Niger (OPHI, 2022). In stark contrast, more than half of the multidimensionally poor are destitute in Ethiopia (Alkire and Hosseini, 2017). Food and nutrition insecurity are also very incapacitating problems. A sturdy dependence on food aid witnesses the precariousness of food insecurity. The country ranks 90th out of 116 countries on the Global Hunger Index (GHI) (Alliance, 2022). Likewise, nearly two out of five children under five years of age get too little dietary energy and are stunted (EPHI and ICF, 2021).

Rural households in Ethiopia often deal with a wide range of covariate and idiosyncratic shocks (Hirvonen et al., 2020; Gebremariam and Tesfaye, 2018; Hill and Porter, 2017; Weldeegzie, 2017). These shocks worsen environmental degradation and social instability (Gebremeskel et al., 2019; Baloch and Behrman, 2016). The recurrence and concurrence of shocks not only endanger their livelihoods but also deteriorate resources and ability to recover (Borgomeo et al., 2018; Gao and Mills, 2018; Mekuyie et al., 2018; Campos et al., 2014; Thiede, 2014; Carter et al., 2007). These ultimately cause a deeply entrenched cycle of subsistence and vulnerability to poverty, food and nutrition insecurity, and destitution. Besides, exposure to shocks accelerates ecosystem degradation and makes agricultural production riskier. Given the increasing vulnerability, the future of rural households is getting more challenging. Therefore, many of them stay at risk of being left behind.

1.2. Review of related literature

This section encompasses basic concepts and a summary of empirical literature relevant to the linkage between resilience and welfare problems. It helps to create familiarity with current thinking and research and indicates future research into a previously overlooked or understudied area.

1.2.1. Overview of concepts and theories

1.2.1.1. Poverty

The concept of poverty and how to measure it has witnessed clear evolution. Conventionally, poverty is associated with the situation whether an individual possesses enough income or consumes enough to surpass the predetermined level of basic needs (Ravallion, 2016).

Consumption expenditure or income has been used as measure of household poverty. Expenditure is typically preferred to income as it better captures long run welfare. The Permanent Income Hypothesis also underlined that expenditure is more stable than income (DeJuan and Seater, 1999) and better capture household's capabilities (World Bank, 2018). Expenditure, encompassing food and non-food elements of well-being that relays on market-determined prices to provide socially determined weights for each element, reflects the household ability to meet basic needs. Ethiopia's official poverty statistics follows the standard expenditure-based measure (MoFED, 2017; 2012). Income is one of the factors enabling consumption which in turn shows a household access to credit and saving at times when their income was too low.

The expenditure-based poverty measurement follows two main steps: identification and aggregation (Ravallion, 2016). The first step entails choosing a welfare indicator and establishing a poverty line. The poverty line is often drawn using Cost of Basic Needs (CBN) approach. Once the poverty line is constructed, the population can be categorized into poor and non-poor. The identification of who is poor is relatively straightforward: the poor are those whose overall achievement or resource variable falls below the poverty line. The Foster-Greer-Thorbecke (FGT) indices can also be employed to gauge the incidence, intensity, and severity of poverty (Foster et al., 2010). The conceptual and practical limitations of this approach is the failure to acknowledge the need for non-monetary dimensions of well-being that are excluded from the measures because there are no prices for them (Krishna, 2017). Households experiencing poverty also describe their deprivation beyond low income (Alkire and Foster, 2011a). The conventional measure possibly results in awkwardly informed poverty policy discussions.

Poverty goes beyond the simple fact of scarcity of income. Currently, it evolved into utility - and capability-based concepts, as Sen proposed to include inequality, health, education, security, political voice, and discrimination (Sen, 1981). The developments in the literature highlighting limitations on monetary approach and following the seminal works of Sen (1976 and 1979) that poverty is defined as a lack of capability have begun to propose non-monetary measures. Subsequently, poverty is believed to be complex and multidimensional in its

conception, causation, manifestation, diagnosis, and the policies designed in pursuit of its reduction (Alkire et al., 2015). It has also been underlined that non-monetary measures of well-being can play a complementary role to monetary-based measures to portray a complete picture of longer-term poverty and the experience of poverty (Hulme and Shepherd, 2003). Such comprehensive structural poverty measures such as Human Development Index (HDI), Multidimensional Poverty Index (MPI), and an asset-based indices have been proposed (Alkire and Foster, 2011b).

The application of the conventional poverty allows insight into the evolution of poverty within society. To overcome the major drawbacks, poverty analysis is conceived in the asset space. Therefore, asset poverty is used to define poverty towards the third generation poverty measures: stochastic from structural poverty. It also decompose structural and stochastic poverty transitions (Carter and Barrett, 2006). Using the information on assets and expected levels of well-being, one can distinguish the stochastic and structural transitions following Carter and May (1999). The monetary and asset poverty transitions create a line between those who became stochastically poor or non-poor, i.e. out of sheer luck, and those structurally, i.e. for not having adequate assets. Structural transition into poverty exists when households encounter income and asset loss. However, asset accumulation and enhanced asset returns favor structural upward mobility. On the other hand, a stochastic transition into poverty occurs because of already poor asset ownership and further deterioration in returns to assets. When income rises but no change in assets prevails or households sell off assets to gain income, stochastic upward mobility is about to happen (Dutta, 2021).

The multidimensional approach is assumed to be a high-resolution lens to look at poverty as human lives are battered and diminished in many ways (Alkire, 2011). What makes the methodology a prominent and attractive option is its desirable features such as flexibility, dimensional monotonicity, subgroup decomposition, the joint distribution of deprivations, and intuitive interpretations (Alkire, et al., 2015). The method is getting prominent as it lightens the heavy burden of poverty reduction for policymakers: identifies the most deprived poorest people so that efficiently allocate resources; highly interconnections among deprivations and helps to identify poverty traps; and complements with other measures and quickly reflect the

effects of changes in poverty-reducing policies. The literature on poverty dynamics is extensive, but many studies conclude only about the dynamics of monetary poverty. However, there is growing, though infant, literature on the dynamics of multidimensional poverty.

1.2.1.2. Food and nutrition insecurity

The conceptualization, measurement, and causes of food and nutrition insecurity have also clearly witnessed progression. It began with a lack of sufficiency of food, which is a function of domestic agricultural production, trade, and food aid focusing on the supply side (Shaw, 2007). In the Food Availability Decline (FAD) theory, food insecurity is a sudden decline in per capita food availability triggered by climate-induced factors. When food insufficiency occurs, food prices hikes and those unable to bear such a burden consume less. Food security, in simpler terms, is measured by the nation's ability to produce food calculated to be enough to feed the entire population. The concept is viewed exclusively through the lens of food shortages and implicitly presumes that food is made available equally to the entire community, though such an assumption fails to reflect reality. Therefore, this theory is criticized by Sen as incomplete and deterministic for its inability to explain entitlement failure. It inevitably overlooks the variability which exists within a community.

Though many developing countries became food self-sufficient, people were still hungry and food insecure. Likewise, having an ongoing availability of enough food does not guarantee that individuals have a nutritionally sound diet. There should be purchasing power among the people to access food by providing them employment and strengthening their livelihood base, leading to the emergence of the Food Entitlement Decline (FED). First proposed by Sen (1981), the theory argued that food insecurity emanated from supply and lack of effective demand amongst the poor. Food insecurity sprang from the low purchasing power of the consumer. The definition eventually evolved as distress emerged over the unbalanced distribution and access to food. The paradigm blames poverty for the inability to gain access to food. FAO (1983) also elaborated a new outset of food insecurity built on entitlement failure. This paradigm adds two principal dimensions of food insecurity physical access, which emphasizes the logistic dimension, and economic access related to income and purchasing power to buy the available food commodities from the market. When an entitlement set lacks adequate quantities of food,

food insecurity ensues. A wide range of factors is sought that determine entitlement to food. This theory has been criticized for its inability to recognize the social and political aspects.

Likewise, having an ongoing availability and accessibility to enough food does not guarantee that individuals have a nutritionally sound diet. Some other factors also affect the sphere of food security apart from availability and accessibility. Therefore, it needs a paradigm shift that emphasized food utilization as the third dimension is introduced in addressing the issues of diet quality, food safety, and adequate intake of macro and micronutrients. The inability of a single indicator to fully capture food security implies stability became a vital element of food security in the 1996 world food summit (Headey and Ecker, 2013). With heightened awareness and vulnerability to risks of food shortages, the multidimensional approach rapidly proliferates. The perspective refers to the livelihoods' inability to guarantee the four distinct but overlapping dimensions of food insecurity (Shaw, 2007). It also adds to the socio-cultural acceptance of food and captures the temporal dimension of all pillars.

Despite the pledge of all the dimensions of food security, factors determining long-term sustainability are left unexplored. The dynamism of food insecurity makes neither the causes nor the solutions as straightforward as humanitarian responses to natural disasters. While social protections prevent outright starvations, they remain untouched by the underlying vulnerabilities. While these succeeded in averting mass starvation, they did not banish the threat of further famine, fail to protect against asset depletion, and left untouched the underlying vulnerabilities. Food security without sacrificing investments in livelihood security in the future is reflective of genuine food sustainability. A sustainable livelihood approach to food security has emerged with the vital theme of tackling the problem that may arise due to economic, social, political, institutional, environmental, and ecological factors. The approach, founded on the idea of resilience, helps us to build appropriate interventions to eliminate food insecurity in diverse contexts. This compels us to look for a twin-track approach that synchronizes humanitarian and development interventions. A livelihood is sustainable when it can cope with and recover from stresses and shocks, and maintain or enhance its capability and assets, while not undermining the natural resources base (Chambers and Conway, 1992).

1.2.1.3. Destitution

Unlike poverty and food and nutrition insecurity, destitution is a less rigorously defined term in the development literature. Usually, there is a need to be aware of whether poverty reduction has improved the situations of the ultra-poor – labeled as destitute. Therefore, it is crucial to distinguish them from the moderately poor population. In the marginalist conception, Lipton (1988) differentiates the destitute from the poor using arbitrary thresholds. Accordingly, the poor are those households unable to meet their minimum subsistence needs despite spending 60% or more of their incomes on food, while the ultra-poor or poor cannot meet their minimum subsistence needs despite spending 80% or more of their incomes on food. In contrast, the structuralist would incorporate qualitative distinctions between destitution and poverty. Destitute is somehow recognizably different. A sociological perspective extends beyond economic proxies for ill-being to include indicators of social exclusion and marginalization that led to unsustainable livelihoods (Devereux, 2003). The entitlements based conception, on the other hand, suggests that the destitute are those whose production plus labor-plus trade-based entitlements are inadequate to generate subsistence and who therefore derive a sizeable proportion of their livelihood from transfer-based entitlements, either public or private (Sen, 1981).

There is a scarcity in the literature to measure and describe the conditions of the destitute using survey data and provide direction for welfare-enhancing policies. The approach in destitution measurement is very scarce. The empirics preconceived destitution as an extreme form of poverty emanated from untenable livelihood in which households possess precarious productive assets needed to experience poverty escapes, and rural people rely on public and private transfers (Sharp et al., 2003). Destitution entails social, political, and economic deprivation apart from income. It is, thus, grounded in multidimensional notions. The destitute are poorest of the poor (Devereux and Sharp, 2006) and a subset of the multidimensionally poor (Alkire and Seth, 2015) so deprived that they fall below the stringent deprivation thresholds or poverty cut-off. In operationalizing destitution from a multidimensional perspective, some attempts have been made. The earliest studies that developed a measurement methodology are Devereux and Sharp (2004). Their analytical framework postulates destitution as a multidimensional variable. The index was constructed using fifteen key indicators by Principal Component Analysis (PCA) following Filmer and Pritchett (1998). The

counting-based identification is proposed by Alkire and Foster (2011a) to identify the destitute. This method entails intensity and depth approaches. Intensity pinpoints the subsets of the poor by setting a more stringent poverty threshold while keeping fixed dimensions, the weight vector, and deprivation benchmarks used for identifying the poor. The approach captures a multiplicity of deprivations in akin indicators but ignores information on the depth of deprivations. It has been applied by Alkire et al. (2015) to identify the ultra-poor in developing countries. The latter, on the other hand, employs a set of more ultra-deprivation thresholds. The depth approach captures a multiplicity of deprivations in terms of ultra-deprivations. Alkire and Robles (2015) have recently applied this approach. Nonetheless, the different approaches identify entirely or partially distinct subsets of the poor, and the decline of these subsets does not move in tandem (Alkire and Seth, 2015). This study attempted to follow the intensity approach as it reflects a higher intensity of simultaneous deprivations in multiple dimensions.

1.2.1.4. Resilience

Though relatively new in development discourse, resilience has the earliest root in engineering and later popularized in ecology. Psychologist, on the other hand, attempted to synthesize the term from ecology to the psychology of personal development, mental health, and community development to show where overlaps occur (Berkes and Ross, 2013). They found that a community's resilience depends on its strengths and assets, augmented by social learning, formal and informal networks, integration of knowledge from multiple sources, economic diversification, infrastructure, and values and beliefs. Later on, ecologists trim the term and employ it to describe the amount of disturbance a system can absorb before shifting into an alternative state (Holling, 1973). Gradually, a tide of research that moved into socio-ecological systems flooded literature in the ensuing decades (Folke, 2006). Holling's work increases also popularity in several disciplines other than ecology. For example, disaster risk reduction (IFRC, 2016), climate change adaptation (Moser et al., 2010), urbanization (Béné et al., 2014), and social protection (Davies et al., 2013), all-encompassing the concept to different extents. In the development discourse, resilience is typically discussed in terms of long-lasting adverse development consequences to livelihoods and the ability to overcome them (Barrett and Constas, 2014; RM-TWG, 2014). The interest in development discourses has arisen from

concerns over the cumulative effect of humanitarian crises. Viewed as a strategic approach to dealing with a wide range of shocks that undermine the efforts to reduce poverty and food insecurity, resilience has emerged as a vital concept for policy and program development (Hoddinott, 2014).

Conceptually and methodologically, measuring resilience in the context of food security has witnessed an apparent evolution (Ansah et al., 2019). It implies different things to different scholars, institutions, and agencies. They tried to conceptualize and measure resilience in different ways. Regardless of the plethora of definitions, the whole essence rests on Resilience Measurement Technical Working Group conceptualization. It states that "resilience is the capacity that ensures transitory adverse events (shocks) or more persistent adverse trends (stressors) do not have long-lasting adverse development consequences" (Constas et al., 2014). Therefore, countries are resilient when there are increases in resilience capacities and reduce welfare problems in the face of shocks and stresses.

Resilience is related to, but transcends, the concept of vulnerability. Both concepts emphasize risk exposure and the context-dependent shocks to which one might be exposed. Vulnerability typically refers to the sensitivity to shocks reflecting the likelihood that some disturbance leads to a change of state to an undesirable position, given one's capacity to mitigate or cope with the shock. Resilience helps to reduce the impact of vulnerability and address the structural causes of vulnerability (Béné et al., 2015). It concerns the sustained path of well-being in the face of shocks and stressors (Barrett and Constas, 2014).

A few theory-based empirical approaches push the methodological frontier in resilience measurements. Béné et al. (2016) introduced a more elaborated conceptualization in that resilience results in a blend of absorptive, adaptive, and transformative capacities each of them leading to different short and long-term responses depending on the intensity of shocks. When shocks are less intensified, the more likely the household will be able to resist and absorb the impact of shocks without compromising their function, status, or state. Households may also exercise their adaptive capacity. They employ various incremental changes and adaptations to continue functioning in response to shock, without making major qualitative changes to the way they operate. Nevertheless, some transformational responses are required when shocks

overwhelm both the absorptive and adaptive capacities of the households. Resilience capacity responds to crises by protecting either the life or livelihoods of households after these have been hit by shocks.

The second approach employed a theory of poverty-traps to resilience and estimate pastoralists welfare function in Northern Kenya taking the evolution of livestock holdings into account over time (Cissé and Barrett, 2018). Their method allows previous livestock holding to determine the future livestock wealth in a non-linear way to generate the S-shaped welfare curve.

The third approach is the Resilience Index Measurement and Analysis (RIMA) developed by FAO (FAO, 2016). In this approach, resilience is conceptualized as a multidimensional latent variable with four key contributing pillars. Observed indicators within each attributes are combined to construct a composite index of resilience capacity. Early empirical applications of RIMA adapted to two stage factor analysis (FA) to measure resilience. The last generation of applications however employed FA and structural equation modeling (SEM). It proposed an indirect measure of resilience that adopts regression analysis, and, consequently slows causal inferences.

1.2.2. Empirics on resilience and welfare problems linkages

Following Constas et al. (2016)'s typologies of defining resilience, we assessed the empirical analyses. Generally, findings indicate that resilience enhances the ability of households to cope with various shocks so that household food and nutrition security are not adversely affected. We find three groups of empirics based on the three definitions. Employing "resilience as a capacity, hence can be predicted, explained or constructed by selecting other variables", a large body of empirical research argues resilience capacity is vital for reducing food and nutrition insecurity (Melketo et al., 2021; Nahid et al., 2021; D'Errico and Pietrelli, 2017; Tefera et al., 2017; Boukary et al., 2016). These studies employed a non-aggregated approach and did not disentangle resilience from food and nutrition insecurity. Resilience, therefore, is considered an outcome. They did not take into account resilience dynamics shocks. In this case, households with higher resilience scores have better food and nutrition security. Thence, policies and

program interventions aimed at improving food security directly lead to better resilience. This set of studies could not adequately scrutinize resilience and food security.

In contrast, the second group computed resilience vis-à-vis observed changes in food and nutrition security over time or change and return time before and aftershocks (Chamdimba et al., 2021; Béné et al., 2016; Upton et al., 2016). These categories adopt resilience "as an observed change over time or return time of a well-being outcome". The policy intervention is to provide targeted interventions that enable vulnerable households to cope with shocks so that changes in food security do not fall below the predetermined minimal thresholds. Nonetheless, this approach fails to provide a quantitative measure of resilience capacity.

While others used resilience as an outcome variable to predict food insecurity and provide a better quantitative analysis of their linkages (Atara et al., 2020; D'Errico et al., 2018). This set of empirical studies follows the definition "resilience, once constructed as a variable, can be defined as a capacity that predicts well-being". Adopted from Alinovi et al. (2008) and the revised versions of Alinovi et al., (2010), FAO is the first development entity to study resilience with food security employment. Early empirical applications of FAO (2014) adopted RIMA-I two-stage FA with Bartlett's prediction technique. In the first step, resilience attributes were estimated through FA of observable variables, and then resilience was estimated through FA using pillars. Subsequently, FAO (2016) proposes RIMA-II indirect measure of resilience adopting regression analysis and, thus, allows causal inference.

1.2.3. Conceptual framework

The heavy reliance of rural livelihoods on natural resources in Ethiopia often makes households largely at the mercy of uncertainties. The country is repeatedly hit by a plethora of concurrent and recurrent shocks. These shocks are of idiosyncratic and covariate in nature. These shocks exacerbate poverty, food and nutrition insecurity, and destitution, and thus jeopardize the lives and livelihoods of millions of smallholders. As a remedy, Ethiopia has implemented a number of interventions to reduce those most experiential indicators of welfare problems. There is also ample evidences of the encouraging impact in saving lives and livelihoods (Borga and D'Ambrosio, 2021; Berhane et al., 2015; Fiszbein et al., 2014). However, they predominantly

focused on cargo-net or bouncing-back activities and offer little on sustained route out of poverty, food and nutrition insecurity, and destitution (Baye, 2017). The apparent links between resilience, food and nutrition security have been drawn with plenitude of evidences. Yet the resilience discourse is still evolving, and faces significant conceptual and operational challenges. With these caveats in mind, particular focus is given on synergizing relief and development to reduce other welfare problems in the face of shocks. The added value of resilience as a catalytic element to understand how households respond to shock or stress have already been widely recognised in the social-ecological systems literature (Cinner and Barnes, 2019; Walker et al., 2006). Far less literature is found in the development discourse. The few studies yet focus essentially on the apparent link between shocks and food insecurity (D'Errico et al., 2017; D'Errico and Pietrelli, 2017; Tefera et al., 2017). The approach depends on the premise of the economic cost of protecting, recovering, and improvement in livelihood systems in the wake of shocks. In this dissertation we revisit resilience from the specific perspective of welfare problems other than food security.

Resilience augments to minimizing exposure to shocks and recovering quickly when exposed, making informed choices about alternative livelihood strategies based on changing conditions, and creating a system level enabling conditions for long-lasting resilience. Growth in household resilience enhances sustained escape out of multidimensional, structural and stochastic poverty, food and nutrition insecurity, and destitutions in the face of shocks and stresses. When shock occurs, households cope up with different degree of responses. The lower the intensity of the shock, the more likely the household will be able to resist effectively, absorbing the shock's impacts without changing their function, status, or state. In that vein, the absorptive capacity of the household emerges essentially from the various coping strategies by which its members moderate or buffer the impacts of shocks on their livelihoods and basic needs (Béné et al., 2016).

In complement to their absorptive capacity, households can exercise their adaptive capacity when shocks are moderate in intensity. This adaptive capacity refers to the various incremental changes and adaptations that people undergo in order to continue functioning in response to a shock or a growing stress, without making major qualitative changes to the way they operate

(Béné et al., 2012). If, however, the changes required in response to shocks or stresses are so large and/or so frequent that they overwhelm both the absorptive and adaptive capacities of the households, some form of transformational response will have to take place (Béné et al., 2016).

Building resilience – the ability to manage shocks without compromising their future well-being – vitally reduce humanitarian costs. It is a win-win approach (Béné et al., 2016). This rapprochement did not, however, happen only at the institutional level, it also occurs within programs such as PSNP in Ethiopia (Gilligan et al., 2009), challenging the frontiers of poverty reduction and targeting the ultra-poor in Bangladesh (Davies et al., 2013), and pastoralist livelihood initiative in Kenya (Carter et al., 2007). There is a rapidly growing cognizance that resilience should focus on saving livelihoods than saving lives (Kuriakose et al., 2012). Therefore, understanding the linkages between resilience and welfare problems is crucial for policies and desired interventions that target rural households in Ethiopia.

Since resilience is dynamic in nature (Rutter, 2012), the analysis needs a dynamic framework. The earlier frameworks applied to guide, diagnose, measure, and evaluate resilience clearly unveil what happens to household well-being, the resilience capacities and the response mechanisms when shocks and stresses occur. Figure 1.1 illustrate the pathways of enhancing resilience in eradicating welfare problems in the face of shocks in rural Ethiopia. It claims the role of resilience in eliminating poverty, food and nutrition insecurity, and destitution using multiple perspectives. It describes what happens to a household welfare problems when a shock occurs and resilience mechanisms are activated. This analytical framework is based on FAO RIMA II (FAO, 2016) and the natural evolution of the conceptual framework elaborated by (Alinovi et al., 2008). Y_0 is obtained through a set of time-variant and time-invariant characteristics, a number of pillars contributing to household resilience capacity. When shocks occurs, a series of coping, adaptive, and transforming strategies are activated, principally consumption smoothing, assets smoothing and adoption of new livelihood strategies. Household resilience contributes to these absorptive, coping and transformative capacities in an attempt to bounce back to the previous state of well-being. This can result in an increase or decrease in Y. Any change in resilience capacities has an effect on Y and, consequently, can limit future capacity to react to shocks.

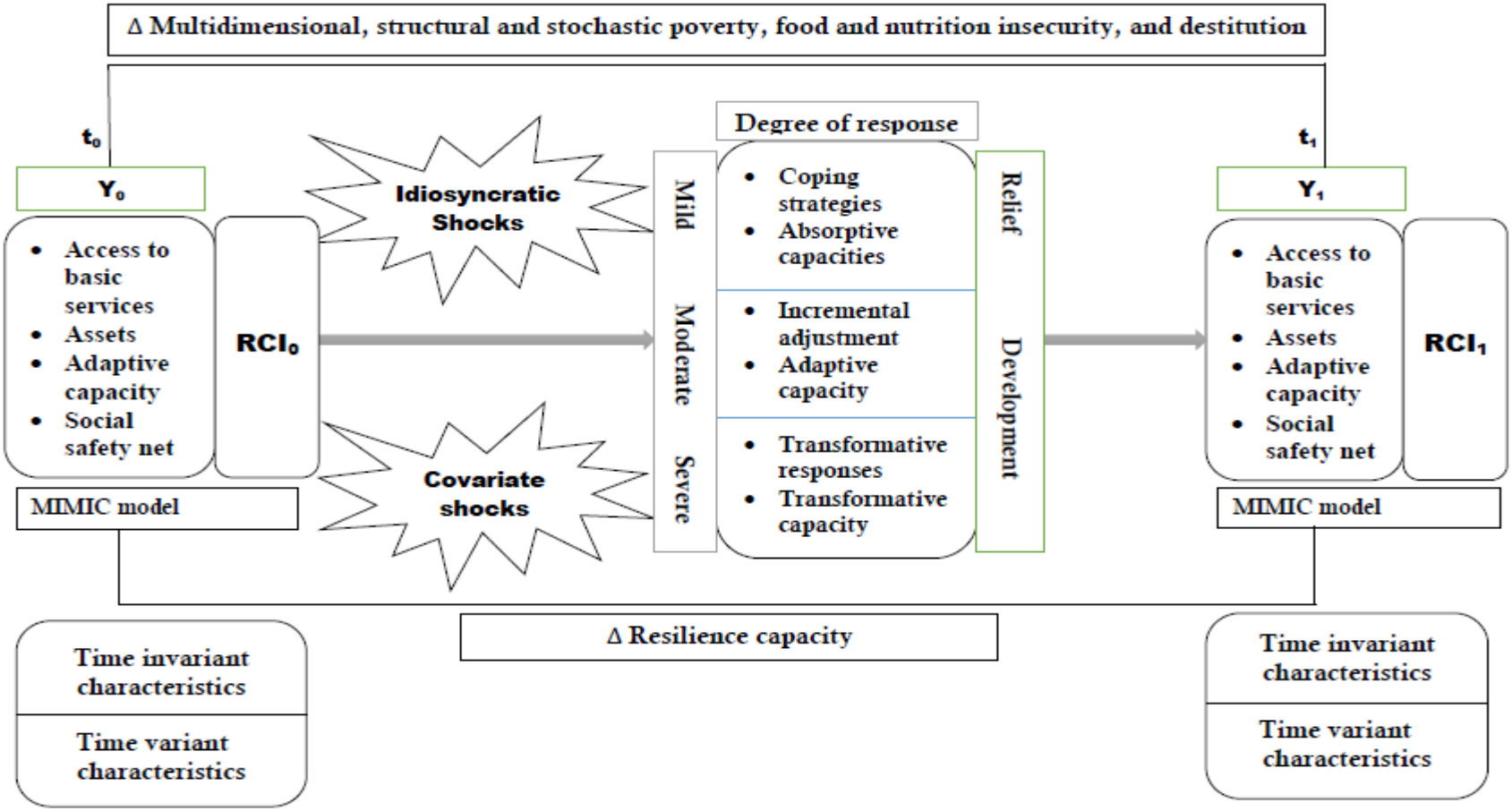


Figure 1.1: Conceptual framework of the study

1.3. Problem statement

The social and economic cost of poverty, food and nutrition insecurity, and destitution in rural Ethiopia are multifaceted. Productivity loss, poor educational performance and healthcare, high expenditures, social unrest, and hopelessness that ultimately cost millions of lives are some of empirically ascertained ones (Diriba, 2020). Generally, the country often loses 16.5% of its GDP or 55.5 billion Ethiopian Birr (ETB) each year due to chronic malnutrition (Alliance, 2022). Besides, 28% of child mortality is associated with undernutrition (COHA, 2014). Undernutrition in turn deteriorates the cognitive potential and perpetuates the vicious cycle of poverty and underdevelopment (Martorell and Zongrone, 2012). How welfare problems develop, what accounts for their persistence, and what specific measures are taken to eliminate them in the presence of shocks remain the underlying objective of the incumbent government.

Following the implementations of consecutive development plans and strategies, poverty and food and nutrition insecurity decline mainly between 2001/02-19/20 with spatial heterogeneity (World Bank, 2020a). However, some 25 million people still remain money metric poor (MoFED, 2017). Ethiopia is registered to be the poorest in SSA having a multidimensional poverty index of 0.687 with a last rank next to Niger (OPHI, 2022). More than half of the multidimensional poor are destitute in Ethiopia (Alkire and Hosseini, 2017). Besides, more than 20 million people live in a chronic state of food deprivation, of which nearly 8 million are regular safety net beneficiaries (Diriba, 2020). Though the global hunger index (GHI)[1] declines from 53.7 to 24.1 (2000-2020) (Alliance, 2022), the score remains under the serious scale.

The recent progress in the fight against those welfare problems has suffered the worst setbacks due to four daunting challenges. First, rural households are subject to idiosyncratic and covariate shocks. For example, climate-induced (Hirvonen et al., 2020), price-related (Hill and Porter, 2017), and health-related (Gebremariam and Tesfaye, 2018) shocks exacerbate welfare problems by way of reduced education, labor market participation, and agricultural output that subsequently drive a decline in incomes and consumption (Ngoma et al., 2019). Shocks compromise the abilities to develop households' stock of wealth and stifle them to use it effectively to sustain improvements in their lives. As a result, they lack the required assets to

[1]GHI is a tool designed to monitor the country's progress and limitations in the fight against hunger computed using the following three steps: compute the values of four proxies (undernourishment, child stunting, child wasting, and child mortality), set a standardized score on a 100-point scale for each indicator, and aggregated standardized scores and find out GHI scores (Grebmer et al., 2019).

convert into income requirements. When prolonged and multiple, shocks result in a downward spiral of asset loss and impoverishment that ultimately limit years of development gains and efforts to eradicate welfare problems (Campos et al., 2014).

The second important reason to explain is the methodological flaws. Ethiopia's official poverty, food and nutrition insecurity, and destitution statistics follow the conventional approaches and design interventions for tackling them accordingly (MoFED, 2017; 2012). However, these approaches have been criticized for their failures to capture multifaceted attributes (Krishna, 2017). Likewise, households experiencing those welfare problems also describe their deprivation beyond low income and calorie consumption (Alkire and Foster, 2011a).

Third, welfare problems are inherently dynamic. Rural households churn around the welfare thresholds[2], while impoverishment and transitory escape overshadows the trajectories (Scott et al., 2014). Coexisting streams flowing in parallel reconfigure the stock of the poor, food and nutrition insecure, and destitute (Krishna, 2017). Experiencing ascents is insufficient to reduce the problem unless we simultaneously address descents. According to Krishna (2010), fundamental causes and large-scale events are not all that matter. Reducing those welfare problems more effectively in the future demands ins and outs of the rural households. A thorough and context-specific understanding of asymmetric reasons is imperative for developing more effective policy designs.

Last, Ethiopia has experienced substantial economic growth for the last two decades (Shimeles, 2019). All parts of the changing economic landscape pay little dividends (World Bank, 2020a). Therefore, humanitarian assistance, disaster risk reduction, climate change adaptation, and social protection interventions have been implemented in the fight against poverty, food and nutrition insecurity, and destitution (Knippenberg and Hoddinott, 2017). However, they are costly, weak in coverage, function in silos, and lack systematic attempts to identify the in need, determine their needs, address them, and sustainably move out of the problem.

[2] It implies to the different scales, cut-off points or benchmarks to classify households as poor, food and nutrition insecure, and destitute and non-poor, food and nutrition secure, and non-destitute. It includes multidimensional poverty and destitution thresholds, poverty lines, minimal kilocalorie per adult, the amount of money to purchase the minimal food basket, etc.

The interventions have yet been polarized and usually perceive a serious divide between relief and development. Relief efforts are aimed to respond to crises by protecting the life and livelihoods after a shock. As such, they often deal with coping strategies and trying to strengthen absorptive capacity. These redemptive approaches have not led to any meaningful mechanism for mitigating the adverse effects of shocks. Therefore, many poor, food and nutrition insecure and destitute end up neglected in the alleviation efforts. In contrast, development efforts are mostly aimed at addressing long-term issues of societal changes. As such, they are more closely linked to the adaptive capacity leading to incremental adjustment and transformational changes (Béné et al., 2016). With this caveat in mind, resilience is introduced to transcend the pitfalls of earlier interventions. It has made its way to the forefront as a catalytic element to integrate the myriad of activities. It is also becoming the central paradigm in many sectors, suggesting that it is well on its way to be mainstreamed in the development practices (Hoddinott, 2014).

Despite the added-value of adopting a resilience approach, it needs to be embodied in a more rigorous empirical analysis. The studies so far focus essentially on the apparent link between resilience and food insecurity. These understanding considerably improve and have created an impetus for numerous scholarly efforts. Though the earlier studies operationalized the concept of resilience as a policy instrument, majorities did not disentangle resilience from food and nutrition insecurity. Besides, resilience is still fairly new in the context of other welfare problems, such as poverty. In light of this, Article 1 examined the role of resilience in reducing multidimensional poverty. The paper is motivated by the fact that resilience appears to play an important catalytic element that permits programmatic rapprochement of integrating relief and development in sustaining multidimensional poverty reduction in rural Ethiopia.

To design policies of ending extreme poverty to zero, reformulating poverty analysis that integrates money-metric and asset basis is overwhelming. The empirics also underscore the need for a forward-looking and dynamic framework that consistently predicts future poverty (Tsehay and Bauer, 2012; Liverpool-Tasie and Winter-Nelson, 2010; Carter and Barrett, 2006). The principal intention of Article 2 is thus estimating the effect of shocks on structural and stochastic poverty and analyzing the role of resilience as a mechanism for dealing with shocks and structural and stochastic poverty.

While poverty reduction is a vital development objective, food and nutrition insecurity also took center stage in the policy arena of Ethiopia. The fight against them by fostering the twin-

track approach of harmonizing relief and development remains vital to policymaking for decades (Seff et al., 2018; Souza and Jolliffe, 2016). Henceforth, Article 3 aims to shed light on the linkages between shocks, food and nutrition insecurity, and resilience. More specifically, we address such questions as: (i) what are the most important components of household resilience? (ii) Then, it uses the estimated resilience capacity to test whether or not they capture household resilience to food and nutrition insecurity, and (iii) does resilience serves as a mechanism for dealing with shocks and food and nutrition insecurity?

Currently, a considerable share of rural households remains destitute. According to Campos et al. (2014), poverty reduction relies to a large extent on what happens to the uncounted pockets of poverty. The decline in the national trends may conceal pockets of entrenched poverty and a deepening livelihood crisis. The risks of neglecting or overlooking the plight of those who subsist far below the poverty line require analyses that single out the destitute as a population of concern (World Bank, 2020b). The reliance of rural households on rain-fed agriculture also makes clear the perplexing links between destitution and shocks. However, there is a scarcity of empirical evidence about the linkages between shocks, resilience capacity, and destitution. Against this backdrop, Article 4 analyzes the influence of shocks and the mediating role of resilience capacity between shocks and destitution in rural Ethiopia.

Welfare losses accompanied with risk exposure and less integrated interventions spurred interest in building resilience to reach the SDGs promise to leave no one behind. What is noticeable is that Ethiopia is best at tackling poverty, food and nutrition insecurity, and destitution. However, the problems and how to tackle them remain the most pressing dilemma in Ethiopia. More specifically, two questions are at the heart of much of the theme of development research and public policy: what makes Ethiopia emblematic to poverty, food and nutrition insecurity, and destitution? And what must be done to address them?

1.4. Objectives

Eradication of poverty, food and nutrition insecurity, destitution, and shared prosperity are the core elements of development. They are prerequisites for sustainable, equitable, and peaceful world development. To that end, the world is clearly on track to reach the interim targets. Many countries surpassed the targets. However, many SSA countries are seriously off-track. Achieving the targets require mobilizing far more resources than the small and diminishing share. To assess whether those welfare trajectories are aberration or warning signs of what the future holds, continuous and systematic analyses are critical for tracking progress and

identifying areas that necessitates additional actions. Currently, Ethiopia is at the bottom of the global economic ladder and distinctive not just in being the poorest but also harboring the bulk of food and nutrition insecure and destitute. The asymmetric progress in the fight against those welfare problems brings into focuses the relative strengths and weaknesses in how breakthroughs towards the goals are monitored. Thus, the general objective of this study is to scrutinize the role of building resilience on reducing poverty, food and nutrition insecurity, and destitution in rural Ethiopia.

The crucial first step in tackling welfare problems understands whether resilience and other factors determine multidimensional poverty. It also analyzes the presence of state-dependence on multidimensional poverty or the fact that many of those who are poor can move out of multidimensional poverty as well as the fact that many others who are not poor become impoverished. Likewise, the effect of shocks in jeopardizing the lives and livelihoods of rural households has widely been recognized. Given the importance moving beyond the static income based poverty measurement to integrate both asset and income dimensions for long term poverty reduction, we attempted to analyze the linkages among shocks, structural and stochastic poverty and transitions, and resilience. The role of resilience as a mechanism for dealing with shocks and stochastic and structural poverty were also addressed. Moreover, we identified the major drivers and interrupters[3] of stochastic and structural poverty to suggest a distinct set of policies.

Ensuring food and nutrition security are also central aspects of the SDGs and vital policy objectives at the national level. Thus, we provide empirical evidence on how household resilience is related to future household food and nutrition security outcomes, decreasing the probability of suffering a future food and nutrition security loss and facilitating recovery after loss. Since no single indicator has been identified to comprehensively cover all attributes of food and nutrition security at a time, the analyses employed complementary measures.

Despite increasing attention to resilience, the link between resilience and destitution has never been explored. It is important to identify the destitute and the vulnerable to the destitute to profile their socioeconomic characteristics. Reasons why the destitute lack the ability to meet basic needs, decline in possession of key productive assets such as land and livestock, and

[3] The analyses of panel data point to factors that act as drivers and interrupters of poverty. Drivers are factors forcing people into poverty while interrupters are factors that can enable escape from poverty (Bhide, S., and Mehta,, 2018).

heightened dependence on transfers need to be clarified and find the way out. Thus, this study provides a spatiotemporal analysis of the influence of shocks and the mediating role of resilience between shocks and destitution in rural Ethiopia. Furthermore, the analysis captures the role of resilience on vulnerability to destitution.

1.5. Research questions

This dissertation aimed at providing answers to the following specific set of empirical and policy questions in rural Ethiopia:

- Do households with higher resilience tend to have less multidimensional poverty? What are the most appropriate measures to address multidimensional poverty in rural Ethiopia? Does a household that is multidimensionally poor in a given period have more likelihood of remaining multidimensionally poor in the subsequent period?
- Does resilience play an integrative role of relief and development to eliminate structural and stochastic poverty? What must be done towards stemming descents and ascents that constantly reconstitute the composition of the structural and stochastic poverty? Why some households escape structural and stochastic poverty and remain out of it while others escape only to fall back into it? Does building resilience play a mediating role between shocks and structural and stochastic poverty?
- What are the most important components of household resilience? Does household resilience contribute to ensuring food and nutrition security? What factors predict the probability of a household entering into or leaving food and nutrition insecurity over time? Why households managed to sustain their escapes out of multidimensional food insecurity?
- Does building resilience emerge as the vital mediator in escaping destitution in the presence of shocks? How the spatial and temporal distribution of destitution looks like? What risks the vulnerable households to destitution face in finding ways out of destitution?

1.6. Research proposition

Few working propositions structured our work and the way the research was designed.

***Resilience matters*:** Ethiopia is exposed to various idiosyncratic and covariate shocks that result in transitory welfare loss or jeopardize the lives and livelihoods of millions of rural

households (Knippenberg and Hoddinott, 2017). A growing number of governmental and non-governmental organizations respond differently to these shocks via humanitarian assistance, disaster risk reduction, climate change adaptations, social protection, etc. The empirics also support the role of these interventions in reducing the welfare problems in the face of shocks (Bahru and Zeller, 2021; Borga and D'Ambrosio, 2021; Hoddinott and Taffesse, 2019). Humanitarian assistance is critical for saving lives and livelihoods, alleviating sufferings, and maintaining human dignity. However, they often arrive late and there is increasing recognition that these types of response are reactive or redemptive in nature, short-run, costly and less sustainable. Those interventions also function in a silo. Therefore, the persistent effect of shocks that many interventions failed to address spurred the interest of resilience in the development practice. Therefore, the dissertation posits that the main added-value of using resilience as a nascent paradigm and mainstreaming it in a development practice lies in its synergizing role of relief and development to reduce the impact of vulnerability to shocks (short-term) and address the structural causes of vulnerability (long-term). This research explores the potential for this concept in the context of poverty, food and nutrition insecurity and destitution. Investing on resilience – the ability to manage shocks without compromising their future wellbeing – is significantly more cost effective. Resilience is economical, timely, both proactive and reactive, and sustainable in nature and allow us to function synergistically to eradicate poverty, food and nutrition insecurity, and destitution. "*An ounce of prevention is worth a proud of cure*". That is the "*Economics of resilience*".

1.7. Scope and limitations of the study

The risks poor, food and nutrition insecure, and destitute face in paving the ways out of these welfare problems is multiple and intense. Generally, economic growth is the mainstream narrative, but not the sole means to these objectives. Many parts of the country are increasingly exposed to shocks that would enormously erode the households' capacities to cope in succeeding years. Many interventions have been put in place to reduce the adverse effect of shocks. A growing number of international development agencies, policy makers, development practitioners, and the government have now recommends the catalytic role of resilience. Thus, the dissertation embodied to have rigorous empirical analyses on scrutinizing the role of harmonizing relief and development efforts in sustained escape out of those welfare problems in rural Ethiopia.

Understanding the welfare trajectories is vital to policy formulation. Who benefits, who loses from change, what drives, and interrupts the changes are core policy questions. Panel data is central to understanding these changes, and this dissertation is devoted to four papers examining change in welfare problems as measured by three waves of data from the Ethiopia Socioeconomic Survey (2011/12 – 2015/16). Nonetheless, the fourth round (2018/19) is not a follow-up of the previous waves. It is a baseline survey for a new panel in the afterward. These studies were undertaken in rural Ethiopia encompassing five regions: the four most populous regions (Tigray, Amhara, Oromia, and SNNPR) and Others (Afar, Benishangul Gumuz, Gambela, Harari, and Somali regions). The study applies micro-econometric tools to address the issues of shocks, welfare, and resilience dynamics in Ethiopia in self-contained but closely related papers.

To observe and explain change, we need to examine the moving pictures. The past decade or so has depicted a vast number of quantitative analyses of poverty, food and nutrition insecurity, and destitution. In contrast, researchers have increasingly acknowledged the importance of grasping the viewpoints and perspectives of people in poverty, food and nutrition insecurity, and destitution situations. Qualitative survey is the rich and evolving methodology for exploring the dynamic nature of people's lives (Shaffer, 2013). In that vein, we were expected to enrich quantitative researches by combining them with qualitative ones. To that end, we need qualitative survey to address questions of experience and motivation which cannot be captured by quantitative surveys. Complementarities of these approaches help to investigate different but overlapping issues with a view to clarify or better interpret the results. Nevertheless, the study encountered difficulties in undertaking qualitative survey. Security was the biggest challenge specifically to collect the qualitative data. The plan to deploy enumerators to the field was markedly disrupted by the outbreak of COVID-19 and state of emergency to help curb the spread and heightened war and insurgence of armed forces in different part of the country. Furthermore, the financial resources allocated for the purpose was the other formidable challenge. Thus, there is a heavy weighting on the results of quantitative approaches to support key conclusions drawn.

1.8. Significance of the study

Rural areas are pivotal to the economic, social, and environmental viability of nations. More specifically, their roles in generating incomes and employment opportunities, production of nutritious food, natural resources management, climate adaptation, and related roles have a

large contribution to growing rural economies. Therefore, ending extreme poverty and hunger in all its forms, and ensuring food and nutrition security for all can be attained via increased focus on rural development. Attaining the global commitments require recognizing rural households as essential development partners and agents of change in their own lives and communities. Nevertheless, challenges facing rural economies are multifaceted and interwoven, and addressing them demands integrated, cross-sectoral, multi-stakeholder, and context-specific interventions. Hence, combating these welfare problems in rural areas stand as an utmost priority.

Rural areas in Ethiopia encompass a relative abundance of natural capital. In contrast, rural communities are facing several challenges. They harbor the bulk of the poor, food and nutrition insecure, and destitute. Therefore, it would be helpful to have a complete picture of rural households to track their path. This helps us to identify what factors shape the pathways into and out of poverty, food and nutrition insecurity, and destitution as well as find out the sustained routes out of those welfare problems. The study is intended to make a tangible claim about integrating relief and development to sustainably eradicate welfare problems and statistically integrate the existing research on agricultural productivity and poverty linkages and find out sources of heterogeneity.

The rationale is depicted in a multifaceted way. It contributes some insights into the existing knowledge of development practices. Resilience is a proliferating area of study in which many researchers are engaged. However, much remains to learn about the mediating role of resilience between shocks and poverty, food and nutrition insecurity, and destitution. The study, first, generates evidence of the causal pathways through which resilience affects multidimensional poverty that is barely explicitly considered in empirical analyses. We introduced a shift of emphasis to the resilience literature from a food and nutrition security perspective to poverty. We also provide overviews of the developments of conceptual and analytical frameworks guiding the resilience and structural and stochastic poverty linkages. Furthermore, the study tried to conceptualize and measure resilience in the context of destitution.

The approaches to measure welfare problems can principally influence how we come to understand and analyze them and design policies to eradicate them. For this reason, measurement methodologies can be of tremendous practical relevance. An exclusive focus on one factor alone cannot capture the reality of poverty, food and nutrition insecurity, and destitution. Disentangling welfare problems with complementary measures help us to portray

more comprehensive pictures over time. They reveal who are poor, food and nutrition insecure and destitute, how they are poor, food nutrition insecure, and destitute, and the range of different disadvantages they experience. The better information available on welfare dynamics, the well-equipped we will be to eradicate them**.** This study, therefore, underscores the importance of research that carefully measures welfare problems with multiple approaches since more than one is best.

1.9. Research paradigm

A research paradigm is a set of assumption on the meaning of reality, perceptual orientations to get new findings of that reality shared by members of a research community, and the ways to get knowledge of that reality (Creswell, 2014). It aims to address three fundamental questions, including what reality is, the epistemological relationship between reality and researchers, and the methodological question respecting how researchers know about reality (Cohen et al., 2018). There is no single paradigm which has claimed as a most promising approach for obtaining scientific knowledge (Liu, 2022). Currently, research is moving towards multidisciplinary research design which is challenging researchers to be proficient. So, it is important to understand different research paradigms. Each paradigm has a different perspective on the ontology, epistemology, and methodology of research with some disparities and commonalities.

Following incompatibility theory Liu (2022) there is a growing concern in contemporary research to employ both quantitative and qualitative ways though the difference is their flexibility to be as systematic and 'scientific' as possible. The inability to fully understand an issue in the qualitative or quantitative sphere demands the amalgamation of both crystallized as a perspective (Creswell, 2014). Mixed method studies combine the qualitative and quantitative approaches in a single study. Likewise, the role of mixed methods research in analyzing poverty, food and nutrition insecurity, and destitution has now been widely acknowledged (Cookson and Stirk, 2019). However, this study applied a quantitative approach due to the nature of the research problem, data sources, and experiences. Positivism is the broader philosophical underpinning that embraces the quantitative paradigm. The approach often draws up on deductive reasoning where the objective of the researcher is to confirm often a well-established theory employing primary data analysis (Cohen et al., 2018) unlike Interpretivism where the objective is to develop a theory. The ontological position of the quantitative paradigm is that there is only one truth, an objective reality that exists independent

of the human perception. Positivists view reality as external and independent of the researcher (Irshaidat, 2022). The study follow an objectivist epistemology which assumes that the world or reality can be understood through scientific methods (Creswell, 2014). Therefore, the researchers and the researched are independent entities. Thus, positivists tend to believe that what we observe reflects the world or reality. The methods adopted follow a confirmatory scientific approach as the focus is on testing the hypothesized relationships between variables based on some theory. Quantitative research techniques include: randomization of sample selection, structured questionnaire, larger sample sizes (Grandgirard et al., 2002).

1.10. Overview of research methodology

This section encompasses the mechanisms of computing the major variables of interest and the virtues of panel data and meta-regression analyses after a brief description of the data sources.

1.10.1. Data sources

The analyses in this dissertation rely on two datasets. The first data comes from the three rounds of the Ethiopian Socioeconomic Survey (ESS), a panel survey conducted by the Central Statistics Agency of Ethiopia (CSA) in collaboration with the World Bank Living Standards Measurement Study Integrated Survey of Agriculture (LSMS-ISA)[4]. The ESS makes use of five questioners to collect the data. The household questionnaire is conducted to acquire demographic and socioeconomic details on individuals in the household. The questionnaire entails information on basic demographics, education, health, labor and time use, saving, food and non-food expenditure, household non-farm income-generating activities, food security, shock exposure, safety nets, housing conditions, assets, credit, and other sources of household income. Household location is geo-referenced in order to be able to link the ESS data to other available geographic data sets. It includes geospatial variables measuring distance between field and household, slope and elevation of field, and potential wetness index.

There are also three agriculture questionnaires (post-planting, post-harvest, and livestock questionnaires) administered to all sample households engaged in agriculture activities. The post-planting and post-harvest agriculture survey focus on crop farming activities and request information on land ownership and use, farm labor, inputs use, GPS land area measurement

[4] The survey is implemented every two years. The targeted households were visited in 2011/12, 2013/14, and 2015/16. The data, questionnaires design, interviewer manuals, basic information documents, and survey reports, are all freely available for download at: https://www.worldbank.org/en/programs/lsms/initiatives/lsms-ISA#2

and coordinates of household fields, irrigation, and crop harvest and utilization. The livestock part collects information on livestock production, cost and sales of livestock by-products. Lastly, the community questionnaire is designed to collect information on the socio-economic indicators of a selected group of community members. It generates information on community organizations, resource management, changes in the community, key events, community needs, access to infrastructure, and local retail price information (CSA and World Bank, 2017).

The data were collected from rural, small towns, and urban areas. The first wave of data collection covered only rural and small-town areas. In the subsequent waves, the sample was expanded to urban areas. This study was restricted to the nationally representative panel sample of rural households in Ethiopia. The rural households were part of the larger panel comprising of 3,969 (2011/12), 3776 (2013/14), and 3,699 (2015/16). Following loss due to attrition, unmatched in all rounds, and missing information on the variables of interests, we restrict the final analytical sample to get a balanced panel of 2605 rural households.

1.10.2. Measurements of major variables of interest

The importance of addressing multiple dimensions of poverty, food and nutrition insecurity, and destitution are particularly relevant in the context of SDGs. As a result, various researchers suggest portfolio of complementary measures. Institutions also show how welfare problems are changing and introduce improved ways to monitor our progress toward ending them. Conceptualization and measurement of welfare problems in turn have witnessed clear evolutions. The empirics points towards evidence of mismatch between complementary measures such as monetary and multidimensional poverty (Salecker et al., 2020; Brück and Kebede, 2013). They find that using a money-metric measure alone does not capture high incidence of multidimensional poverty that it is possible to be multidimensional poor without being monetary poor. Besides, using a monetary measure alone overlooks significant change in multidimensional poverty over time. Relying only on one measure can send inaccurate signals to policymakers regarding the optimal design of social policies as well as monitoring their effectiveness. We tried to compute those welfare problems using complementary measures. Therefore, five measures of food and nutrition insecurity were constructed: kilocalorie per adult equivalent, per capita food consumption expenditure, Food Consumption Score (FCS); Dietary Diversity Score (DDS), multidimensional food insecurity (MFII). Likewise, poverty is computed using monetary, asset, multidimensional, and integrated measures. Lastly, poorest of the poor are characteristically different and may require different

types of assistance (Harriss-White, 2005). Understanding different degrees and kinds of poverty contributes to their removal. Therefore, destitution is measured in a multidimensional notion using intensity approach.

1.10.3. Virtues of panel data analysis

Stability and change are essential elements of social reality and economic progress. Policies are often designed to deal with how best we induce beneficial change. At root, poverty, food and nutrition insecurity, and destitution are nothing more than the sum of poor, food and nutrition insecure, and destitute people in a country or region. However, it increases when people fall into those welfare problems, and it declines when more people move out than have moved in. Dynamics shows a more comprehensive understanding of poverty, food and nutrition insecurity, and destitution than point-in-time studies. While the later provide a snap shot of the population at a given moment, dynamics research traces the same individuals or households over time and so is able to record stories of change. To put forward more effective assistance we need inquires on: Why have some (but not other) poor, food and nutrition insecure, and destitute households succeeded in experiencing ascents? What have they done individually, or what was done for them by outsiders, that distinguishes them from the less successful people? We also need to be more acquainted with the reasons for descent: Why many households fall into poverty, food and nutrition insecurity, and destitution over the same period? Is there state dependence?

The reasons responsible for escape and descent in each particular context have to be clearly identified. Having studied a snapshot of the problem, it is difficult to say more about the nature of strategies. These gaps in knowledge usually need to be filled by studies showing the dynamics. It helps us to see a broad population with diverse trajectories. Who moves in and out, and why, and so sheds light on how life chances are stacked against certain individuals and households. Therefore, we need to better estimate how many people are affected by welfare problems at some point in time and how many people are not able to escape over a longer period of time. To sustainably reduce the welfare problems, we needs to be informed with the insights of what drives and interrupts individual or household outcomes.

Currently, panel data studies are growing at a geometric rate due to some virtues as data availability, greater capacity for capturing the complexity of human behavior, challenging methodology, and provides more accurate inferences of model parameters (Baltagi, 2005). A larger data set entails more variability and less collinearity among the variables, more degrees

of freedom, and more efficiency than cross sectional and time series ones (Biørn, 2017). They are also highly informative about levels and profiles of welfare problems and various dimensions, and can provide measures of change at the aggregated or disaggregated level.

1.11. Organization of the dissertation

This dissertation addresses the issues of resilience, shocks, and welfare problems in rural Ethiopia in four self-contained but related articles. The remainder of this dissertation is organized into 5 chapters and a synthesis of them as follows. Chapter 2 presents the first article titled *Does building the resilience capacity of rural households reduces multidimensional poverty? Panel data evidence from Ethiopia*. It tried to answer the quest whether enhancing resilience capacity lessens multidimensional poverty and poverty dynamics. On the other hand, analyzing poverty with the third generation measures explicitly on an asset basis offers important advantages to address the structural and stochastic poverty and transitions**.** Therefore, chapter 3 entitled *Structural and stochastic poverty, shocks, and resilience capacity in rural Ethiopia* analyzed the welfare impacts of shocks on structural and stochastic poverty and the mediating role of resilience between shocks and structural and stochastic poverty. *The effect of resilience capacity on food and nutrition insecurity* in the presence of idiosyncratic and covariate shocks is also addressed in chapter 4. Furthermore, prioritizing who to focus resources on to ensure the poor are not left behind is intensifying in the post-2015 development goals. As a result, exploring the destitution and vulnerability to destitution impact of shocks is a major theme of the dissertation. Hence, chapter 5 undertook in-depth analyses of *the spatiotemporal patterns of resilience and multidimensional destitution linkages in the presence of shocks in rural Ethiopia,* to play a crucial role in sustained poverty reduction.

Chapter 2: Does Building the Resilience Capacity of Rural Households Reduce Multidimensional Poverty? Panel Data Evidence from Ethiopia

Abstract

Enhancing resilience holds the key to welfare improvement. While there are assumptions that resilience has led to curbing poverty, in fact, the empirics are limited to ascertain the linkages between resilience and multidimensional poverty and find out implications for policy uptake in Ethiopia. This study addresses the role of household resilience on multidimensional poverty reduction using the Ethiopian Socioeconomic Survey data collected by the Central Statistical Agency in collaboration with the World Bank Living Standard Measurement Study (2011/12 - 15/16). The study finds a steady decline in multidimensional poverty as a response to slight increases in resilience capacity. The reduction is emanated from a greater change in headcount than the intensity of deprivation. The fixed effect estimate indicated that enhancing resilience capacity is the most decisive factor responsible for multidimensional poverty reduction. Nevertheless, resilience is not the panacea. Therefore, the rural households curb multidimensional poverty by increasing crop income through commercialization and gradually diversifying non-farm income sources. Moreover, wage labor participation, literacy, saving, and having more economically active members are found to open up opportunities to sustained multidimensional poverty escapes. The dynamic random effect probit model also confirmed the existence of genuine state dependence of multidimensional poverty in rural Ethiopia. Findings suggested that the government policies aimed at enhancing resilience for multidimensional poverty should adopt productive inclusion and rural transformation. Promoting synergistic rural-urban linkages also ensures a balanced mix of infrastructure development that would improve market access and promote the rural non-farm sector, commercialization, and livelihood diversification. Support for migration, making urban development migrant-friendly, ensuring sustainable financial inclusion of the poor, and increasing access to basic services should also be part of the strategy. This implied that striving for sustainable multidimensional poverty reduction demands change in the patterns of labor mobility, livelihood transition, and urbanization.

Keywords *– Resilience, multidimensional poverty, dynamic random effect probit, Ethiopia*

2.1. Introduction

Following the declarations and commitments of poverty eradication, it has substantially been fallen in many developing countries (OPHI, 2019; World Bank, 2017). However, sizeable numbers of people in Sub Sahara Africa are still facing the grinding hardships of poverty (Alkire et al., 2017; Alkire and Housseini, 2014).

Poverty in Ethiopia is an age-old, pervasive, and intractable challenge that endures today (MoFED, 2017; Stifel and Woldehanna, 2017; Bersisa and Heshmat, 2016; Ambel et al., 2015; World Bank, 2015; Swanepoel, 2005). It is emblematic to be the poorest in Africa (OPHI, 2019). Smallholders constitute the bulk of the poor (Rapsomanikis, 2015). Poverty reduction becomes formidable because the country is trapped by structural factors such as climate change, rapid

population growth, poor access to land, and tenure insecurity (Azzarri and Signorelli, 2020; Ghebru and Tafesse, 2019; Hansen et al., 2019; Baye, 2017; Aragie, 2013; Mideksa, 2010). It is further exacerbated by regional economic polarization (Argaw, 2017), income inequalities (Bigsten et al., 2003), powerlessness and stagnated agrarian transformation (Bekele, 2018), conflicts dreaded almost everywhere (Luckham and Ahmed, 2001), marginalization in the social, political, and economic systems (Abebaw and Admassie, 2014; Gole et al., 2014), and politicization of ethnicity (Milas and Latif, 2000). These all, of course, induces a grandiose out-migration of the youth beyond Africa's shores.

Ethiopia has experienced considerable economic growth for more than a decade (Moller and Wacker, 2017; Dercon, 2006). This growth is followed by human development, infrastructure growth, increased agricultural production and productivity, large public investments on social safety nets, increasing assets and their returns, and reducing the effect of shocks (Planning and Development Commission, 2018; Abro et al., 2014; Diao and Pratt, 2007; Bigsten et al., 2003). These economic sceneries are more likely to reduce poverty. However, evaluating the dividends to inform policymaking for better poverty targeting became obstinate due to three reasons.

First, Ethiopia's official poverty statistics solely follow the monetary approach (MoFED, 2017; 2012). It identifies the poor and non-poor via a poverty line by estimating whether an individual has enough income, or consumes enough. Despite allowing for a measure that can reflect food and non-food elements of wellbeing, and relying on market-determined prices to provide socially determined weights for each element, the approach has strongly been criticized. It fails to fully capture education, health, and nutrition wellbeing dimensions (Suppa, 2016; Alkire and Foster, 2011b). According to Tran et al. (2014), the availability of monetary resources provides no information about the intrahousehold allocation of resources.

Second, poverty is inherently dynamic so that the stock of the poor is continuously changed due to upward and downward mobility (Krishna, 2017). In these asymmetric flows, the proportion of descents sometimes outweigh ascents (Scot et al., 2014; Hanjra et al., 2009; Bigsten and Shimeles, 2008). Besides, poverty vulnerability and exit time are increasing (World Bank 2015; Goshu, 2013; Bigsten and Shimeles, 2008). It is also worth mentioning that shocks are recurring and worsening vulnerability (Fuje, 2018; Dercon et al., 2006).

Last, failure to move beyond business as usual approaches makes poverty reduction a strenuous goal. Much of the efforts in eradicating poverty have so far been on reaching and supporting people living in poverty through safety nets and humanitarian emergencies, so that they can escape it. We could not address what happens to households after they escape poverty. Do they continue in upward mobility, churn around the poverty line or reenter into poverty? Less attention has also been paid to both protecting the vulnerable non-poor from impoverishment and ensuring that households are on sustained pathways out of poverty.

Monetary poverty, that is inability to meet an acceptable standard of living, has a long tradition (Ravallion, 2016). Though focusing on income is not enough to capture the true poverty, it serves as the bedrock for the emergence of wider approaches. Following Sen's (1979, 1976) capability approach, poverty has witnessed conceptual and methodological evolution. Recently, multidimensional poverty is introduced as a high-resolution lens to capture reliable information assuming that human lives are battered and diminished in multiple ways (Alkire, 2011; Alkire and Foster, 2011a, Alkire and Santos, 2010; Bourguignon and Chakravarty, 2008; Tsui, 2002). The emergent literature highlights that the overlap between monetary and non-monetary measures is not perfect (Salecker et al., 2020; Bader et al., 2016). Besides, the validity of a one size fits all measurement model is also disproved by Steinert et al. (2016). Hence, poverty becomes a condition that exist when people are exposed to multiple deprivations such as poor health, illiteracy, inadequate living standards, social exclusion, powerlessness, voicelesness, poor quality of work, and the threat of violence, among others (Alkire et al., 2015; Wagle, 2008; Bhalla and Lapeyre, 2004).The causations, manifestations, and policies in pursuit of its reduction are also multidimensional.

Poverty has features that transcend from the narrow economic conceptualization (Ellis, 1983). Sustained escape out of poverty, framed in the context of the SDGs, and through generous financial assistance from the international community has so far been less successful. Due to the recurrences of humanitarian crises, enhancing resilience capacity has gained popularity in recent policy discourse. Resilience is a twin-track approach of harmonizing humanitarian and development interventions (Fan et al., 2014; Hoddinott, 2014). It is grounded with the premises of cost-effectiveness and creating potential synergies among interventions to save lives and restores livelihoods (Bhandary et al., 2019; Cabot, 2018). Resilience is multifaceted and helps foster a country's transition from a relief stage to a development path (Adger et al., 2012).

Nevertheless, resilience has not yet been well conceptualized. It began with the idea of a system's ability to return to the steady-state after a perturbation in mechanics in 1858 (Bodin and Wiman, 2004) and ability to assimilate the magnitude of disturbance before restructuring through changing the variables and processes in ecology in the 1970s (Holling, 1973) that subsequently evolve into building a household capacity (D'Errico and Giuseppe, 2016; Alinovi et al., 2010). FAO is the first development entity to extensively measure resilience in the food security context. Recently, econometric approaches have been broadly applied (Giuseppe and D'Errico, 2018; FAO, 2016; Alinovi et al., 2010). The previous studies are encouraging in operationalizing the concept. In this study, the definition of Constas et al. (2016) stating that "resilience is a capacity that predicts wellbeing outcomes" is employed. Resilience as a latent variable is constructed from such latent pillars as access to basic services, income and food access, asset, adaptive capacity, stability, and social safety nets.

The studies on causality between resilience and food insecurity, emanated from Constas et al. (2016), are rapidly proliferating. The empirics are clustered into three categories. The first set of studies were capitalized on the concept that resilience is a capacity predicted by indicators related to food security (Melketo et al., 2021; Ambelu et al., 2017; Tefera et al., 2017; Boukaryn et al., 2016; Lokosang et al., 2014; Alinovi et al., 2010). These studies could not be able to separate the variables of interest. Others conceived resilience as an important predictor of food security in the face of shocks and stressors (Atara et al., 2020; Giuseppe and D'Errico, 2018; Smith and Frankenberger, 2018; D'Errico and Pietrelli, 2017). These categories better analyze resilience quantitatively as a capacity and are used as an outcome to predict food insecurity. A few studies even examine the linkages dynamically (D'Errico and Giuseppe, 2018; Maxwell et al., 2013). Though snapshot surveys failed to provide a temporal picture of the linkages, Atara et al. (2020) and D'Errico and Pietrelli (2017) also analyzed the relationships in a statically. The third group of empirical studies measure resilience in terms of change and return time of food security status before and aftershocks (Knippenberg et al., 2017; Alfani et al., 2015; Béné et al., 2016; Upton et al., 2016).

Resilience, differentiated from the longstanding literature in the food security context, is adopted for poverty analysis by Barrett and Constas (2014). They were gravitated to the concept of resilience in poverty reduction due to the successful experiences of a twin-track approach of providing assistance of the short-run recovery to adverse shocks and longer-run socioeconomic development. It opens an opportunity to link development with humanitarian interventions to enhance resilience to sustainably reduce multidimensional poverty. However,

the empirical understandings of resilience and its links with multidimensional poverty are limited. To the best of our knowledge, the role of enhancing resilience in curbing multidimensional poverty is not well documented. The novelty of our study is confirming the multidimensional poverty reduction effects of resilience, measured as a capacity and used as an intermediate variable, adopted from the food security context.

The remainder of this paper is organized as follows. Section 2.2 provides conceptual framework of the study. Section 2.3 presents the data and study setting, and construction of resilience capacity index, and multidimensional poverty estimation. Section 2.4 profiles the key findings of the study and contains the results from our econometric analysis. And, section 2.5 provides the concluding remarks.

2.2. Conceptual framework

Frameworks have emerged from different sectors and organizations to apply resilience in the scientific niche. More particularly, the concept has been widely adopted in disaster relief and humanitarian aid and has become an important part of the lexicon of climate change adaptation and international development (Speranza, 2010). These frameworks are employed within a limited context, scale, and scope (reviewed by Saja et al., 2019). They all describe what happens to household wellbeing when shocks occur. However, the multidisciplinary nature of resilience causes a lack of coherent theoretical or conceptual framework.

Following the works of Alinovi et al. (2008), measuring resilience in the food security context widely proliferates. Their analytical frameworks introduced resilience capacity as latent multidimensional phenomena computed from a set of other latent pillars in turn constructed from observable variables through hierarchical modeling. Alinovi et al. (2010) further expand the insight by employing a combination of multivariate techniques. Subsequently, FAO (2016) introduced RIMA-II, taking into account resilience and food security separately. Two stages of factor analysis and structural equation modeling have been getting known. RIMA-II proposed an indirect resilience measure that adopts regression and, consequently, allows causal inference as an area of improvement from the previous frameworks. However, resilience is not taken as a capacity generated as a composite of both the determinants and outcome. Ciani and Romano (2013) and their predecessors (D'Errico et al., 2018; Smith and Frankenberger, 2018; D'Errico and Pietrelli, 2017), adjusted the methodological flaw so that resilience has been computed as the capacity that can predict food security.

Resilience, as an analytical framework beyond food security context, is introduced by Béné et al. (2012). Many agreed on the nascent feature of resilience to help frame development problems in systematically. It integrates the socioeconomic aspects of the rural poor and the ecology on which they depend, thus induce efficient poverty targeting (Sarma and Pais, 2008). This might happened since rural households are repeatedly struck by shocks that enormously erode the capacities to cope in the subsequent years. Nonetheless, this framework fails to analyze dynamically and disentangle resilience from food security.

Resilience is dynamic that integrates humanitarian and longer-term development (Rutter, 2012). It permits programmatic rapprochement from the humanitarian aid to addressing development problems by integrating livelihoods, social protection, health, and nutrition sectors that have been operating independently. This study adopts the RIMA-II framework to focus specifically on multidimensional poverty and examine the various causal pathways through which resilience capacity affects multidimensional poverty.

Figure 2.1 depicts what happens to a household's multidimensional poverty when a shock occurs and resilience mechanisms are activated. Changes in the resilience capacity of households with a set of time-variant and invariant characteristics capture all possible pathways to curb multidimensional poverty. When shock occurs, households would employ consumption smoothing, asset selling, and adoption of new livelihood strategies to absorb and adapt to shocks and transform in the face of shocks.

Resilience capacity, therefore, contributes to the ability to reduce exposure to shocks through preventive measures and coping strategies and keep away from destructive impacts. Moreover, it makes proactive and informed choices about alternative livelihood strategies and creates the enabling environment for systemic change in an attempt to recover to the previous state of well-being (TANGO International, 2018). Any change in resilience capacity affects multidimensional poverty and, consequently, enhances the future capacity to react to shocks.

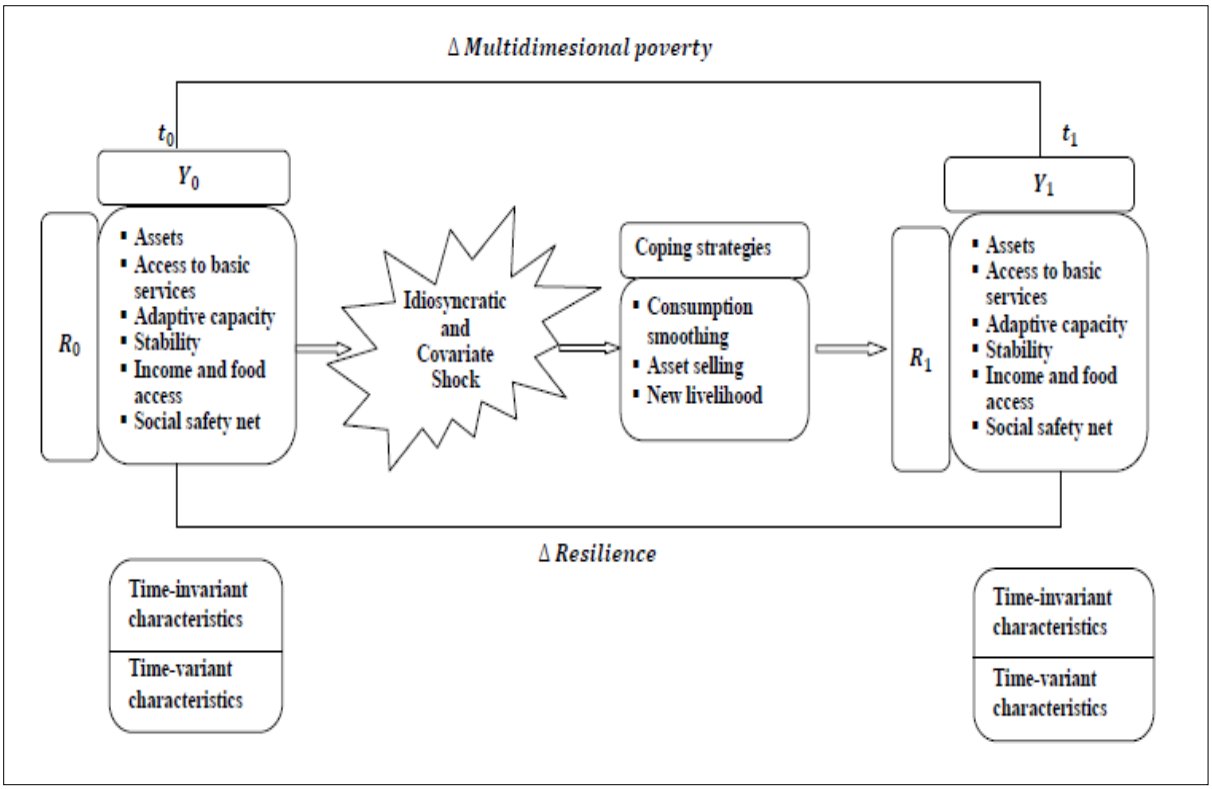


Figure 2.1: Conceptual framework of resilience and multidimensional poverty linkages

2.3. Materials and methods

2.3.1. Data

The secondary data sources used in this analysis are the ESS, conducted by the CSA in collaboration with the World Bank LSMS-ISA. The ESS is nationally representative stratified survey that contain detailed households information on income, expenditure, occupation, demographic aspects, health and education, occupation, production activities, asset ownership, agricultural production, self-reported information on shocks, and several other important aspects of the household economy (CSA and World Bank, 2017).

The data were collected from rural, small towns, and urban areas employing a two-stage stratified sampling technique[5]. The sample households have selected from the four most populous regions (Amhara, Tigray, SNNP, and Oromia) and others (Afar, Somali, Gambela, Benishangul Gumuz, and Harari) merged as a single region based on proportional to size. In

[5]The sampling frame used relied on the 2007 lists of Ethiopian cartographic census frames. For more detail, please look at the ESS (2015/2016) information document at https://microdata.worldbank.org/index.php/catalog/2783

line with our analyses, households with missing rounds were dropped and included only rural households for which data on all the necessary factors are available. The survey encompasses rural households of 3,969 in 2011/12, 3776 in 2013/14, and 3,699 in 2015/16. Tracking the waves is done at the household level. The attrition rate is less than 1% per year (5.96% in total between 2011/12 and 2015/16), producing a sample of 3,615 rural households surveyed in all waves. Restricting households with such item non-responses resulted in a loss of 14.46% for a balanced population of 2605 rural households consisting of 7815 observations over three rounds.

2.3.2. Resilience measurement

Resilience is a latent and multidimensional phenomenon. Many empirics often measure resilience with different dimension reduction techniques (Giuseppe and D'Errico, 2018; Mekuyie et al., 2018; Tefera et al., 2017; FAO, 2016; Alinovi et al., 2010). The approach followed here aggregates resilience capacity index (RCI) in a two-stage procedure. It entails the measurement of each latent pillar through PCA and estimation of the resilience capacity index based on these latent pillars through Treelet Transformation (TT). Many datasets used in the current empirical analyses are multidimensional and redundant, and the order of variables does not have significant meaning attached. The variables in such datasets need hierarchical clustering (Gorst-rasmussen, 2012). Measuring the pillars one by one makes the model more flexible, permits the inclusion of prior information, and solves the parameter identification problem (Alinovi et al., 2010). The latent pillars are used as covariates in the construction of the RCI (see Table 2.11a – 2.11f).

TT, proposed by Lee et al. (2008), is a recently introduced machine learning dimension reduction technique that has previously been used by a few studies (Assi et al., 2018; Lee and Nadler, 2007). This technique results in the derivation of RCI from a dataset that contains multiple variables of assets, access to basic services, income and food access, stability, adaptability, and social safety nets. It aimed at converting a set of observations of possibly correlated variables into orthogonal components. Its unique feature is the optimality property of explaining as much variation as possible in the original data using few dimensions and simplified interpretation (Gorst-rasmussen, 2012). It also yields a coordinate system for the data at each level of the cluster tree and cluster tree dendrogram (see Figure 2.4 in the appendices).

Specifically, the resilience capacity of a household i is estimated as:

$$RCI_t = f(ABS_t + AST_t + IFA_t + AC_t + SSN_t + S_t + \in_t)$$

where the RCI of a household at time t is a function of access to basic services (ABS), assets (AST), income and food access (IFA), adaptive capacity (AC), social safety nets (SSN), and stability (STB) of their livelihoods, as well as time-variant and invariant household characteristics. Thus, the pillars to encompass generally rely on households' absorption, adaptation, and transformation capacities (StataCorp, 2019). The major pillars of resilience capacity index are, therefore:

***Access to Basic Services*:** Exogenous responses provided by the public play a key role in determining the risk exposure of households. Access to electricity, clean water, improved toilets represent ABS (Murendo et al., 2020; Ciani and Romano, 2014).

Assets: Assets are part of household wealth that consistently predict future poverty status than consumption (Tsehay and Bauer, 2012). Better possession of land, livestock, and numbers of rooms build household resilience capacity to be free from poverty even in the face of shocks and stresses (Brück et al., 2019; D'Errico and Giuseppe, 2018).

Adaptive Capacity: Variables used as a household's capacity to cope with and adapt to shocks include food ratio, numbers of income sources, and subsistent households (Murendo et al., 2020; Boukary et al., 2016).

***Income and Food Access*:** Better income and access to food directly correlate with building the resilience capacity of households. Indicators include per capita income, food and non-food consumption expenditure in terms of ETB per adult per day of a household.

***Social Safety Net*:** They comprise formal and informal access to cash or in-kind transfers to households from different sources. The variables include participation in productive safety net programs (PSNP) and remittances (Brück et al., 2019; FAO, 2016).

***Stability*:** It captures the degree to which options of rural households vary over time. The variables used as proxies in measuring stability include the number of off-farm skills, availability of food stock, and potential wetness index (Alinovi et al., 2010).

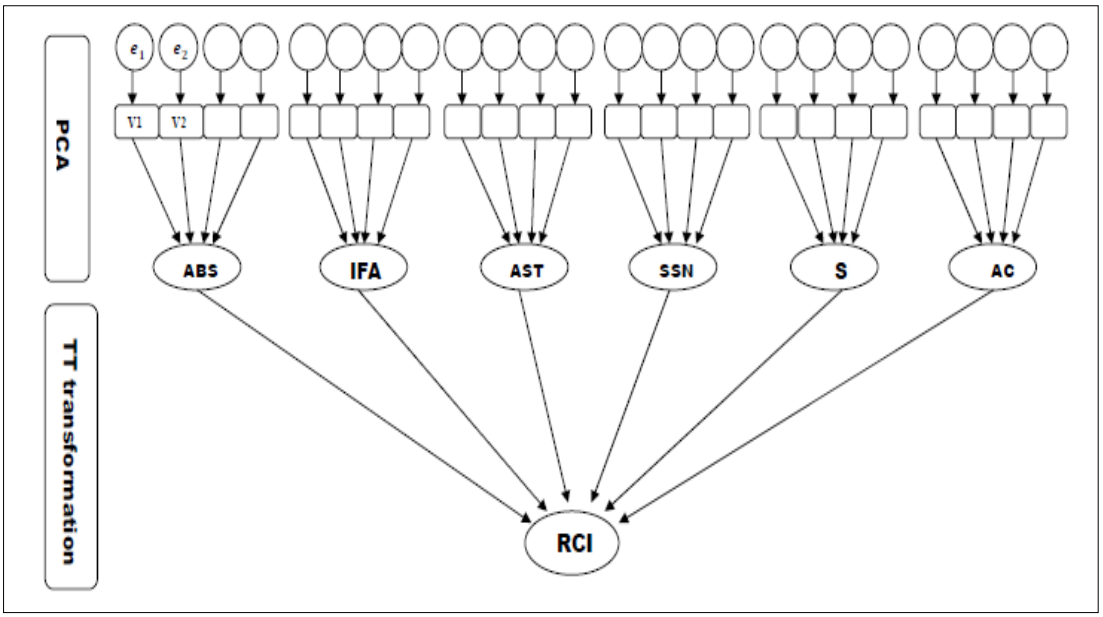


Figure 2.2: Path diagram of resilience capacity index estimation

2.3.3. Multidimensional poverty measurement

There is a rapidly growing literature in multidimensional poverty analysis across the world. Studies in Ethiopia employed different techniques: dominance approach (Bersisa and Heshmat, 2016), Alkire and Foster methodology (Abeje et al., 2020; Kuschminder et al., 2018; Tigre, 2018; Alkire et al., 2017; Brück and Kebede, 2013; Apablaza andYalonetzky, 2013), multiple overlapping deprivations (Ambel et al., 2015), among others. This study employed Alkire and Foster's (2011b) methodology in constructing a multidimensional poverty index. What make this methodology a particularly attractive option to inform policymaking, according to Alkire, et al. (2015) are its practical and technical advantages. Practically, the Alkire and Foster families of measures employ a counting approach to identify the poor and exclusively consider joint distribution of deprivations. Technically, flexibility, dimensional monotonicity, subgroup decomposition, methodological robustness, and intuitive interpretations are the desirable properties. Moreover, adaptability to different contexts and purposes so that different dimensions and indicators can be selected is the desirable part property. The method is getting popular as it easily identify the most deprived people for efficient resource allocation, high interconnections among deprivations and helping to identify poverty traps, and complements with other measures and quickly reflect the effects of changes in poverty-reducing policies.

2.3.3.1. Alkire and Foster methodology

This methodology capitalized on Sen's (1976) theoretical premise that the choice of relevant functions and capabilities for any poverty measure reflects a value judgment and the multifaceted indicators and targets set in the SDGs (Alkire and Foster, 2011b). It identifies the multidimensional poor with identification and aggregation steps. The identification step generally entails computing deprivation profiles for each household with dual cut-off methods. Households are classified as deprived or non-deprived in each indicator by comparing their achievements with respective deprivation cut-off. Nineteen indicators, reflecting the country's contexts as well as the availability of data were selected. The dimensions and indicators used for multidimensional poverty analysis are listed in Table 2.1.

Table 2.1: Description of indicators used for the estimation of multidimensional poverty

Dimensions	Indicators	Deprived if	Weights
Health	Child mortality	One or more children have died	0.055
	Intra-HH food difference	Household members do not roughly eat the same diet	0.055
		Households worried about not having enough food	0.055
	Food shortage	All member of the household faced any health problems	0.055
	Illness	Households do not have a habit of boiling water	0.055
	Water treatment Drinking water	Unprotected source of water for a drink	0.055
Education	Adult literacy	No one has completed five years of schooling	0.111
	Informal education	All HH members cannot read and write in any language	0.111
	Enrollment	No one in the household ever attends a school	0.111
Standard of living	House floor	Households have a dirt floor	0.033
	House wall	Household wall made from wood, mud, and thatched	0.033
	Kitchen	Households do not have a separate kitchen	0.033
	Rural technology	Households do not use improved energy-saving Mitad[6]	0.033
	Number of rooms	Households live in a single room	0.033
	Waste disposal	Households dispose or throw away solid waste	0.033
	Sanitation	Households use field or forest as a toilet	0.033
	Electricity	Households use kerosene lump or Kuraz	0.033
	Cooking fuel	Household uses dirt cooking fuel	0.033
	Household assets	Asset ownership	0.033

Households are then classified as multidimensionally poor or nonpoor by comparing the weighted sum of their deprivations with the poverty cut-off. The cut-off ($k \geq 0.333$) is defined as a threshold to classify a household as multidimensionally poor and non-poor. The choices of dimensions and their weights follow the normative judgment of the human development index that achievements in each dimension are equal in intrinsic value. We selected education,

[6] 'Mitad' in Amharic refers to a traditional cooking device (pane) made of clay

health, and standard of living as the basic components of capabilities (Dika et al., 2021; Abeje et al., 2020; Mushongera, 2017; Alkire and Santos, 2014).

Extended from Foster - Greer - Thorbecke's class of poverty measures (Foster et al., 1984), the aggregation step computes incidence, intensity of deprivation, and multidimensional poverty index. The two partial indices, headcount ratio and intensity of deprivations among the poor, respectively indicate the proportion of multidimensionally poor and depth of deprivation experienced by the poor. Finally, the multidimensional poverty index or adjusted headcount ratio combines the incidence of poverty and the average deprivation score of the poor. It reflects the ratio of a multidimensionally poor population adjusted by poverty intensity.

Let q be the number of multidimensionally poor out of n households, the headcount ratio (H) is formally defined as:

$$H = \frac{q}{n}, q = \sum_{i=1}^{n} I(C_i \geq k)$$

The indicator function $I_i = 1$ if the individual is deprived concerning indicator i and 0 otherwise. As in Nawaz and Iqbal (2016), the deprivation score of each individual is calculated as a weighted sum of the number of deprivations so that $C_i(k)$ is between 0 and 1 using the formula:

$$C_i = W_1 I_1 + W_2 I_2 + W_3 I_3 + \ldots\ldots\ldots + W_d I_d$$

Where, W_i is the weight attributed to indicator i with $\sum_{i=1}^{d} W_i = 1$

H violates dimensional monotonicity. It cannot reflect the depth of deprivation as multidimensionally poor households over time get worsen or lessen in deprivations in dimensions. It fails to portray the extra burden of poverty laid upon the poorest of the poor (Roche, 2013).

To convey the extent of deprivations that poor households experienced in a higher portion of dimensions have a higher intensity of poverty and hence are poorer than households having a lower intensity, Alkire and Foster (2011b) developed multidimensional poverty intensity (A). Given the censored deprivation score $C_i(k)$ represents the share of possible deprivations experienced by a poor person i, the intensity of poverty among the multidimensionally poor is formally expressed as:

$$A = \frac{1}{q}\sum_{i=1}^{q} C_i(k)$$

Finally, we have the adjusted headcount ratio (M_0) as a product of H and A. M_0 reflects the ratio of a multidimensionally poor population adjusted by the poverty intensity (Alkire and Foster, 2011b). Mathematically, it can be written as:

$$M_0 = \mu(C_i(k)) = H \times A = \frac{1}{q}\sum_{i=1}^{q} C_i(k)$$

2.3.3.2. Dynamic decomposition

One good feature of multidimensional poverty is the possibility to analyze its dynamics. A study by Alkire et al. (2015) capitalized on Apablaza and Yalonetzky (2013) and Roche (2013) paves the way to scrutinize changes in adjusted headcount ratio and its components over time through absolute versus the relative pace of change. The absolute and relative rates of change respectively refer to change in adjusted headcount and its sub-indices between survey rounds, and their changes expressed in terms of percentage of the base period. Mathematically,

$$\Delta M_0 = M_o\,(X_{t^2}) - M_o\,(X_{t^1}) \text{ and } \delta M_0 = \frac{M_0(X_{t^2}) - M_0(X_{t^1})}{M_0(X_{t^1})}\, x\ 100$$

where, M_0 is adjusted headcount (it also works for partial indices), $t^1$and t^2 are the base and final survey periods respectively, X_{t^1} and X_{t^2} represent achievement matrices for respective periods.

For an informed policy decision, quantifying the degree of poverty reduction emanated from changes in the incidence or intensity or the combined effects as well as the marginal contributions of sub-indices on the overall change in adjusted headcount play paramount importance. Following Apablaza and Yalonetzky (2013), the change in adjusted headcount ratio with its components and their interaction can be decomposed as follows:

$$\Delta M_0 = \underbrace{A^{t^2}\left(H^{t^2} - H^{t^1}\right)}_{\text{Poverty effect from entry and exit}} + \underbrace{H^{t^2}\left(A^{t^2} - A^{t^1}\right)}_{\text{Poverty effect from ongoing poor}} + \underbrace{\left(\left(H^{t^2} - H^{t^1}\right)\left(A^{t^2} - A^{t^1}\right)\right)}_{\text{Interaction effect}}$$

This decomposition reflects poverty effects from ascents and descents and interaction effects. Roche (2013) also proposed techniques for analyzing the marginal contributions of incidence effect and intensity effect. The marginal contribution of changes in incidence and intensity is expressed as a percentage of the overall change in adjusted headcount so they both add to 100% (Alkire et al., 2015). Mathematically, they can be written as:

$$\Delta M_o = \underbrace{\frac{A^{t^2} + A^{t^1}}{2}\left(H^{t^2} - H^{t^1}\right)}_{\text{Incidence of poverty effect}} + \underbrace{\frac{H^{t^2} + H^{t^1}}{2}\left(A^{t^2} - A^{t^1}\right)}_{\text{Intensity of poverty effect}}$$

And

$$\Phi_{\mathrm{H}}^{0} = \frac{\left(\frac{A^{t^2} + A^{t^1}}{2}\left(H^{t^2} - H^{t^1}\right)\right) x\ 100}{\Delta M_0} \quad \text{and} \quad \Phi_{\mathrm{A}}^{0} = \frac{\left(\frac{H^{t^2} + H^{t^1}}{2}\left(A^{t^2} - A^{t^1}\right)\right) x\ 100}{\Delta M_0}$$

Multidimensional poverty might be reduced due ascent or a decline in the intensity of deprivation. Alkire et al (2015) label these poverty reduction configurations as movers and stayers. Denoting $A^{\hat{E}}$ as the proportion of people who escaped poverty and $\Delta A^{\hat{O}}$ as intensity change in net ongoing poor, change in adjusted headcount can be decomposed as:

$$\Delta M_0 = \Delta H\ x\ A^{\hat{E}} + H\ (X_{t^2})\ x\ \Delta A^{\hat{O}}$$

2.3.4. Empirical strategy

2.3.4.1. Fixed effect model

In panel data, an outcome variable of an individual i at time t is a function of explanatory variables across individuals over time. Fixed effects and the random effects models are chosen as they provide better control for the influence of missing or unobserved variables (Arellano, 2004). Moreover, these models can account for intertemporal as well as individual differences among the units of analysis. The panel data model is simply specified as:

$$y_{it} = \alpha_i + \beta x'_{it} + \varepsilon_{it}$$

Where y_{it} is a dependent variable observed for unit i at time t, x'_{it} it is a k-dimensional vector of explanatory variables for unit i at time t, β is a vector of coefficients to be estimated, $\alpha_i$denotes unobserved unit-specific effects, whereas ε_{it} is the disturbance term.

In the standard case, ε_{it} is assumed to be independent and identically distributed over individuals and time, with mean zero and variance σ_{ε}^{2}. If we treat the α_i as N fixed unknown parameters, the model in the above equation is referred to as the standard fixed-effect model. The model is simply a linear regression model in which the intercept terms vary over the individual units i.

What makes fixed effects differ from random effects models is the assumption behind the relationship between x_{it} and α_i. The fixed effects approach assumes that α_i is treated as nonrandom and hence, makes the correlation between the observed explanatory variables x_{it} and α_i possible. On the other hand, the random effects is applicable under the assumption that α_i is random and not correlated with x_{it} and puts it into the error term (Wooldridge, 2013). Hausman test is used to check whether there is such a correlation between the observed explanatory variables and α_i so that the suitable model specification is decided. If there is no correlation, in large samples the results obtained in applying the two estimators should be alike. Yet, if there is a correlation, the estimated results of the two estimators are different. Specifically, in the presence of such a correlation, the random effects estimator is inconsistent whereas that of the fixed effects remains consistent. A test to detect whether there is autocorrelation and whether the variance of the residuals is homoscedastic in the model specified is conducted.

2.3.4.2. Dynamic random effect probit model with unobserved heterogeneity

In dealing with the persistence of dichotomous outcomes, a dynamic random effects probit model is increasingly used. It has been employed in poverty dynamics (Bigsten and Shimeles, 2008; Islam and Shimeles, 2007), unemployment behavior (Flaig et al., 1993), among others. Estimating this model is advantageous as it accounts for state dependence. The outcome probability (multidimensional poverty) is hypothesized to depend on the multidimensional poverty in the previous period. Thus, a current state of multidimensional poverty is modeled as a function of multidimensional poverty in the previous period. Besides, unobserved heterogeneity that makes specific groups prone to multidimensional poverty should be accounted for while modeling multidimensional poverty (Grotti and Cutuli, 2018).

The model is specified as:

$$y_{it}^{*} = \gamma Z_{it} + \rho y_{it-1} + C_i + u_{it} \quad (i = 1, 2, \dots, N;\ t = 2, \dots, T),$$

Where y_{it}^{*} is the latent indicator of multidimensionally poor and y_{it} is the observed binary outcome variable (multidimensional poverty), defined as:

$$y_{it} = \begin{cases} 1 \; if \; y_{it}^{*} \; \leq 0 \\ 0, otherwise \end{cases}$$

i indexes households and *t* indexes time, $y_{i,t-1}$ is the lagged multidimensional poverty status used to measure state dependence, x_{it} is vector of explanatory variables, C_i is unobserved individual-specific time-invariant heterogeneity effect, $u_{it} \sim iid \; N(0 \; \sigma_u^2)$ is the error terms. The parameter γ represents true state dependence; and β is a set of associated parameters to be estimated.

The presence of unobserved heterogeneity and the presence of past value of multidimensional poverty status results in an initial conditions problem. This might happened since the start of the initial panel wave did not correspond with the start of the stochastic process generating households' multidimensional poverty status. The households in the data that existed before the initial panel wave might already have been at risk of multidimensional poverty. Thus, the earlier history might determine multidimensional poverty in the initial period. For an initial condition problem, the literature suggests either modeling of the initial response jointly with the subsequent response as proposed by Heckman (1981) or conditioning on the response at the initial period y_{i0} as proposed by Wooldridge (2012). This study employed modeling of unobserved effects through the inclusion of the values of the time-varying explanatory variables at each period and their within-unit averages in the model following Grotti and Cutuli (2018).

Assuming unobserved heterogeneity is captured by C_i, the lagged value of multidimensional poverty represents genuine state dependence. The unit-specific unobserved effect C_i can be written as follows:

$$C_i = \alpha_0 + \alpha_1 y_{i0} + \bar{z}_i \alpha_2 + \bar{z}_{i0} \alpha_3 + \alpha_i$$

Where, y_{i0} and Z_{i0} refer to the initial value of the response variable and time-varying explanatory variables respectively, $\bar{z}_i = 1/T \sum_{i=0}^{T} z_{it}$ stands for the within-unit averages of the explanatory variables where the averages are based on all period's t = 0... T. Lastly, α_i is a unit-specific time-constant error term normally distributed with mean 0 and variance σ_α^2.

2.4. Results and discussions

2.4.1. Resilience profiling

To understand which group of the household could be able to cope with shocks and stressors and curb multidimensional poverty, resilience classes have been created in terms of terciles of resilience capacity distribution. The comparison revealed significant growth in the average resilience capacity of the least resilient households by 8.03. However, the mean resilience capacity of the most and less resilient households has substantially been deteriorated by 5.07 and 2.96 scores respectively between 2011/12 and 2015/16 (Table 2.2).

Table 2.2: Resilience terciles of rural households in Ethiopia, 2011/12 - 15/16

Categories	2011/12	2013/14	2015/16
Most resilient	36.89	31.29	31.82
Less resilient	34.59	33.78	31.63
Least resilient	28.52	34.93	36.55

A resilience structure matrix presents the contribution of each pillar and identifies the most relevant pillars to the RCI over time and among social groups. When looking at the role of each pillar over years, access to basic services is ranked as the most important contributor to the resilience capacity. Asset possession followed by adaptive capacity is also imperative in building resilience capacity (Figure 2.3). In contrast, the lowest score for 2011/12 is mainly driven by poor stability that subsequently serves the lion's share of enhancing resilience.

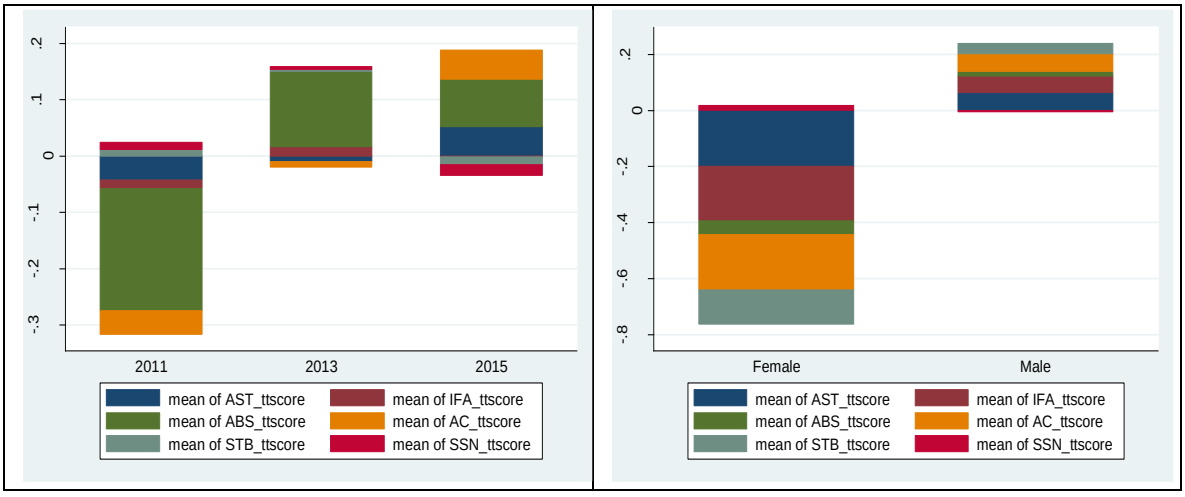


Figure 2.3: Resilience by years and gender of household head in Ethiopia

There are also relevant differences in resilience capacity between female and male-headed households. The analysis disaggregated by gender reveals that male-headed households have a greater resilience capacity. More specifically, income and food access, and social safety net are the most vital pillars for both male and female-headed households (Figure 2.3).

2.4.2. Multidimensional poverty profiling

2.4.3.1. Overview of multidimensional poverty reduction

The sample rural household has experienced a significant reduction of the multidimensional poverty headcount into 72.5% (2015/16) from 80.1% (2011/12) (Table 2.3). Projected for the entire rural population in Ethiopia, 4.2 million people experienced poverty ascents. It is a continuance of the declining trend in the preceding decade by an average of 1.5% (Diwakar, 2016). The intensity of deprivation, which reflects the share of deprivations that each poor household experienced, has been reduced by 7%.

The M_0 value for rural Ethiopia declined from 0.53 to 0.429 in the survey period. The composition of multidimensional poverty by each indicator and their weighted contributions revealed that there is a reduction in multidimensionally poor households adjusted with their average deprivation with 10.1% which is less than the national average reduction of 14.4% (Alkire et al., 2019). To put it differently, more than 35 million[7] rural people who are multidimensionally poor deprived with 66.1% of the total indicators in 2011/12 is reduced to 29 million people deprived with 46.6% of indicators in 2015/16. In the money-metric measure, 22 million people are still poor (UNDP, 2018). A reduction in M_0 occurs because a country has succeeded in reducing both incidence and intensity. Despite the bleakest prognosis of leaving no one behind at 2030, Ethiopia is among those with the fastest absolute reduction in multidimensional poverty in Sub-Saharan Africa (UNDP, 2020).

Table 2.3: Multidimensional poverty measures with equal and nested weight (k = 3)

Indices	2011/12	2013/14	2015/16
H	0.801	0.753	0.725
A	0.661	0.619	0.591
M_0	0.530	0.466	0.429

2.4.3.2. Multidimensional poverty decomposition

[7]Using the World Development Indicator rural population number of Ethiopia

The absolute pace of change indicated that the total deprivations that poor people could have experienced has been eradicated by 6.4%, 3.7%, and 10.1% respectively between the first two waves, the subsequent two waves, and the first and last waves. The relative rate of change, on the other hand, revealed that M_0 has gone down by 12.1%, 7.9%, and 19.1% respectively from 2011/12 to 2015/16 compared to the initial level. The incidence on the other hand fell by 7.6%, absolutely and 9.05% relatively per year between 2011/12 and 2015/16. Reduction in intensity is stronger in relative terms with 10.6% than a 7% reduction absolutely (Table 2.4). Multidimensional poverty is reduced due to incidence more than intensity corroborating Alkire et al. (2017) and Alkire and Housseini (2014).

Table 2.4: Multidimensional poverty rate of change in Ethiopia

	Absolute change			Relative change		
	A	B	C	A	B	C
H	-0.048	-0.028	-0.076	-0.060	-0.037	-0.095
A	-0.042	-0.028	-0.07	-0.064	-0.045	-0.106
M_0	-0.064	-0.037	-0.101	-0.121	-0.079	-0.191

Note: A = 2011/12 - 2013/14, B = 2013/14 - 2015/16, and C = 2011/12 - 2015/16

The decomposition of the change in M_0 that can be attributed either to movers or stayers is shown in Table 2.5. The dynamic subgroup decomposition indicated that the change in M_0 between 2011/12 and 2015/16 credited to those who moved out of poverty is found to be 7% compared to 5.7% of change that was mainly caused by a decrease in intensity among those who stayed poor. However, the 8.8% and 4.2% decline in M_0 between the first and subsequent waves are the result of the respective decline in intensity by 4.9% and 2.2% than those who stayed poor.

Table 2.5: Movers and stayers effect

	2011/12 - 2013/14	2013/14 - 2015/16	2011/12 - 2015/16
Movers effect	0.049	0.022	0.070
Stayers effect	-0.039	0.020	0.057

The decomposition of changes in the adjusted headcount ratio is depicted in Table 2.6. Accordingly, changes in the incidence and intensity of poverty, and the interaction effects respectively are found to be 3.2%, 3%, and 0.2% between the first two rounds, whereas, 2%, 1.7%, and 1% between the last two rounds. However, the results between the first and last rounds of the survey revealed a 5.1% poverty effect from exit and entry, 4.5% poverty effect among ongoing poor, and 0.5% due to the interaction effect.

Table 2.6: Apablaza and Yalonetzky decomposition of M_0, H and A

	2011/12 – 13/14	2013/14 – 15/16	2011/12 -15/16
Poverty effect from entry and exit	-0.032	-0.020	-0.051
Poverty effect among ongoing poor	-0.030	-0.017	-0.045
Interaction effect	0.002	0.001	0.005

Table 2.7 shows the marginal contributions of changes in incidence and intensity on multidimensional poverty reduction with no interaction effect. The marginal contribution of changes in incidence and intensity respectively are found to be 48% and 50.99% between round one and two, 45.78% and 55.92% between rounds two and three, and 47.11% and 52.88% on the entire survey period.

Table 2.7: Roche decomposition of the marginal effect

	2011/12 - 13/14	2013/14 - 15/16	2011/12 - 15/16
Incidence of poverty effect	-0.031	-0.017	-0.048
Intensity of poverty effect	-0.033	-0.021	-0.053
Φ_H^0	48.00	45.78	47.11
Φ_A^0	50.99	55.92	52.88

2.4.4. Descriptive statistics

The linear relationships of resilience and multidimensional poverty are estimated. The p-value revealed that there is a strong statistically significant correlation between resilience and multidimensional poverty. Therefore, the null hypothesis that there is no relationship between the variables of interest is rejected (Table 2.13 in the appendices).

Table 2.8 describes a set of variables used for the estimation of resilience capacity and empirical analyses, and some important points have emerged. First, the chronically poor have a much lower resource base. The size of cultivated land is quite low with an average of 0.5 hectares. In 2011/12, the non-poor households cultivate 1.768 hectares in contrast to the 1.117 hectares for the chronically poor ones. The trend indicates high fragmentation. Wealth represented by TLU and the number of oxen owned indicates similar tendency of decline from always poor to always non-poor categories. While the always poor owned only 2.85 TLUs, households who were poor once, twice, and always poor, respectively, own 3.38, 3.97, and 3.90 TLUs in 2011/12. Per capita income also increased for all groups of households. We also found a decline and marked disparity in food ratio among the poverty groups.

Second, the multidimensionally poor are more prone to shocks. While the nonpoor reported an average of 0.786, as high as 0.818, 0.936, and 0.973 numbers of shocks are reported by the poor once, twice, and always in 2011/12 and consistently increasing over time. Covariate shocks consistent with Dercon et al. (2005) are more virulent than idiosyncratic ones in affecting the resilience capacity. They bring a decline in income, assets, and food consumption, and reduce human capital (Fuje, 2018; Boku, 2017; Birhanu and Zeller, 2009).

Third, household activities tend to reduce multidimensional poverty. Commercialization is very low among all poverty groups and slightly progresses over time. An increase in the share of non-farm income, the number of off-farm skilled workers, and wage labor participation reduce the risk of impoverishment. Much of the income of the rural households comes from crop production. The non-poor have a non-farm income share of 46.05%, whereas, households who are poor once, twice, and always share 46.20%, 35.79%, and 37%, respectively in 2011/12. More than 50% of the nonfarm income shares have been reported by all groups in 2015/16. Besides, a sizeable number of the poorest participate in PSNP as a risk coping mechanism and consumption smoothing.

Last, demographic characteristics are markedly different across different poverty groups. The multidimensionally non-poor are headed by olds. Aguilar and Sumner (2020) also confirmed that multidimensionally poor in rural areas are largely children and young people. The size of households is also the highest among the non-poor households. Households dominated by economically active members are typically less deprived in the empowerment and asset ownership.

Table 2.8: Household characteristics and multidimensional poverty persistence

	Year of the survey											
	2011/12				2013/14				2015/16			
Variables	1	2	3	4	1	2	3	4	1	2	3	4
Age of household head	41.12	44.78	43.82	44.02	48.70	46.97	46.52	46.17	50.16	48.63	48.37	48.14
Household size	6.02	5.41	5.27	4.92	5.66	5.32	5.30	5.00	5.46	5.31	5.30	5.15
Land in hectare	1.768	1.538	1.436	1.117	0.31	0.172	0.142	0.185	.102	.068	.075	.061
Numbers of plots	6.32	6.23	6.60	6.15	8.36	9.08	9.50	9.27	12.08	10.89	10.94	9.51
Tropical livestock unit	2.85	3.38	3.97	3.90	6.05	5.35	5.89	4.80	5.92	5.49	6.32	5.22
Number of oxen	1.306	1.03	.9307	.726	1.43	1.06	1.00	0.78	1.38	1.10	1.07	0.87
Per capita income	2020	2181	2665	2171	2598	2592	2283	2138	3886	2724	3072	2798
Numbers of shocks	.786	.818	.936	.973	.685	.537	.515	.679	1.02	1.29	1.41	1.63
NDVI[8]	44.68	42.95	43.14	41.46	47.3	46.2	47.6	45.8	39.9	39.90	40.59	39.6
Non-farm income share	46.05	46.20	35.79	37.00	22.32	22.29	18.54	20.39	56.33	56.84	56.42	57.77
Commercialization index	.085	.676	.225	.153	15.70	12.46	15.59	13.31	11.35	12.12	13.56	12.44
Off-farm workers	.479	.536	.418	.403	.396	.287	.231	.229	2.09	1.98	1.94	1.93
Wage labor participation	8.16	9.49	4.73	4.59	19.39	19.55	13.51	8.57	13.26	20.11	15.58	16.29
Participation in PSNP	1.02	7.26	5.66	6.78	11.22	11.17	6.93	10.52	4.08	7.82	6.69	8.88
Food ratio	20.46	18.76	19.19	17.99	8.32	14.32	11.62	15.01	3.78	5.14	4.75	4.52

Note: 1 = Non poor at all; 2 = Poor once; 3 = Poor twice; 4 = Poor all the time.

[8] It stands for Normalized Difference Vegetation Index and used as a proxy for water stress problems or land productivity or the state of land degradation (Yengoh et al, 2015). A better NDVI implies strong vegetation cover and responses to environmental change. Households living in areas with better NDVI implied less vulnerability to drought (Tonini et al, 2012) and have more production, and resilient properties of the landscapes and their constituent.

2.4.5. Econometric results

The fixed effect and dynamic random effect probit models are estimated to examine the effect of resilience capacity on multidimensional poverty and its dynamics. The main results are presented in this section, with supporting statistics of variables used in estimations.

2.4.5.1. Results of the fixed effect model

The result of the role of resilience in reducing multidimensional poverty is presented in Table 2.9. The Hausman test indicates individual effects were uncorrelated with other regressors in the model. The chi-square probability is also less than 0.01. Therefore, the null hypothesis is rejected and a fixed effect model is selected. The model is then diagnosed for heteroskedasticity and autocorrelation with Greene's (2012) Wald statistics. If we do not take the problem of heteroskedasticity into account, parameter estimates would be less efficient. Hence, in the fixed effects estimation, robust and consistent standard errors corrected for heteroskedasticity are used.

Smallholder farming in Ethiopia suffers a lot from shocks (Hiensch, 2007; Dercon and Hoddinott, 2006). This often makes households with a higher share of crops from the total income more at risk of deprivation (D'Errico and Giuseppe, 2018). As anticipated, the parameter estimates of the numbers of idiosyncratic shocks that households encountered are positively associated with multidimensional deprivation. Multiple shocks over time in exacerbating a downward poverty trajectory corroborates with studies in other African countries (Maganga et al., 2021; Azzarri and Signorelli, 2020; Salvucci and Santos, 2020; Diwakar et al, 2019; Shehu and Sidique, 2015). However, the finding revealed that enhancing resilience strengthens the household's ability to leave poverty deprivation behind. Sustained escapes out of multidimensional poverty by enhancing resilience through better resource base, attributes, and capacities, and engagements in certain household activities are revealed by the previous studies (Diwakar, 2016; Mariotti and Diwakar, 2016; Scott et al., 2016).

Due to poor technological breakthrough, land fragmentation, and tenure insecurity, smallholder farming is getting less viable for multidimensional poverty reduction (Rapsomanikis, 2015). However, human capital has a crucial role in improving farm productivity (Olopade et al., 2019; Yao, 2019; Attanasio et al., 2017). The parameter estimates of education and household size have a negative and significant role in curbing multidimensional deprivation. This is

indicative of the roles that literacy plays in opening up opportunities and enabling pathways out of multidimensional deprivation (Scott et al., 2014) and the relative strength of economically members. The goal of poverty reduction is also complemented as households increasingly diversify their livelihoods by non-farm and off-farm employment and increased migration (Adamseged et al., 2019; Loison, 2019; Headey et al., 2014; Jann and Schüler, 2008). Wage labor participation has a negative and significant effect on multidimensional deprivation. Though wage employment is mainly casual and generally offers a low return, the participation of rural households in temporary migratory jobs plays a significant role in their daily struggle. The decisions to engage in wage works are often driven by the desperation of expected low returns from farming. The increasing desertion of farming is due to land scarcity and land market restrictions (Bezu and Holden, 2014). But even for households earning better farm income, wage work smooths income and diversify risks.

While the rural poor are mainly farm laborers and marginal farmers, some non-farm activities are also of importance to the poor. The role of non-farm work in providing the means of overcoming the risks of deprivation is overwhelming (Rahman and Mishra, 2020; Zereyesus et al., 2017). We also find that the coefficient of share of nonfarm income in serving as a hedge against multidimensional deprivation is found to be negative and significant. Participation in nonfarm activities is more prevalent among households with lower landholdings per head and less likely to own livestock (World Bank, 2015). Households less endowed with farming resources, female-headed, and have less male family labor as well as households who had at least one member migrate to other places are also more likely to rent out land. moreover, rural households rent out land when crop failure happened due to erratic and unpredictable rainfall (Gebregziabher and Holden, 2011). We also find that renting out land worsens multidimensional deprivation.

The bulk of Ethiopia's poor are smallholders who depend on rain-fed agriculture as the main source of food, income, and employment. However, commercialization has been acknowledged as one of the main pathways for multidimensional poverty escape. The parameter estimate of the welfare effects of commercialization is found to be positive. A few studies also indicated that commercialization contributes to smallholders' poverty reduction among African countries (Abdullah et al., 2019; Ogutu and Qaim, 2019; Cazzuffi et al., 2018; Carletto et al., 2017; Muriithi and Matz, 2015). Smallholders in Ethiopia generate the bulk of

their income from their own crop and livestock production than non-farm income. However, they generate meager amounts of income, through commercialization, as compared with countries in Africa. It is widely acknowledged that financial access is the one among diversified strategies that rural households pursued to escape multidimensional deprivation. Credit eases access and use of technologies and scientific agricultural practices (Nakano and Magezi, 2020; Makate et al., 2019). However, access to credit worsens deprivation due to high interest rates and significant collateral requirements. In contrast, saving significantly reduces multidimensional deprivation as it smooths consumption and reducing alternative coping mechanisms such as distress sale of assets, reduced food intake, or borrowing at disproportionally high-interest rates (Steinert et al., 2018).

Table 2.9: Effects of resilience on multidimensional deprivation – Fixed effect

	Coef.	Std. Err.
Resilience capacity index	-0.3048***	0.0616
Numbers of covariate shocks	0.0017	0.0015
Numbers of idiosyncratic shock	0.0105***	0.0024
Age of household head	-0.0001	0.0001
Female household head	-0.0044	0.0042
Household size	-0.0074*	0.0040
Household size square	-0.0001	0.0003
Education	-0.0087**	0.0036
Share of non-farm income	-0.0088**	0.0039
Saving account	-0.0178***	0.0053
Credit	0.0097**	0.0040
Crop commercialization index	-0.0002*	0.0001
Wage labor participation	-0.0133***	0.0044
Land rent out	0.0243***	0.0033
Numbers of oxen used for plow	0.0015	0.0019
Constants	0.5482***	0.0196
Observation	7,815	
Sigma_u	0.0771	
Sigma_e	0.1043	
Rho	0.3529	

Note: *** p < 0.01, ** p < 0.05, and * p < 0.10

2.4.5.2. Results of the dynamic random effect probit model

The result of the dynamic random effect probit model of multidimensional poverty is presented in Table 2.10. The lagged value of the dependent variable captures state dependence. Once

controlled for initial condition and net unobserved heterogeneity, the positive coefficient indicates the presence of significant dynamics of genuine state dependence. This implies that experience has a true effect on future multidimensional poverty corroborating the previous studies (Bigsten and Shimeles, 2008; Islam and Shimeles, 2007). This means that the households who were multidimensionally poor in the preceding year are more likely to be multidimensionally poor subsequently.

Table 2.10: Effect of resilience on multidimensional poverty dynamics - (Dynamic random effect probit model)

Variables	Coef.	Std. Err.
Lagged multidimensional poverty	0.1737***	0.0579
Resilience capacity index	-2.2167***	0.6706
Household size	-0.0787***	0.0201
Education	-0.0072	0.0504
Share of non-farm income	-0.1322**	0.0539
Number of shocks	0.0320*	0.0172
Crop commercialization index	-0.0023	0.0015
Extension	0.0058	0.0439
Land rent out	0.2908***	0.0437
Resilience capacity index__0	-3.3726***	0.6921
Household size __0	-0.0857***	0.0205
Education__0	-0.2049***	0.0669
Share of non-farm income __0	-0.1555**	0.0634
Number of shocks__0	-0.0263	0.0207
Crop commercialization index __0	-0.0138**	0.0071
Extension__0	0.0058	0.0530
Land rent out__0	0.0282	0.0646
m__ Resilience capacity index	-11.403***	1.2693
m__ Household size	0.1664***	0.0307
m__Education	0.1375	0.1061
m__ Share of non-farm income	0.1595	0.1411
m__ Number of shocks	0.0750**	0.0340
m__ Crop commercialization index	-0.0010	0.0025
m__Extension	-0.3661***	0.0924
m__ Land rent out	-0.5937***	0.1163
Constant	3.5548***	0.2639
Observations	7815	

Note: *** p < 0.01, ** p < 0.05, and * p < 0.10

Looking the coefficients for control variables, resilience capacity, household size, and share of nonfarm income significantly lessen the risk of multidimensional poverty. This implies that households with a set of resilience capacities are more likely to escape multidimensional poverty. One of the attributes to minimize spells of multidimensional poverty over time is household size. This is clearly a reflection of having more economically active members. The other household activity to reduce risks of multidimensional poverty is enhancing the share of non-farm income. Promoting non-farm economic activities provide important mechanisms to augment farm income and curb multidimensional poverty consistent with studies in different countries (Dagunga et al., 2020; Che Mat et al., 2020; Danso-Abbeam et al., 2020; Rahman and Mishra, 2020; Al-Amin and Hossain, 2019). However, exposures to multiple shocks and land rent out worsen the risk of multidimensional poverty.

Next, we find coefficients of the set of variables that capture unobserved heterogeneity. Here we observed a statistically significant and substantial positive effect of the initial condition resilience capacity index. Contrarily, household sizes, the share of nonfarm income, education, and crop commercialization have a significant and negative effect. The within-unit averages of resilience capacity index, extension, and land rent out negatively, and household size and numbers of shocks positively determine multidimensional poverty. It implies that these characteristics have correlated with unobserved factors associated with poverty. In other words, these households have been featured by time-constant unobserved factors that increase their poverty risks.

2.5. Conclusions

This study examined the effect of household resilience capacity on multidimensional poverty and poverty dynamics in rural Ethiopia using Rural Socioeconomic Survey data collected by CSA in collaboration with the World Bank Living Standard Measurement Studies spanning for 5 years (2011/12 - 2015/16). The study finds out that many households experienced a slight growth in resilience capacity. The major pillars that explain resilience are adaptive capacity, income and food access, and stability. Regional measures also show divergences in scores of resilience. Relative proximity to basic services, housing conditions, literacy, and resources such as land and TLU as well as per capita income contribute more to regional disparities.

Multidimensional poverty has declined through a greater change in headcount than the intensity of deprivation. Regardless of the considerable effort in curbing poverty, millions of people are

still multidimensionally poor. This is due to the outweighing probability of descents in the simultaneous flows of creation and reduction of poverty. The empirical result also provides much-needed evidence in support of recent policies designed to encourage poverty reduction. We find that enhancing resilience capacity accompanied by commercialization, raising the share of non-farm income, literacy, a household size that would be rationalized with the existence of more economically active members, and saving are found to open up opportunities to curb multidimensional deprivation. However, the recurrence of multiple idiosyncratic shocks, credit, and renting out land worsens the welfare of rural people. Plenty of emphases, substantial budgets, and policies are better developed for agriculture, but the sector is fraught with shocks and is not sufficiently remunerative to sustainably lift rural people out of poverty. Hence, improving the performance of small farmers through access to land, improving access to agricultural inputs, investment in small-scale irrigation, sustainable intensification and crop diversification is necessary to propel resilience for poverty, but they are not sufficient on their own. Critical for policy uptake, productive inclusion provides a basis for longer-term resilience for multidimensional poverty. Support for migration, making urban development migrant-friendly, promoting the rural non-farm sector, ensuring sustainable financial inclusion of the poor, commercialization, diversification of income and livelihood, and increasing access to basic services should also be part of the strategy.

The dynamic random effect probit result shows that there is a strong state dependence on multidimensional poverty. Hence, households who experienced poverty in the preceding year are found to be at a higher risk of staying in poverty. High multidimensional poverty persistence arises from both the consequences of past multidimensional poverty and household adverse characteristics making them more poverty prone. The strong state dependence that perpetuates poverty has important implications to design long term interventions that support sustained escapes out of poverty. As part of sustainable resilience for multidimensional poverty solutions, rural-urban integration augmenting transition into the urban-based economy is what emerged from the analysis. Hence, the key priority areas on which efforts should focus to provide the necessary support for overcoming multidimensional poverty begin with rural transformation. Findings also suggested that the key policy approaches aimed at enhancing resilience in curbing multidimensional poverty include investment in rural infrastructure, expansion of semi-formal financial institutions, and public expenditures to support early warning systems, safety nets, and humanitarian emergencies. Rural households have to be well connected to markets and towns which are important hubs in economic transactions.

Chapter 3: Structural and Stochastic Poverty, Shocks, and Resilience in rural Ethiopia

Abstract

Rural households in Ethiopia are subject to idiosyncratic and covariate shocks so poverty becomes a pressing problem. The question of how to sustainably escape from poverty figuration in the wake of shocks remains a worthy subject of development research. We examine the effect of shocks on structural and stochastic poverty, transitions, and the role of resilience as a mechanism for dealing with shocks and stochastic and structural poverty. We employed three waves of the Ethiopian Socioeconomic Survey panel data. The study finds evidence that recurrent and concurrent shocks have detrimental impacts on structural and stochastic poverty. In contrast, the fixed effect multinomial logit regression results revealed that resilience capacities curb poverty as shocks intensified. Besides, access to irrigation, literacy, good vegetation cover, and non-farm economic activities help eradicate structural and stochastic poverty. The Cox proportional hazard models, on the other hand, point to credible evidence that drivers and interrupters of structural and stochastic poverty include rainfall variability, drought, conflict, input and output price volatility, and idiosyncratic shocks. Thence, critical for policy uptake, the indispensable option pursued to reduce structural and stochastic poverty is enhancing resilience capacity. Promoting synergistic rural-urban linkages also ensures a balanced mix of development that would bolster access to irrigation, commercialization, non-farm activities, and human capital formation. To protect poverty descent and enhance ascent the findings suggest that two distinct sets of policies are required thus, harmonizing cargo net and safety net policies.

***Keywords**: shocks, poverty, fixed effect multinomial logit, panel data, rural Ethiopia*

3.1. Introduction

Poverty is the major challenge facing the developing world (Hoang, 2018). More than 730 million poor people live in Africa (Beegle and Christiaensen, 2019). Corroborating with its slower economic growth, poverty reduction is sluggish (Arndt et al., 2016). Africa still harbors a significant share of extreme poverty. And it is also projected that the extremely poor will increasingly be potent in SSA (World Bank, 2020b).

Ethiopia exerted tremendous efforts and implemented national development plans and strategies taking poverty reduction as an underlying goal. As a result, a notable achievement has been made. In particular, the steady economic performance matches a 2.3 million people poverty escapes between 2011/12 and 2015/16 (World Bank, 2020a). Nevertheless, poverty remains rampant and allegorical. An official estimate of 23.5% of the population is money-metric poor (MoFED, 2017) and retains a multidimensional poverty index of 0.489 (OPHI, 2019). The

problem, indeed, is predominantly a rural phenomenon (Stifel and Woldehanna, 2017). Therefore, poverty continues to be a dreadful challenge for decades to come.

Despite the unprecedented economic growth over two decades, less of it is translated into vigorous poverty reduction. Poverty remains persistent due to high initial poverty, precarious asset levels, and insufficient access to public services (Shimeles, 2019). Ethiopia is also figurative of rising sociopolitical instability, land tenure insecurity, inflation, unemployment, weak capital accumulation and investment, and environmental degradation (Caravaggio et al., 2021; Bekele, 2018; Baye, 2017). A few daunting challenges are also worth to mention why the quest for alleviating poverty has suffered the worst setback.

First, smallholders are subjected to covariate and idiosyncratic shocks[9]. For example climate-related (Hirvonen et al., 2020), price-related (Hill and Porter, 2017), and health-related (Gebremariam and Tesfaye, 2018) that exacerbated poverty via reduced education, labor market participation, agricultural output, incomes, and consumption (Ngoma et al., 2019; Davies, 2010). Shocks crumble the abilities to develop a household's stock of wealth and stifle to use of it effectively. When prolonged shocks result in a downward spiral of asset loss as people are forced to abandon productive activities (Barua and Banerjee, 2020). Recurrence and concurrence of shocks enormously whipped out livelihood resources and efforts to eradicate poverty (Campos et al., 2014).

Second, poverty is a result of two offsetting trends of ascents and descents. No one is fail-safe from the rising and falling tides (Krishna, 2017). These comovements reconfigure compositions of the poor. Poverty re-entry and impoverishment unduly outweigh the dynamics in rural Ethiopia that spurs a reversal of fortune (Mariotti and Diwakar, 2016).

The other equally important reason to explain is the methodological flaws. Ethiopia's official poverty statistics follow the conventional approach (MoFED, 2017; 2012). However, this avenue has strongly been criticized for its hitch in capturing multifaceted attributes (Krishna, 2017). Moreover, consumption tends to fluctuate over time (Hulme and Shepherd, 2003). The measure could not also divulge intrahousehold resource allocation (Tran et al., 2014). Thus, reformulating poverty analysis that explicitly integrates money-metric and asset basis has long been the interest of development research. A hallmark of an integrated modeling approach is

[9] Covariate shocks affect all households in the village and possibly those nearby, whereas shocks in which the impacts are limited to the individual or household levels are idiosyncratic (Pradhan and Mukherjee, 2018).

the apparent precision to measure structural and stochastic poverty and decompose their trajectories (Schotte, 2019; Radeny, 2012; Carter and Barrett, 2006).

The national poverty reduction strategies function in silos and lack systematic attempts to pinpoint the poor, determine their needs, and address them to sustain escape poverty. Besides, the strategies left little room to maneuver the multifaceted deprivation of the poor. Any standardized national policy and strategies are largely immaterial. Therefore, it is imperative to enhance resilience to shocks underpinned through a mosaic of development and humanitarian support. Resilience is the imminent high-resolution lens amalgamating the safety- and cargo net policies in the fight against poverty (Sou, 2019; Barrett, 2005).

The synergy of the preceding concerns stalled poverty reduction in Ethiopia. A few empirics underscore that shocks perpetuate monetary poverty (Barua and Banerjee, 2020; Shehu and Sidique, 2020). While others statically edify the effect of shocks on structural and stochastic poverty (Ngoma et al., 2019; Angelsen and Dokken, 2018). Thus far, the literature lacks a thorough discussion on structural and stochastic poverty and how resilience lightens structural and stochastic poverty in the presence of shocks. Against this backdrop, this study attempts to address the effect of shocks on structural and stochastic poverty and the role of resilience as a mechanism for dealing with shocks and structural and stochastic poverty. It also scrutinizes how shocks and other factors prompt ebbs and growth in structural and stochastic poverty in rural Ethiopia. The forethought here is that explaining the net poverty change entails insight into the coexisting poverty making and unmaking. Because reasoning why some (but not others) could escape is crucial.

The paper is structured as follows. Section 3.2 presents the theoretical framework. In section 3.3, we briefly discussed the research methodologies. Section 3.4 discusses the major results. Finally, section 3.5 concludes the paper.

3.2. Theoretical framework

In the wake of liquidity constraints, the notion that poor households will smooth consumption has a firm theoretical foundation. Carter and Lybbert (2012) also acknowledged that poor households often prefer to smooth their consumption than their assets in the presence of shocks. The possible reason is that selling productive assets would induce a permanent asset loss in income which subsequently traps poverty. To get a clear insight into drivers and interrupters of structural and stochastic poverty and the mediating role of resilience between shocks and

structural and stochastic poverty, this paper backed up its argument based on the asset smoothing approach of Carter and May (1999). The approach underlined the role of productive assets in enhancing the income-generating process and serving as a buffer stock in times of an anticipated decline in income. In other words, the immediate welfare implications of asset smoothing could well be an intergenerational asset transfer that could shield poverty in ensuing generations. How asset accumulation and loss upset poverty is schematically depicted in Figure 3.1. It helps us to build an integrated poverty measure using asset and income perspectives.

The axes measure the income of the households in money-metric criteria (vertical) and assets accessible to households (horizontal). The assets are defined in terms of tangible and intangible categories. Likewise, the vertical and horizontal grid lines represent income and asset poverty lines. The income poverty line (Z) indicates the minimum amount of income required that divides the income poor from the non-poor. The asset poverty line ($\bar{A}$) is an extension of the monetary poverty line. It entails the level of assets that yields the expected level of income equal to the poverty line. The line allows us to figure out households into asset poor and non-poor (Carter and May, 1999).

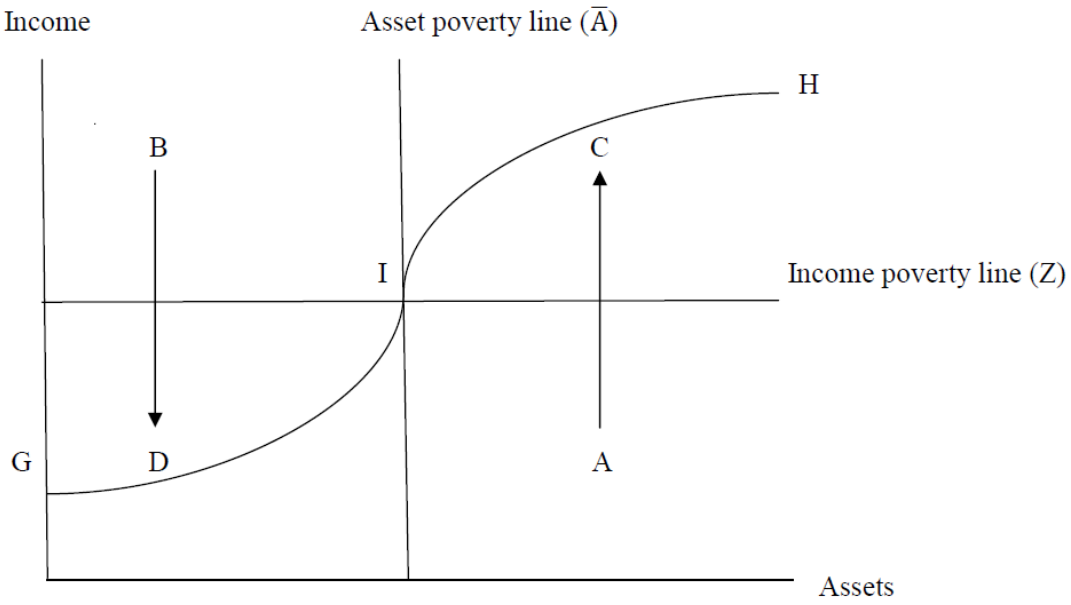


Figure 3.1: Integrated measures of poverty (Carter and May, 1999).

Disaggregating poverty transitions claim the information on household access to assets and expected levels of well-being or income. Based on the value of income (Y_i) and asset poverty index (API), and the denotation of the conventional money-metric poverty line (Z) and asset poverty line ($\bar{A}$), we can identify the structural and stochastic poor as follows. Structurally poor are those household located at point D since their realized income is below the income poverty

line ($Y_i < Z$) and their asset level are also below the asset poverty line ($API_i < \bar{A}$). It is also noticed that households who are poor in their realized income ($Y_i < Z$) but have an asset level above the asset poverty line ($API_i > \bar{A}$) are defined as stochastically poor. They are situated at point A.

It is also possible for a household to be monetary non-poor ($Y_i > Z$) but asset-poor ($API_i < \bar{A}$). These households are stochastic non-poor and are located at point B. This holds in many cases of rural households proximate to towns in Ethiopia. They earn better income as they engaged in wage labor in nearby towns and rent out lands. It is widely acknowledged that wage income is one of the diversified strategies most rural households pursued to escape poverty. Participation of the poor in different casual work in times of peak land preparation or harvest times, temporary migratory jobs in domestic help, construction, and mining, and any jobs in the lower end of the quality spectrum play the biggest role in their daily struggle. However, incomes are cyclical and susceptible to risks. Therefore, these households can experience a stochastic transition into poverty (shift from point B to D). Finally, households positioned at point C are structurally non-poor households. They are neither money-metric ($Y_i > Z$) nor asset ($API_i > \bar{A}$) poor. It is also possible that households at point A experience changeover into point C due to high return to assets or new asset accumulations and become non-poor. This process is known as a stochastic transition out of poverty. In contrast, the households may experience a structural transition into poverty (a shift into point D from C) due to income and asset losses. When households shift from point C to D because of asset accumulation and enhanced asset returns, they experienced structural upward mobility (Dutta, 2021).

3.3. Methodology

3.3.1. Data

The study uses the three rounds of the ESS data (2011/12 - 2015/16) conducted by the CSA in collaboration with the World Bank LSMS-ISA. The first wave covered only rural and small-towns while expanding to urban areas in the subsequent waves. It is a rich multitopic data set consisting of detailed information on living conditions, demographics, income, expenditure, occupation, health, education, production, asset holding, saving, and other individual and level variables. The community data includes community services, social networks, mobility, religious practices, land use, access to roads, markets, transport, development interventions, and business activities. It also comprises geo-referenced variables, livestock, crop production,

post-harvest analysis, and post-planning. The sample was drawn using two-stage stratified sampling procedures (CSA and World Bank, 2017). Given the objectives of this study, we restricted our analysis to a nationally representative final balanced sample of 2170 rural households.

3.3.2. Shocks and resilience measures

Shocks are reported in response to whether the household is affected in the 12 months of the survey year. The covariate shocks include drought, heavy rain, flood, conflict, input price hikes, displacement for government projects, and fire. The idiosyncratic shocks entail death, illness, livestock loss, crop damage, theft, loss of non-farm jobs, and loss of a house or farm. These variables are taken as dichotomous. However, production shock is aggregated from incidences of crop damage and livestock loss. The household-level shock module also responds to the incidence of input price, food price hikes, and food price declines combined as price shocks.

RCI is computed with two stages of PCA and TT. PCA is employed to measure each resilience attribute taking variables driven on an ad-hoc basis. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy is more than 0.60. In the second stage, we employed the TT machine learning technique to compute RCI using the latent attributes following Gorst-rasmussen (2012). In measuring the latent pillars, observable variable selection is based on the factor loadings. Once each latent pillar is estimated, they are used as covariates in the construction of the RCI. Machine learning is a rapidly emerging analytical approach that attempts to build statistical models from data and make accurate predictions and decisions. TT is an unobserved type of machine learning employed for data reduction that merges hierarchical clustering with PCA.

3.3.3. Structural and stochastic poverty measures

This paper adopted the framework proposed by Bader et al. (2016) to compute structural and stochastic poverty by contrasting money-metric and asset measures. In a nutshell, households that are income poor and lack the required assets to convert into income requirements are structurally poor. In contrast, if they obtain a level of income below the income poverty line but their asset-based expected level of income is above the asset poverty line, we identify those households as stochastically poor. Households who were non-poor by the money-metric approach but asset poor are stochastically non-poor. However, those who were neither monetary nor asset poor are structurally non-poor (Dutta, 2021; Dutta and Kumar, 2015).

The monetary and asset poverty measures were computed as follows. Identification of the monetary poor entails choosing a welfare indicator, establishing a poverty line, and aggregating poverty data. Consumption expenditure is used since it better captures long-run welfare, reflects a household's ability to meet their basic needs, and captures households' capabilities (World Bank, 2018). We draw the poverty line using the Cost of Basic Needs approach. Foster et al. (1984) are employed to measure monetary poverty. Let the household consumption expenditure (Y_i) is ranked as:

$$Y_1 \leq Y_2 \ldots\ldots\ldots Y_q \leq \mathrm{Z} < Y_{q+1} \ldots\ldots\ldots Y_N$$

Where Z > 0 is the poverty line. The households with $Y_i <$ Z are considered to be poor. The number of poor households is q. The cost of eliminating poverty of the ith poor household is $Z - Y_i$. P_α is the poverty measure and α is the poverty aversion parameter. The FGT family of monetary poverty for N number of households is specified as:

$$P_\alpha = \frac{1}{N}\sum_{i=1}^{q}\left(\frac{Z - Y_i}{Z}\right)^\alpha ;\ \alpha \geq 0$$

For $\alpha = 0$, P_0 equals the headcount, which accounts for the incidence of poverty. When $\alpha = 1$, P_1 is the poverty gap that refers to the minimum cost of eliminating poverty. For $\alpha = 2$, P_2 accounts for poverty severity (Martin Ravallion, 2016).

The asset poverty index is computed with PCA using a total of 41 assets: 6 dwelling characteristics, 31 household durables, and 4 household means of production. Variables with low standard deviations or an asset that all households own or no one own that would exhibit no variation between households and would be zero weighted that would carry a low weight from the PCA were excluded.

Application of PCA yields a series of components with the first component explaining the largest variance in the data. We pooled assets across the three waves, obtained scoring factors, means, and standard deviations for the pooled data, and used the estimates to calculate period-specific asset indices. Since the data is not standardized, we ran the correlation matrix analysis to ensure that all data have equal weight. The number of principal components is extracted by selecting components where the associated Eigenvalue is greater than one. We generated the index as:

$$API_j = \sum \frac{F_i(X_{ji} - X_i)}{S_i}$$

Where API_j is the value of the j[th] household's asset poverty index obtained, F_i is the weight for the i[th] variable, X_{ji} refers to the value of the i[th] variable for the j[th] household, and X_i and σ_i are the mean and standard deviation of the i[th] variable of the sample households. We identify the asset poverty line corresponding to a 40% headcount of monetary poverty at the population level.

3.3.4. Empirical strategy

3.3.4.1. Fixed effect multinomial logit model

Since poverty in integrated modeling is represented by four mutually exclusive categories - structural non-poor, stochastic poor, stochastic non-poor, and structural poor – we can employ a discrete choice model. Rabe-Hesketh and Skrondal (2012) suggest pooled multinomial (ignoring individual heterogeneity) and multinomial probit with random effects. In both cases, one must assume that any unobserved heterogeneity is independent of the observed covariates. The possibility to control for unobserved heterogeneity and relaxed independence of irrelevant alternatives (IIA) assumption makes the fixed effect multinomial logit the most acclamatory approach (Glick and Sahn, 2005). We estimate the fixed effect multinomial logit model, to analyze the linkage between shocks, structural and stochastic poverty, and resilience in rural Ethiopia.

Assuming $i = 1, \ldots\ldots, \mathrm{N}$ sample of households with observations across time $t = 1, \ldots\ldots, \mathrm{T_i}$, the outcome variable o_j with $j = 1, \ldots\ldots, \mathrm{J}$ is a categorical variable with J levels for all individuals and observation times. The values of the outcome levels are unrestricted: $\forall_j$: $o_j \in \mathbb{R}$. For each household *i* and each time *t*, the outcome y_{it} is measured as structural and stochastic poverty transitions and a vector of M covariates $x_{it} = x_{it1}, \ldots\ldots x_{itM}$. We also defined y^*_{itj} as the latent propensity for each household *i* at time *t* to choose outcome *j*. Therefore, the relation between the propensities y^*_{itj} and covariates x_{it} would be:

$$\forall_j \in \{1, \ldots\ldots J\}: y^*_{itj} = \alpha_{ij} + x_{it}\beta_j + \varepsilon_{itj},$$

where β_j is the coefficient vector, α_{ij} is a random variable, ε_{itj} is a random variable across all outcomes j. The link to the chosen outcome is defined by:

$$\forall_j \in \{1, \dots \dots J\}: \Pr(y_{it} = o_j/\alpha_i, \beta, x_{it}) = \Pr\left(\max_{k \in (1,\dots\dots J)} y^*_{itk} = y^*_{itj}/\alpha_i, \beta, x_{it}\right)$$

An arbitrarily chosen outcome $B \in \{1, \dots \dots, J\}$ is defined as the base outcome, and the respective coefficients are restricted to zero: $\alpha_{iB} = 0, \beta_B = 0$. Taking the above assumptions into account, the probabilities of each outcome can be derived.

$$Pr\,(y_{it} = o_j |\, \alpha_i, \beta, x_{it}) = \begin{cases} \frac{\exp(\alpha_{ij} + x_{it}\beta_j)}{1 + \sum_{k \neq B} \exp(\alpha_{ij} + x_{it}\beta_j)} j \neq B \\ \frac{1}{1 + \sum_{k \neq B} \exp(\alpha_{ij} + x_{it}\beta_j)} j = B \end{cases},$$

This model is preferable as it allows for individual unobserved heterogeneity concerning the intercepts. This indicates that the terms of heterogeneity α_{ij} are random variables having no restrictions on the joint distribution with covariates x_{it}. Since directly estimating the individual α_{ij} leads to incidental parameter problems, additional assumptions are needed to consistently estimate the coefficient vector β. The assumptions include the observed covariates are strictly exogenous conditional on the unobserved heterogeneity and the error terms are independent across time:

$$\forall_t \in \{1, \dots \dots, \mathrm{T_i}\}, j \in \{1, \dots \dots, \mathrm{J}\}: f_{y_{it}|\alpha_{ij}, x_i} \equiv f_{y_{it}|\alpha_{ij}, x_1, \dots\dots, x_{Jt}} = f_{y_{it}|\alpha_{ij}, x_t}$$

and

$$\forall_{s,t} \in \{1, \dots \dots, \mathrm{T_i}\}, \forall_j \in \{1, \dots \dots, \mathrm{J}\}: \varepsilon_{isj} \perp \varepsilon_{itj}$$

Taking into account the aforementioned assumptions, the probability mass function for the sequence of chosen outcomes across time for individual i conditional on the sufficient statistic is written as:

$$f_{y_i|\alpha_i, \beta, x_i, \theta_i} = \frac{exp\left(\sum_{t=1}^{T_i} \sum_{j=1, j\neq 1}^{J} \delta_{y_{it}, o_j} X_{it}\beta_j\right)}{\sum_{v_i \in \Upsilon_i} exp\left(\sum_{t=1}^{T_i} \sum_{j=1, j\neq 1}^{J} \delta_{y_{it}, o_j} X_{it}\beta_j\right)}$$

The log-likelihood function of the fixed effects multinomial logit model, according to Pforr (2014), is expressed as:

$$\ln l_i\,(\beta | y_i, x_i) = \sum_{t=1}^{Ti} \sum_{j=1, j\neq\beta}^{J} \delta_{y_{it} o_j} x_{it}\beta_j - \ln \sum_{V_i \in \Upsilon_i} \exp\left(\sum_{t=1}^{Ti} \sum_{j=1, j\neq\beta}^{J} \delta_{y_{it} o_j} x_{it}\beta_j\right)$$

Hence, the overall log-likelihood function for the sample is specified as:

$$\ln \mathrm{L}\,(\beta|y,x) = \sum_{i=1}^{N} \ln\, l_i\,(\beta|y_i,x_i)$$

3.3.4.2. Cox proportional-hazards model

Cox proportional hazards proposed by Cox (1972) is one of the most widely used models in analyzing survival data, which is used to relate several risk factors, considered simultaneously, to survival time. This study is applied to estimate the effect of covariates on the probability of poverty descent within a given time t. In Cox proportional hazard model, the measure of the effect is hazard rate, which is the risk of failure.

The hazard function for a household with a particular set of covariates z is assumed to be

$$h(t) = h_0\, h(t) e^{\frac{Z}{\beta}}$$

Where h_0(t) is an arbitrary and unspecified baseline hazard function and Z is a vector of covariates for each household, and β is the vector of unknown regression parameters we wish to estimate, assumed to be the same for all.

The hazard ratio or relative risk, in the proportional hazards model, of an entry from poverty at any time t is

$$\frac{h(t,Z)}{h_0(t)} = \frac{e^{\frac{-Z}{\beta}}}{e^{\frac{-Z}{\beta}}}$$

The associated survival function is

$$S(t,Z) = S_0\,(t)\, e^{\frac{-Z}{\beta}}$$

Where $S_0\,(t)$ is the baseline survivor function associated with $h_0(t)$, we assume that entering poverty is a function of various demographic and socioeconomic characteristics. These covariates were associated with the probability of entering or exiting poverty by a given time t.

3.4. Result and discussion

3.4.1. Structural and stochastic poverty profiling

Table 3.1 exhibits the changes in constituent groups over time.Accordingly, the stochastically poor experienced exacerbations by 1.4% between 2011/12 and 2013/14 and by 0.39% between 2011/12 and 2015/16. Besides, structural poverty was provoked by 4.33% and 3.8% in the same period. It is due to endowment shock or entitlement failure deteriorating assets. As a result, they could no longer generate enough income to be affluent. Both households would be observed as transitory poor. Numerous households have gained entitlement windfall but still lack the asset to generate plentiful income to be non-poor. However, 1.01% and 0.53% of households experienced stochastic and structural upward mobility between 2011/12 and 2013/14. Likewise, the extent of stochastic non-poor deteriorated by 5.73% and 5.65% between 2013/14 - 2015/16 and 2011/12 - 2015/16. Finally, a large proportion of non-poor is created by 1.45%, 3.61%, and 5.06% in successive rounds.

Table 3.1: Temporal distributions

				Change rate Δ (%)		
	2011/14	2013/14	2015/16	A	B	C
Structural non-poor	35.19	35.27	29.54	0.08	-5.73	-5.65
Stochastic poor	33.54	32.53	33.93	-1.01	1.4	0.39
Stochastic non-poor	31.16	32.61	36.22	1.45	3.61	5.06
Structural poor	32.24	31.71	36.04	-0.53	4.33	3.8

Note: A = 201 1/12 – 2013/14, B = 2013/14 – 2015/16, and C = 2011/12 – 2015/16

Table 3.2 present the spatial patterns of structural and stochastic poverty in Ethiopia. The incidence of structural and stochastic poverty varies regionally. The loci of structurally and stochastically poor appear to be concentrated in SNNP and Amhara where more than 60% of the smallholders were poor. The non-poor in these regions were even more vulnerable to poverty due to more recurrence and concurrence of shocks and the least likely to have resources to cope when shocks happened, lack of productive assets, poor infrastructure, and inadequate social services (Planning and Development Commission, 2018). However, Tigray and Other are the least structural and stochastic poor regions. Oromia, SNNP, and Others were regions having the highest structurally and stochastically non-poor households.

Table 3.2: Spatial distributions

	Tigray	Amhara	Oromia	SNNP	Others	Total
Structural non-poor	13.5	19.0	24.9	20.1	22.5	34.1
Stochastic poor	8.6	31.2	14.8	30.4	14.9	25.1
Stochastic non-poor	13.6	18.8	21.9	22.8	22.7	22.2
Structural poor	8.04	28.3	15.8	34.9	12.9	18.6
Total	11.3	23.7	20.03	26.1	18.8	100

3.4.2. Structural and stochastic poverty trajectories and transitions

Figure 3.2 depicts a segment of the population poverty trajectories[10] and the share per trajectory. Nearly 40% (structurally) and 33.26% (stochastically) of households are either impoverished or transitory escapers. This implied that many households churn around the poverty line. Given high vulnerability to shocks, the rates at which rural households experienced descents or impoverishment greatly outweigh the sustained escapes consistent with Diwakar and Shepherd (2018). A large share of households remains out of structural than stochastic poverty over time in the face of shocks. All the different flow configurations also produce only 2.23% and 0.27% in the stock of chronic structural and stochastic poverty.

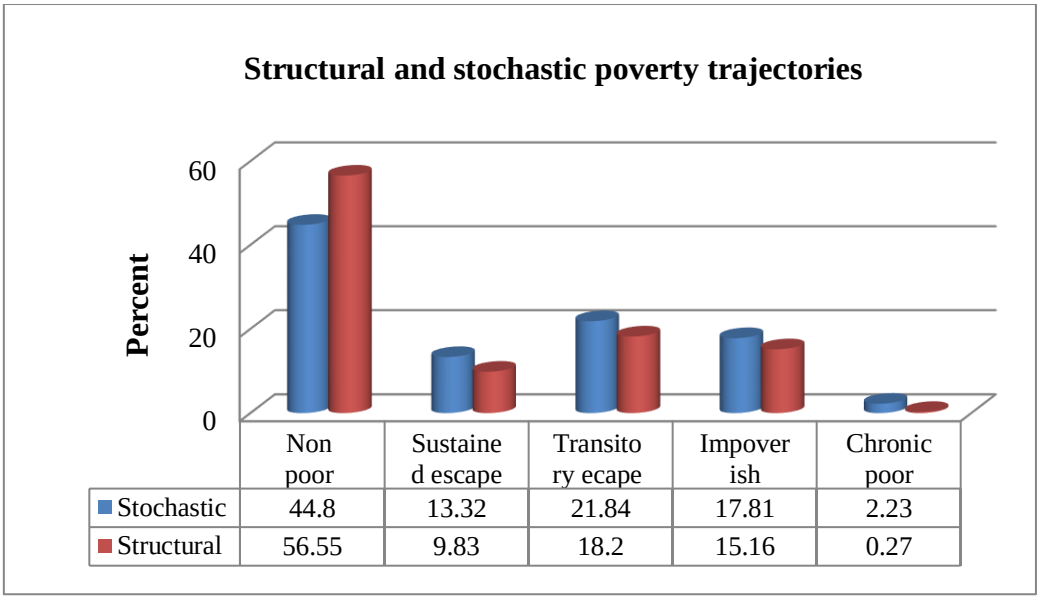


Figure 3.2: Poverty trajectories

[10]Sustained escape exists when households remain out of poverty over time, even in the face of shocks. When households used to live in poverty succeeded in escaping and then subsequently fell back into it, transitory escape exists. Impoverishment implies a household evolves poorer. Chronic poverty is a long-term problem that persists over many years. A household that ultimately avoids impoverishment or transitory escape is non-poor (Diwakar and Shepherd, 2018).

The transition matrices show that poverty is constantly reinvigorated by two opposite and concurrent streams flowing in parallel (Table 3.3). There is also a certain degree of persistence. Out of the total poor in 2011/12, 3.72% and 7.14% of the people remained structural and stochastic poor in 6.83% and 4.18% 2015/16. A better story emerges when we observe the comovements of the poor and non-poor. Upward movements were widely stochastic. A large share of households (13.28%) experienced escape from stochastic poverty, while 10.63% escaped structural poverty. Of the households experiencing descents, 15.16% were due to stochastic transitions, while over 18.04% were structural transitions. These results on the upheaval into and out of poverty show net progress of 3.8% and 0.39% in reducing structural and stochastic poverty in Ethiopia (see Table 4.1). Among the dual entitlement failure, we find out that 6.83% were structurally poor, and about 4.18% of the twice-poor households were structurally poor.

Table 3.3: Transition matrices

Structural					
		2015/16			
		Poor		Non-poor	
2011/12	Poor	Twice poor	(6.83)	Upward mobile	(10.63)
	Non-poor	Downward mobile	(18.04)	Twice non-poor	(64.49)
	Total		(24.87)		(75.12)
Stochastic					
		Poor		Non-poor	
2011/12	Poor	Twice poor	(4.18)	Upward mobile	(13.28)
	Non-poor	Downward mobile	(15.16)	Twice non-poor	(67.37)
	Total		(19.34)		(80.65)

3.4.3. Descriptive statistics

Table 3.4 presents descriptive statistics of household characteristics and poverty transitions. The structurally and stochastically non-poor consist of 67.37% and 57.62% of the population. Generally, the non-poor encountered modest shock exposure. Price shocks were experienced by 0.047% of the structurally non-poor, and only 0.037% of stochastic non-poor are affected by production shocks. They have also mere risks of idiosyncratic and other covariate shocks. Other notable features include better market orientation, literacy, and proximity to the market and towns. They are also more likely to participate in wage labor and the non-farm economy. They possessed more nuanced access to irrigation corroborating rural Kenya (Radeny, 2012).

A smaller proportion of households moved up structurally (13.28%) and stochastically (17.5%). These groups experienced an improvement in the asset dimensions. Their attributes

and capacities are markedly better than other poverty trajectories. Literacy, size of households, and age of the household head are the highest while female heads are the least possible proportions for the upward mobiles. Other prominent features encompass better-skilled off-farm workers, land resources, and access to irrigation. Nevertheless, the upward mobiles are less stricken by covariate and idiosyncratic shocks.

The structurally and stochastically downward mobiles consist of 16.15% and 17.81%. They are peculiar with the lowest financial and physical capital, commercialization, literacy, and economically non-active members next to their poor counterparts. More than a quarter (28.1% and 28.4%) of households in this mobility group generates income from non-farm economic activities.

The dual entitlement failure accounting for 4.18% (structural) and 7.06% (stochastic) are characterized by an inadequate endowment base. The size of cultivated land is entirely low. Wealth represented by livestock indicates similar trends (3.707 and 4.651 TLUs). The average incomes, respectively, are 6408 ETB and 7086 ETB. The ability to escape structural and stochastic poverty is deterred by drought, production, and marketing shocks and numbers of other covariate and idiosyncratic shocks. Shock accompanied by weak conversion factors exacerbates poverty perseverance (Diwakar and Shepherd, 2018). In addition, these households are less connected to towns and markets that are meaningful hubs to engage in economic transactions. As a result, they meagrely engage in wage labour and the non-farm economy. Inadequate access to irrigation and poor market orientation are also important caveats to their welfare.

Table 3.4: Descriptive statistics

	Structurally					Stochastically				
	NP (N = 1454)	UM (N =289)	DM (N =352)	P (N = 91)	test statistics	NP (N = 1250)	UM (N = 380)	DM (N =386)	P (N =154)	test statistics
Attributes and capacities										
Age of the household head	46.37	48.56	46.06	45.04	3.609	46.79	45.78	47.07	45.34	13.04***
Household size	5.045	5.491	5.569	5.651	7.286***	4.936	5.357	5.599	6.092	1.292
Female-headed (Yes = 1)	0.234	0.257	0.215	0.275	2.112	0.264	0.177	0.217	0.195	15.86***
Education (Literate = 1)	0.343	0.297	0.296	0.247	2.722	0.369	0.263	0.286	0.233	10.28**
Resource base										
Income (Ethiopian Birr)	9091	6900	7048	6408	502.3***	8939	8614	6843	7086	538.63***
Land (hectare)	0.396	0.536	0.485	0.386	0.150***	0.381	0.611	0.396	0.437	0.1000***
Livestock-owned (TLU)	5.089	3.863	5.126	3.707	90.59***	5.047	4.736	4.539	4.651	54.85***
Oxen for plow (#)	0.947	0.843	0.924	0.715	2.810	0.950	0.868	0.840	1.000	41.81***
Farm plots (#)	8.695	8.982	9.448	9.091	11.52***	8.652	8.006	9.340	9.364	2.660
Skilled non-farm workers (#)	0.889	0.794	0.739	0.772	10.58**	0.809	0.903	0.603	0.597	46.17***
Household activities										
Commercialization index	13.71	12.80	7.692	9.549	40.62***	9.956	7.014	12.56	9.505	14.03***
Share of non-farm income (%)	0.297	0.264	0.281	0.264	0.639	0.274	0.258	0.284	0.206	1.995
Wage participation (Yes = 1)	0.115	0.101	0.103	0.064	13.31***	0.108	0.092	0.131	0.103	11.43**
Shocks										
Drought shock (Yes = 1)	0.151	0.166	0.203	0.179	9.106**	0.111	0.201	0.191	0.148	21.45***
Production shock (Yes = 1)	0.037	0.122	0.133	0.142	51.71***	0.181	0.235	0.245	0.188	11.63***
Price shock (Yes = 1)	0.047	0.125	0.122	0.131	32.25***	0.194	0.237	0.245	0.258	2.516
Other covariate shocks (#)	0.458	0.612	0.650	0.646	2.180	0.576	0.583	0.721	0.621	20.68***
Other idiosyncratic shocks (#)	0.322	0.315	0.377	0.495	13.46***	0.327	0.357	0.338	0.364	2.591
Others										
Credit (Yes = 1)	0.234	0.208	0.298	0.174	8.446***	0.212	0.291	0.234	0.320	12.23***
Distance to the market (Km)	66.85	78.40	74.37	90.04	9.738**	66.61	75.46	76.60	74.49	18.00***
Distance to the town (Km)	40.77	40.27	39.91	46.51	31.84***	40.89	39.55	42.74	38.42	33.70***
Irrigation (Yes = 1)	0.151	0.106	0.098	0.036	314.9***	0.157	0.160	0.135	0.120	106.48***

Note: NP = non poor, UM = upward mobile, DM = downward mobile, and P = poor

3.4.4. Econometric results

3.4.4.1. Resilience capacity and structural and stochastic poverty in presence of shocks and interaction effects

Table 3.5 presents the regression result for the effect of shocks on structural and stochastic poverty and the mediating role of resilience between shocks and stochastic structural poverty. The statistical test supports the fixed-effects multinomial logit model that loosens up assumptions of IIA. Rain-fed farming is often associated with a high risk of vulnerability to shocks (Hussain et al., 2020). Unequivocally, the country is a hotbed of prolific shocks. The finding also validated that structural and stochastic poverty is adversely affected by crippling rainfall variability, price, and production shocks. The plausible explanation for this is that shocks ultimately cause losses in incomes, crops, and livestock, a decline in consumption, social instability, and eventually obliterate households' asset gains (Dimitrova, 2021; Gebrechorkos et al., 2020).

The findings also revealed a sturdy positive impact of resilience capacity on eliminating structural and stochastic poverty. Enhancing resilience grows into a sustainable solution to eradicating structural and stochastically poverty. Resilience marks the ability of households to withstand and recover from shocks and maintain their welfare even in the face of shocks. Resilience matters for poverty reduction by verifying prior evidence (Haile et al., 2021). Equally important, NDVI dwindle poverty estimates for developing countries heavily dependent on agriculture. The result also confirmed the importance of better NDVI in reducing structural and stochastic poverty.

The interaction term between resilience capacity and shocks is negative and significant in poverty regardless of the measures. It indicates that the effect of resilience capacity on reducing structural and stochastic poverty might be higher as shocks escalated. Likewise, the coefficients on the interaction term between resilience and price, production, and idiosyncratic shocks are negative and statistically significant evidenced in support of the protective role of resilience capacity to shocks. Finally, the interaction term between resilience capacity and rainfall variability is negative and significant on stochastic non-poor. It implies that resilience protects the stochastic non-poor from asset depletion in the presence of numerous shocks.

Several other factors also affect structural and stochastic poverty. Of the demographic characteristics, some have a significant effect on structural and stochastic poverty relying on

experience and the relative strength of size economies against the diminishing return. The negative impact of household size elucidates more economically non-active members invariable with Dutta and Kumar (2015) and Tsehay and Bauer (2012). The household dependency burden also reveals a damaging effect on structural and stochastic poverty harmonious to Dutta (2021). As per our expectation, younger households (represented by age of the household head) are associated with lower structural and stochastic poverty while structural and stochastic poverty would gradually decrease as household heads get older (embodied in the square of the household head). Moreover, households headed by females appear to be associated with a higher level of structural poverty. In contrast, female headship is positively and significantly associated with the stochastic non-poor. Female-headed households and poverty linkages rely on the choice of measures. Specifically, poverty measures based on the assets indices show that female-headed are better-off. Stochastic non-poor are asset poor reflective of females' low level of empowerment and entitlement to valuable resources in rural Ethiopia.

The role of smallholder farming in supporting the welfare of rural households is nontrivial. Access to irrigation offers the key to improving rural livelihoods. The finding agrees with this proposition in that increasing access to irrigation curbs structural and stochastic poverty. Irrigators can maximize yields and household crop revenue validating Naylor and Burney (2012). It has also clearly witnessed a significant diversification of sources of income (Gebregziabher et al., 2009). On the other hand, literacy is associated with lower stochastic poverty as it opens up opportunities to create potential pathways for diversifying other non-farm economic activities consistent with (Dutta and Kumar, 2015).

The parameter estimates of the number of farm plots appear to be detrimental to the welfare of rural households. The number of farm plots which is customarily a proxy for land fragmentation (Postek et al., 2019) might go either way in affecting poverty as explained by the demand side (desired level of fragmentation by the farmer itself) and supply-driven (which is unnecessarily imposed by external factors). Commercialization is a widely acknowledged strategy most pursued to escape structural and stochastic poverty. Nevertheless, distance to the market has a substantial negative role in stochastic poverty. Though restricted to areas with good market access, proximate to towns, and low-wage survival jobs, better involvement in commercialization activities are crucial aspects of ownership asset protection and poverty reduction (Cazzuffi et al., 2020).

Table 3.5: Fixed-effect multinomial logit model estimates

	Stochastically poor		Stochastically non-poor		Structurally poor	
	Coef.	SE	Coef.	SE	Coef.	SE
Structurally non-poor	base outcome					
Age of the head	-0.0922***	0.022	-0.077***	0.018	-0.091***	0.023
Age squared of the head	0.0009***	0.0002	0.0009***	0.0002	0.0009***	0.0002
Female household head	-0.1886	0.132	0.5327***	0.109	0.3434**	0.152
Household size	0.4611***	0.051	0.0334	0.042	0.579***	0.056
Dependency ratio	0.1854**	0.074	0.0477	0.065	0.1397*	0.081
Education	-0.3882*	0.209	0.2787	0.170	-0.074	0.228
Commercialization index	-0.0505***	0.004	-0.009***	0.003	-0.035***	0.004
Irrigation	-0.4665***	0.121	-0.190**	0.095	-0.402***	0.137
Numbers of farm plots	-0.0617***	0.009	-0.019***	0.007	-0.037***	0.009
Distance to the market	-0.0481	0.034	-0.075**	0.034	-0.0444	0.034
Drought	1.1288	0.898	0.5107	0.595	1.144	1.005
Price shock	-0.9442	1.267	-1.472*	0.868	2.564*	1.527
Production shock	0.0099	1.199	1.1878	0.905	3.707**	1.452
Rainfall variability	0.4249	0.539	0.7385*	0.402	0.986	0.612
Idiosyncratic shocks	1.3650	0.835	0.247	0.573	0.4087	0.924
NDVI	-0.0067*	0.004	-0.006*	0.003	-0.008**	0.004
Resilience capacity	-25.66***	3.424	-0.569	2.177	-34.57***	3.855
Resilience * Price shock	3.1174	4.863	5.883*	3.212	-11.735*	6.067
Resilience * Drought	-4.3182	3.456	-1.3640	2.213	-4.3273	3.948
Resilience * Production shock	0.1713	4.636	-4.4864	3.410	-15.15***	5.774
Resilience * Rainfall variability	-1.8803	2.061	-2.6293*	1.510	-3.501	2.405
Resilience * Idiosyncratic shocks	-5.6464*	3.198	-1.1651	2.122	-1.654	3.600
Observations	6512		6512		6512	

Note: *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.10$

3.4.4.2. The effect of shocks on structural and stochastic poverty entry and exit

Sustained poverty reduction demands protecting downward tug and enhancing upward mobility. Both flow configurations are asymmetric in terms of reasons (Krishna, 2007). Table 3.6 depicts that escapes and descents are not responsive to the same reasons. Households fall into structural and stochastic poverty due to multiple sets of reasons. Corroborating the previous studies in other developing countries (Maganga et al., 2021; Ngoma et al., 2019; Letta et al., 2018; Wossen and Berger, 2015), the results show that climate-induced shocks such as rainfall variability and drought exacerbate structural and stochastic poverty entry. Poor households tend to live in flood-prone areas, and we also found that floods can heighten entry into structural and stochastic poverty consistent with Kawasaki et al. (2020). It is noticeable that this result may have emanated from the adverse effects of shocks on household welfare

through a decline in crop production, reduced education, labor market participation, and income. In its worst case, prolonged shocks appear to have lasting impacts on human capital, mental health, and cognitive potential (Alem and Tato, 2022; Dercon and Porter, 2014). Moreover, conflict is highly prevalent as a factor contributing to stochastic entry because they destabilize regions (Hirvonen et al., 2020).

Female headship is significant for both poverty outcomes, indicating that these groups experience a high probability of stochastic and structural poverty entry consistent with Bayudan-Dacuycuy and Lim (2013). Female-headed households in Ethiopia are meager in asset ownership, consumption, and the ability to cope with shocks.

In contrast, several factors protect entry into structural and stochastic poverty. Accordingly, resilience capacity significantly insulates structural and stochastic poverty descents. The higher the extent of resilience capacity, the more significant safety net, and cargo net effects. The lagged resilience capacity is also significant and implies last year's resilience being a sentinel of current downward mobility. Likewise, a household with literate heads is more likely and significantly hinders structural and stochastic poverty descents. Besides, households move into structural and stochastic poverty on account of access to irrigation because irrigation is vital for protecting large numbers of plunges by rising crop revenue and enhancing the rate of technology adoption (Zewdie et al., 2019).

Smallholder farming is the dominant source of income in rural Ethiopia. The situation is unlikely to continue as land pressure increases with population growth and smallholder farmers are impugned by shocks. We also found that an increase in the share of non-farm income has equal importance in protecting entry into structural poverty. The parameter estimate of NDVI revealed that vegetation covers strongly affect reducing structural and stochastic poverty entry. According to Zhang and Zhang (2019), high natural vegetation exhibited less sensitivity to drought and low poverty.

No single factor is associated with structural and stochastic poverty exit. Poor households escape poverty as a result of multiple sets of reasons. Resilience and its lagged values are essential pathways out of poverty. It is due to a mix of resource endowments, asset accumulation, and improving returns. Furthermore, literacy, irrigation, and the share of non-farm income play a decisive role in structural and stochastic poverty escapes. Well established in the literature, education augments sturdy exit effects in developing countries (Ngoma et al.,

2019; Dutta and Kumar, 2015). It facilitates the change from lower productivity and wage farming activities to higher productivity and wage non-farm activities. Better participation in the non-farm economy, in turn, enhances the structural poverty escapes substantiating Dutta (2021). Irrigation is also highly prevalent in contributing to structural poverty exits as it mitigates drought and effects on crop yields, income, and nutrition. The impact is far preeminent when households are literate and engaged in the market. The complementary role of irrigation, education, and proximity to the market holds in Ethiopia (Hanjra et al., 2009).

This study concedes how shocks inclusive of rainfall variability, drought, and flooding shocks markedly hinder poverty escapes as they erode smallholders' livelihood potential through the deterioration of productive assets (Hansen et al., 2019). Conflict also aggravates poverty by damaging infrastructure, destruction of assets, and breaking up the social fabric. The detrimental effects of early-life conflict on the physical and cognitive potential have also been reported (Martin-Shields and Stojetz, 2018). The results also show that price shock and other idiosyncratic shocks have a significant negative impact on stochastic exit. The finding complements the role of idiosyncratic shocks on a decline in per capita consumption and asset depletion (Alem and Söderbom, 2012; Davies, 2010). The input price hikes and food price inflation often threaten the ability to escape poverty (Hill and Porter, 2017).

Household size has an ambiguous role in poverty exit. The finding reveals that higher dependency burdens obstruct upward structural poverty mobility. In line with Dutta (2021), household size positively impacts stochastic poverty ascents rationalized by the existence of more economically active members. Besides, households headed by females are highly prevalent as a factor holding back stochastic poverty ascents. The coefficient of the age of the household head has hardly always amounted to escapes or descents of structural and stochastic poverty, with the incorporation of age as a human capital making no difference.

Table 3.6: Cox proportional hazard model estimates

	Structural entry		Structural exit		Stochastic entry		Stochastic exit	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Resilience capacity	-4.789***	0.625	2.477***	0.446	-3.294***	0.577	2.081***	0.487
Lag resilience capacity	-2.479***	0.587	1.622***	0.396	-1.860***	0.551	1.523***	0.414
Rainfall variability	0.006***	0.002	-0.005*	0.003	0.007***	0.002	-0.008***	0.003
Drought	0.0001**	0.0001	0.0001	0.0001	0.0001**	0.0001	0.0001	0.0001
Flooding	0.064***	0.019	-0.011	0.018	0.036*	0.018	-0.090**	0.044
Conflict	0.001	0.001	-0.085**	0.035	0.115***	0.036	0.013	0.029
Price shock	-0.075	0.063	0.017	0.028	-0.011	0.042	-0.184***	0.012
Idiosyncratic shocks	0.028	0.029	-0.069**	0.034	0.030	0.028	-0.340***	0.038
NDVI	-0.672***	0.055	-0.048	0.042	-0.565***	0.051	0.010	0.018
Age of household head	0.0001	0.001	0.0001	0.001	0.0001	0.001	0.001	0.001
Household size	0.015	0.013	-0.180***	0.011	0.0001	0.012	0.009***	0.001
Female household head	0.003**	0.001	-0.001	0.001	0.004***	0.001	-0.133***	0.036
Education	-0.095**	0.044	0.009***	0.001	0.0001	0.001	0.045	0.058
Share of non-farm income	-0.138***	0.037	0.119**	0.053	0.020	0.057	-0.001	0.001
Irrigation	-0.123***	0.039	0.093**	0.041	-0.076**	0.035	0.032	0.043
Observations	7,082		7,082		7,082		7,082	

Note: *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.10$

3.5. Concluding remarks

The general story that emerged from the analyses is one of the slight and uneven progresses of poverty reduction, witnessing exquisite structural gains and stochastic loss between the first two rounds and vice versa in the latter half. The reason why structural and stochastic poverty is not declining faster lies in the fact of pronounced reconfiguration of the poor by simultaneous ebbs and grows. Specifically, stochastically poor exhibit more likely sustained escapes while a colossal portion experiences transitory structural poverty escapes. Besides, the probability of descent and impoverishment outweighs these parallel and opposite flows.

The finding unambiguously underscores the detrimental effect of drought, price volatility, production loss, and other idiosyncratic and covariate shocks exacerbate structural and stochastic poverty. In contrast, the result concedes the deterring role of enhancing resilience capacity against structural and stochastic poverty conundrum. Resilience marks the ability of households to withstand and recover from shocks, and curb structural and stochastic poverty even in the face of shocks. Nevertheless, resilience is not the sole steadfast remedy. The results show that commercialization, irrigation, literacy, and human capital formation play important roles in reducing structural and stochastic poverty.

The poor are swiftly changing with the constituent groups traveling in opposite directions. The finding also answers questions of who is most at risk of falling and who has the best prospects of escaping from structural and stochastic poverty. Multiple linked factors propel asymmetric flows. Accordingly, resilience capacity, access to irrigation, literacy, normalized difference vegetation index, and non-farm activities constitute the most important reasons for influencing upward mobility and protecting decline into poverty. The last year's resilience capacity is also a good predictor of current structural and stochastic poverty. Furthermore, rainfall variability, drought, conflict, input and output price volatility, and several other covariates and idiosyncratic shocks came up as household stressors and acted to aggravate the falling tides of rural poor.

Several interventions that aim to mitigate shocks and enhance resilience are needed to fight against structural and stochastic poverty. There remains the potential for smallholder farming to be an integral part of poverty reduction. This potential is tapped through improving commercialization and public acquisition in irrigation, roads and marketing, and human capital formation. The role of irrigation is reinforced through complementary investments in the non-

farm economy. Nevertheless, the sector is fraught and is less sufficiently remunerative to lift households out of poverty. Therefore, rural revitalization emerges as the crucial option needed to pursue to reduce structural and stochastic poverty. Critical for policy uptake, promoting synergistic rural-urban linkages ensures a balanced mix of infrastructure development that would bolster the non-farm sector, commercialization, human capital, and livelihood diversification. Households choosing rural non-farm activities and out-migration as the fundamental livelihood strategy are more likely to escape from structural and stochastic poverty.

The empirical result also provides much-needed evidence substantiating state-of-the-art policies to encourage poverty reduction. Enhancing resilience reduces the adverse effects of shocks on structural and stochastic poverty. Recent thinking in the policy arena needs to shift away from preparing for and responding to shocks to ensure immediate needs to enhance resilience capacity to meet long-term objectives. Building resilience is required to be part of any pro-poor intervention.

A different set of reasons trigger poverty ascent and exacerbate descents. Policymaking to deal with structural and stochastic poverty has to build up a more comprehensive response. Interventions must also stay fresh with these changes for relevance and effectiveness. Unless we curtail the creation of new poverty, efforts to ascertain poverty escapes will ultimately be futile. It is preeminent to address both groups of reasons as they function within the country. Thus, targeting with a polycentric approach makes more headway than aggregate responses. Rain-fed farming's being less remunerative, vulnerability to shocks, illiteracy, and stagnant non-farm economic activities form a chain that leads to a cycle of subsistence and enduring structural and stochastic poverty in rural Ethiopia. Breaking the chain at any point of these links can help rescue many from falling into structural and stochastic poverty. Expansion of irrigation infrastructures, enhancing the rural non-farm economy, expanding employment opportunities, and investing in human capital lays a solid foundation for poverty to be removed without reversals.

Chapter 4: Food and Nutrition Security Impacts of Resilience Capacity: Evidence from Rural Ethiopia

Abstract

Resilience analysis framed on a twin-track approach of harmonizing humanitarian and development interventions is a nascent paradigm to food and nutrition security. This study contributes to the limited empirical literature that assesses the effect of resilience on food and nutrition insecurity modeled as separate variables for policy uptake in Ethiopia. The panel data comes from the Ethiopian Socioeconomic Survey. We estimated the resilience capacity index by combining factor analysis and structural equation modeling. The study employed kilocalories, food poverty, dietary diversity, food consumption, and multidimensional food security perspectives. Assets ownership, access to social services, and adaptive capacity are the core elements of resilience. We evidenced that resilience capacity enhanced food and nutrition security outcomes. Alternative food and nutrition insecurity measures complement but could not serve as a proxy to each other. The regression results revealed that resilience reduces household food and nutrition insecurity. Nevertheless, the food insecure possesses fewer resources, attributes, and farm assets face extreme poverty and thus benefit less from resilience. Complimentary food and nutrition insecurity measures give a more nuanced description and improve the targeting efficiency of interventions. Farming is no longer the merely or even the principal source of subsistence for many rural households. Issues that require more attention in policies to reinforce resilience capacities in ensuring food and nutrition security include fostering the rural non-farm economy, human capital formation, access to productive assets, and commercialization. Besides, the role of broader agri-food systems change is of utmost importance. Policy measures that enhance growth from below would also go a long way in building resilience for food and nutrition security and break the deeply entrenched cycle of subsistence and vulnerability of smallholder farming.

Keywords*: resilience, structural equation modeling, food insecurity, rural Ethiopia*

4.1. Introduction

Notwithstanding a continuing economic growth, Ethiopia's food and nutrition insecurity is an ever-growing challenge. The country began with food deficiency in the early 1970s. Exclusive of the regular safety nets beneficiaries, an average of 10% of the people annually need emergency food assistance (Domenech et al., 2019). Recently, 3.3 million extra people were in an urgent situation or worse (FAO, 2021). On the other hand, more than 30% of the households consume below the minimum daily nutritional requirements. One out of four is also food poor, signifying that they failed to cover the cost of the recommended daily calorie requirements (WFP and CSA, 2019). The prevalence of child malnutrition is also persistently high. Nearly 6 million children under five years of age are stunted (EPHI and ICF, 2021). Malnutrition impaired cognitive potential and drives enormously to perpetuate the vicious

cycle of poverty and underdevelopment (Martorell and Zongrone, 2012). The problem is more salient in rural areas (Seff et al., 2018; Souza and Jolliffe, 2016).

Conceptions and complex causes, on the one hand, the dynamics and the irrelevance of national strategies, on the other hand, make food and nutrition security arduous goals in Ethiopia. The concept of food insecurity has witnessed a clear evolution. The earlier supply-side view is synonymous with food availability decline (Shaw, 2007). It reflects insufficient dietary energy intake. However, the approach is criticized for its inability to explain entitlement failure (Sen, 1981). The entitlement approach adds physical and economic dimensions to food insecurity. The demand side scrutiny is closely related to food poverty. Entitlement to food, hitherto, fails to guarantee a nutritionally sound diet. Thus, food utilization emphasized micronutrient deficiencies, food safety, and socio-cultural acceptability added as a new dimension. Food security also requires stability in that neither shock nor cyclical events disrupt availability, access, and utilization. A nuanced meaning is given at the 1996 World Food Summit " a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life." Researchers' inclination toward different measures constrained the efficiency of the design and delivery of food security policies.

Food insecurity emanated from complex webs of availability, access, and utilization failures. However, dependence on natural resources often puts farmers at the mercy of shock in Ethiopia. Rural households suffered from many shocks, such as climate-induced (Hirvonen et al., 2020) and price-related (Hill and Porter, 2017). These shocks often jeopardize the livelihoods of many people. In its worst case, prolonged and severe drought subdue the cognitive potential (Baloch and Behrman, 2016) and environmental degradation (Gebremeskel et al., 2019). Other prevailing shocks, such as health-related (Gebremariam and Tesfaye, 2018) and conflicts (Weldeegzie, 2017), lead to increased risks of social instability. The recurrence and concurrence of these shocks enormously whipped out livelihood resources and ability to recover and exacerbate food and nutrition insecurity (Campos et al., 2014).

Food insecurity is inherently dynamic. Households experience an asymmetric flow of ascents and descents that constantly refresh the stock of food insecurity. Impoverishment and re-entry profoundly damage rural livelihoods in Ethiopia (Souza and Jolliffe, 2016). The long-term welfare levels attainable by food and nutrition insecure households depend not only on the severity but also the frequency of impoverishment. When people experience descent

repeatedly, they may find themselves in the vicious cycle of a food and nutrition insecurity trap and persistently reduced resilience capacity that underpins a downward spiral perpetuating food and nutrition insecurity.

Yet, the PSNP remain the core intervention to address food insecurity in Ethiopia. The empirics evidenced the short-term curative effects of the safety net from food and nutrition insecurity (WFP and CSA, 2019) and the need to complement it with interventions targeted at a rapid accumulation of physical and human capital (Hoddinott, and Taffesse, 2019). The redemptive nature of PSNP and the malign impact of shocks necessitate a more systematic and integrative approach. Thus, resilience analysis emerges as the value-added merit that integrates the safety net and cargo net policies (Hoddinott, 2014). Our view of resilience is guided by the interpretation, which stated resilience as "a capacity that ensures adverse stressors and shocks do not have long-lasting adverse development consequences" (Constas et al., 2014). It is grounded in the basic premise of cost-effectiveness to save lives and livelihood restorations (Venton, 2018). Resilience, therefore, is a set of capacities that enable households to effectively function in the face of shocks and stressors and meet food and nutrition security.

The savior role of resilience for food and nutrition insecurity is evidenced in many developing countries. They measure resilience as an indicator of food security than capacity (Melketo et al., 2021; Nahid et al., 2021; Tefera et al., 2017; Boukary et al., 2016). This set of studies did not disentangle resilience from food insecurity. Higher resilience is assumed to pinpoint better food security and suggest a direct food security intervention to enhance resilience. In contrast, others compute resilience vis-à-vis observed change in food security over time or change and return time before and aftershocks (Béné et al., 2016; Chamdimba et al., 2021; Upton et al., 2016). This approach suffers from a limitation of quantifying resilience. The policy suggestions also focused on targeted interventions on vulnerability to food insecurity. Lastly, a few studies used resilience as an outcome variable to predict food insecurity (Atara et al., 2020; D'Errico et al., 2018) and provide better quantitative analysis on their linkages.

Though the previous studies encourage operationalizing the concept of resilience as a policy aimed at food security, the discourse on food security and nutrition is still relatively vague and changing. A few drawbacks are also worth mentioning. Studies that treat resilience capacity, modeled separately from food and nutrition insecurity, are less documented. Besides, using a comprehensive food and nutrition security measure that incorporates all attributes captured in the standard definition or applying multiple approaches picking up different aspects of food

security remained a challenge. Therefore, this study examines the role of resilience capacity in food and nutrition insecurity employing complementary measures to extend the frontiers of knowledge of resilience for food insecurity. Multiple approaches are employed because of the absence one-best-fits-all approach. It also adopts a multidimensional approach capturing all aspects of food insecurity that contributes more effectively to design programs that better target those in need. This study also tests the hypothesis that resilience serves as a worth of protecting food security loss and fostering recovery. Where much of the households experience ascents and descents, understanding the role of resilience on food insecurity dynamics is vital.

The rest of this paper proceeds as follows. Section 4.2 presents the data description and methodological steps in measuring food and nutrition insecurity, resilience capacity, and empirical strategies. Section 4.3 profiles resilience capacity, shock exposure, food and nutrition insecurity, and the econometric results. Section 4.4 concludes and reflects on policy implications.

4.2. Materials and methods

4.2.1. Data description

We analyze data from three waves of the ESS collected by the CSA in collaboration with the LSMS-ISA. The multi-topic data is collected at the individual, household, and community levels. It encompasses demographics, education, health, labor, income and assistances, food consumption and expenditure, nonfood expenditure, food security, self-reported shocks, coping mechanisms, housing, assets, credit, and geospatial data.

The ESS employed a two-stage stratified sampling method (CSA and World Bank, 2017). The sample households are selected from the four most populous regions (Amhara, Tigray, SNNP, and Oromia) and Others merged as a single region of Ethiopia based on population proportional to size. While the typical usage of ESS data in the first wave has focused on rural and small-town areas, the sample expanded to urban areas in the subsequent waves. The data is collected from 3969, 3776, and 3699 households in consecutive waves. Considering the missing households, attrition, unmatched in all rounds, missing information on the variables of interest, and item non-response, the analysis is restricted to a final balanced sample of 2365 rural households in Ethiopia.

Some variables employed for constructing indices and used for empirical analyses need further descriptions. We estimated the self-sufficiency ratio using how much the household food

supply gained from products used for their consumption relative to total production. The gross value of all crop sales per household per year divided by the gross value of all crop production also gives the crop commercialization index. We also take the shock data from self-reports. Households were asked whether they have been affected by any of the seventeen shocks that led to an adverse loss of assets, caused their household income to fall substantially, or resulted in a significant reduction in consumption over the 12 months of the survey period. Shocks affecting all households in the village are covariates, while limited to the household levels are idiosyncratic (Constas et al., 2014).

4.2.2. Food and nutrition insecurity measures

4.2.2.1. Food energy intake (FEI) and per capita food expenditure (PFE)

FEI and PFE are measured using the CBN)approach following (Migotto et al., 2008). CBN entails defining the minimum nutritional requirements of an adult and determining a food basket that can provide this minimum requirement. The food consumption data were converted into kilocalories using the energy conversion factors of the Ethiopian Health and Nutrition Research Institute. FEI, therefore, is computed by dividing the weekly household kilocalorie consumption with an adult equivalent scale. An explicit bundle of the food items and weights required to provide the specified kilocalories threshold at the lowest cost under the prevailing prices alike gives PFE. It typically represents an expected cost of the predetermined daily per capita nutrition requirements consistent with popular diets in the specific context at a given income. The food insecurity disaggregation needed the Foster, Greer, and Thorbecke indices (Foster et al., 2010).

4.2.2.2. Dietary diversity score (DDS) and food consumption score (FCS)

DDS refers to the ability to get adequate food to meet the nutritional requirements for a productive life. Validated for use by FAO (Kennedy and Ballard, 2010), DDS measures the extent to which the food consumption pattern brings disparities in nutrient intakes over time. It reflects both the quantity and quality of food access (Islam et al., 2018). The scores are generated using a simple count of 12 food groups (cereals, tubers, vegetables, fruits, meat, egg, fish, pulses, milk, oil, sugar, and others) consumed over a 7-days recall period. The score ranges from 0 to 12, inversely signifying the nutrient intakes and diversification of diets (Mekonnen et al., 2020). The DDS take the forms of ordered terciles: low (0–4), medium ($5 < DDS \leq 8$), and high ($DDS > 8$), following Ukegbu and Ogu (2017).

We computed FCS as described in the World Food Program (WFP) vulnerability analysis and mapping (WFP VAM, 2008). FCS integrates dietary diversity, food frequency, and nutritional importance of 8 food groups. The FCS represents food access and dietary adequacy generated from a weighted sum of consumed food groups and frequency of consumption over the 7 days recall period. The scores take the form of ordered polytomous categories: poor (0–21), borderline (21.5–35), and acceptable (>35), using WFP's predetermined thresholds points.

4.2.2.3. Multidimensional food insecurity index (MFII)

We employed a TT machine learning technique to construct MFII. Machine learning is a rapidly emerging analytical approach that attempts to build statistical models from data and make accurate predictions and decisions. TT merges hierarchical clustering with PCA as proposed by Gorst-rasmussen (2012). The variables used for the computation are multidimensional and redundant, while their order does not have significant meaning. TT yields a series of components and the first component is taken as the principal component so that serves as weights for index construction. What makes it more preferable is the optimality property of defining as much variation in the original data using few dimensions and simplistic interpretation. TT leads to sparse components and an associated cluster tree that provides a concise visual representation of loading sparsity patterns and the general dependency structure of the data. Due to the lack of a standardized threshold, we employed an arbitrary cutoff point of the lowest 40% of households into food insecure. Table 4.8 of the appendix depicts the variable used for index construction.

4.2.3. Resilience capacity index measures

Resilience for food security has witnessed a clear conceptual evolution. They emerged at a consensus on conceptualization, centered on absorptive, adaptive, and transformational capacities (FAO, 2016). Our understanding is guided by Constas et al. (2014), which stated resilience is "a capacity that ensures adverse stressors and shocks do not have long-lasting adverse development consequences". It implies that resilience is an intermediate variable that can predict food and nutrition security. Hence, if households are resilient, they can lessen food insecurity under shocks and stressors.

Rapidly emerging empirics attempt to provide metrics for RCI. They share commonalities in that resilience is a multidimensional latent variable. The RIMA-II method dominates the literature (Sibrian et al., 2021; D'Errico et al., 2018). A few regression-based approaches have

also been applied (Cissé and Barrett, 2018). This paper adopts the FAO RIMA-II (FAO, 2016) methodology to measure households' RCI. It is a two-stage process that simultaneously employs FA and regression to compute RCI and shows linkages between each pillar and resilience capacity and how each observed variable relates to its pillar. Firstly, the latent attributes are estimated through FA from observed variables. Secondly, the causal analytical model of Multiple Indicators Multiple Causes (MIMIC) predicts the latent RCI. RCI is standardized with minimum-maximum transformation. The latent variable and its causes and the indicators and latent variable are linearly related. The observables and food and nutrition insecurity indicators are the achievement targets of RCI.

The MIMIC model, encompassing measurement and structural parts, is employed to test the hypothesized linkages between covariates and effects of resilience. Two food and nutrition insecurity measures (food poverty and dietary diversity scores) as an example are specified. The model is defined as follows:

$$\begin{bmatrix} Dietary\ diversity\ score \\ Food\ poverty \end{bmatrix} = [\Lambda_1, \Lambda_2] \times [RCI] + [\varepsilon_1, \varepsilon_2]$$

In the structural part, RCI is correlated with access to basic ABS, AST, AC, and SSN mathematically defined as:

$$[RCI] = [\beta_1, \beta_2] \times \begin{bmatrix} ABS \\ AST \\ AC \\ SSN \end{bmatrix} + [\varepsilon_1]$$

In the measurement part where the observed variables are considered as indicators of resilience capacity, the food and nutrition insecurity measures are modeled as follows:

$$Dietary\ diversity\ score = \Lambda_1\ RCI + \varepsilon_1$$
$$Food\ poverty = \Lambda_2\ RCI + \varepsilon_2$$

The latent RCI does not have any scale of measurement. Hence, a reference unit is defined so that the coefficient loading ($\Lambda 1$) of dietary diversity score equals 1. This implies that a unit change in the standard deviation of RCI brings a unit increment in the standard deviations of dietary diversity score. This also defines the unit of measurement ($\Lambda 2$) and variance of the remaining food and nutrition insecurity indicators. Figure 4.1 depicts the model for an example

with two food and nutrition insecurity measures. The pillars of resilience and the observed variables are defined in Table 4.9 of the appendix.

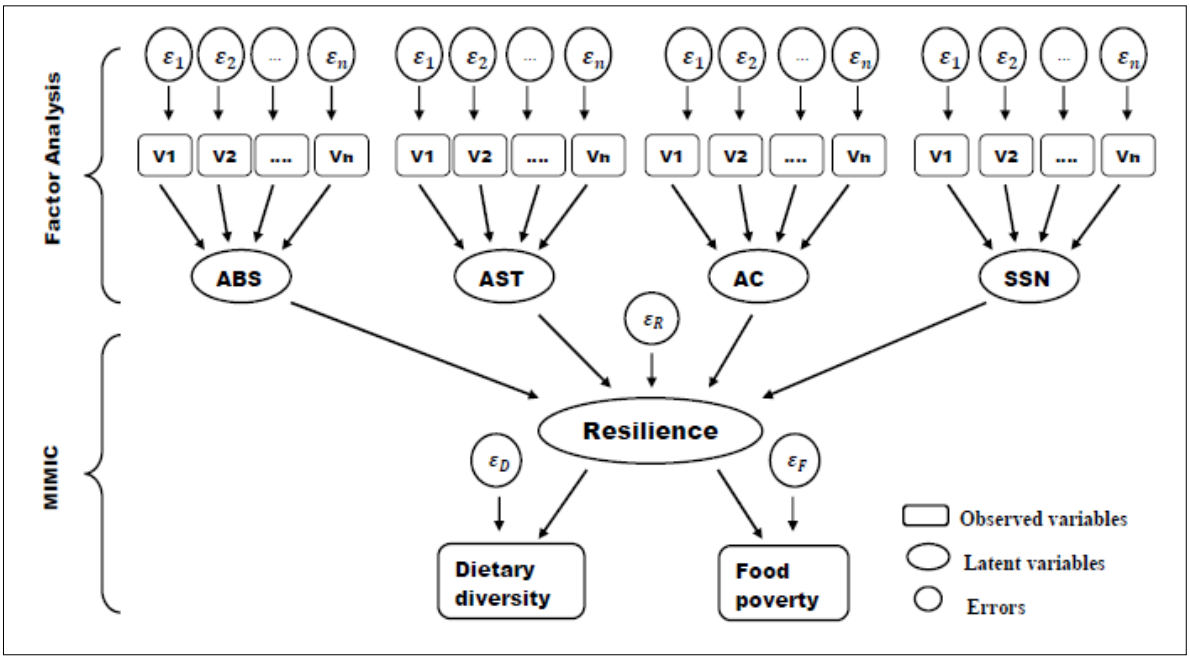


Figure 4.1: Resilience measurement strategies

4.2.4. Econometric strategies

4.2.4.1. Probit model

Households recovered from food and nutrition security loss after a shock is resilient. The assumption is that those with higher resilience capacity had a lower probability of loss and a higher likelihood of recovery. Two probit models are employed to examine the role of resilience capacity on food security loss and recovery. The analysis begins with selecting those who suffered food and nutrition security loss due to shocks. The second step entails isolating the role of resilience and other covariates of the bouncing back process of households who regain food and nutrition security. Building resilience capacity at time t-1 lower the likelihood of suffering a loss between t-1 and t and enhance the probability of recovery between t and t+1 of food and nutrition security. According to D'Errico et al. (2017), the probit model is specified as:

$$Prob\left(food\ and\ nutrition\ security\ loss_{t-1,t} = 1\right) = \Phi(RCI_{t-1}, S_{t-1}, X_{t-1})$$

Where Φ represents the cumulative density function that follows a normal distribution and the probability of suffering losses of food consumption expenditure and kilocalorie consumption between t-1 and t. RCI_{t-1} is the resilience capacity of households at time t-1. S_{t-1} and X_{t-1}

refer to the vectors of idiosyncratic and covariate shocks and household characteristics that affect food and nutrition security losses between t-1 and t.

Likewise, the likelihood of recovery of those households who registered food and nutrition security losses between time t-1 and t was singled out and examined by another probit model between t and t+1. The probability of recovery depends on a resilience capacity and the entire vector of household characteristics and shocks.

4.2.4.2. Multinomial logit model

Finding out reasons why food insecurity persists over time is central to food security dynamics. Assessment of multidimensional food insecurity dynamics requires an evaluation of the prevailing conditions of the population at different points in time. Therefore, we need to distinguish between drivers and interrupters of food insecurity.

The dependent variable is categorized into three: food insecurity status remained unchanged, those who moved from food secure to food insecure, and those who moved out of food insecurity between 2011/12 and 2015/16. Multinomial logit is a popular and most commonly applied model (Wulff, 2015). A multinomial logit model is estimated to assess drivers and interrupters of food insecurity. The base category is food insecurity status that remained unchanged and hence the estimated ascents and descents are relative to the base group. The probability P_{ij} that a household i is in a particular food insecurity status j is modeled as a function of resilience capacity and other covariates as follows:

$$P_{ij} = P_{ij} = \Pr(y_i = j|x_i) = \frac{\exp(x_i'\beta_j)}{1 + \sum_{j=1}^{2} \exp(x_i'\beta_j)}$$

Where $\beta_j$represents a vector of coefficients, β_0 is set to 0, and j can take the values of 0 (there has not been any change in the level of food insecurity), 1 (a household has moved into food insecurity), and 2 (those who moved out of food insecurity), and x is a vector of variables defining the characteristics of the household. $\beta_j$coefficients can be estimated using the maximum likelihood approach.

The odds ratios in the multinomial logit models are independent of other alternatives. The interpretation is done with marginal effects and is calculated as:

$$\frac{\partial p_j}{\partial x_i} = p_j \left[\beta_j - \sum_{k=1}^{j} p_k \beta_k \right] = p_j (\beta_j - \bar{\beta})$$

Where p is the probability, x is resilience capacity and other covariates, and β is a vector of coefficients. The marginal effect explains the effect that a unit changes in x_i has on the probability of food insecurity dynamics j of the household i, holding all other variables constant.

4.2.4.3. Generalized ordered logit model

The dependent variables (DDS and FCS) are treated as ordered categories: low/poor, medium/borderline, and high/acceptable, so, ordered discrete choice models are appropriate. What matters most in an ordered choice model is unobserved heterogeneity. The standard ordered probit model cannot account for unobserved heterogeneity, implying that the effects of associated coefficients are consistent across all categories. Similarly, the parallel assumption is a key constraint. Failing to consider this issue may cause biases in parameter estimations (Williams, 2016). Though multinomial logit is suggested, it requires the property of independence of irrelevant alternatives. A more efficient way to overcome limitations is to employ the generalized ordered logit model with the auto fit procedure. The linkage between RCI and DDS and FCS is expected to be positive. A higher RCI in time t-1 should be associated with higher DDS and FCS at time t. The generalized ordered logit model conforming to the specification is as follows:

$$P(Y_i > j) = g(X\beta_j) = \frac{exp(\alpha_j + X_i\beta_j)}{1 + \{exp(\alpha_j + X_i\beta_j)\}}, \quad j = 1, 2, \ldots, M - 1$$

Where j is DDS and FCS categories and α_j represents the cut-off point for the j^{th} cumulative logit. X_i is a vector of observed explanatory variables, β is a vector of parameters to be estimated, and M is the number of categories of the ordinal dependent variables. Since the dependent variable *Y* is ordinal, taking on the values 1, 2, ….., M, the generalized ordered logit model estimates a set of coefficients for each of the M - 1 points at which *Y* is dichotomized. The probabilities that *Y* will take on each of the values 2, ….., M is equal to:

$$Prob(Y_i = 1) = 1 - g(X_i\beta_1)$$
$$Prob(Y_i = j) = g(X_i\beta_{j-1}) - g(X_i\beta_1) \quad j = 2 \ldots M - 1$$
$$Prob(Y_i = m) = g(X_i\beta_{M-1})$$

The major problem with the ordered model is that its assumptions are violated. One or more β coefficients can be the same for all values of j, while others can differ. It is overly restrictive. The motivation for employing generalized ordered logit with an auto fit procedure is loosening of the proportional odds assumption. It fits the unconstrained model and then tests the Wald statistics on each explanatory variable. If the test is statistically insignificant for one or more variables, the variable with the least significant value is constrained to have equal effects across equations. A statistically insignificant value of a global Wald test shows that the final model does not violate the parallel-lines assumption (Williams, 2016).

4.3. Result and discussion

4.3.1. Resilience distribution

This section presents the spatiotemporal distribution of resilience capacities. Table 4.10 in the appendix reported the factor analysis results of the FAO-RIMA. Their eigenvalues show at least two components to be kept and explain over 60% of the variation. The spider diagram indicated that Oromia and SNNP regions score better (Figure 4.2). It is attributed to better durable assets, livelihood diversification, savings, and access to markets. Moreover, households in the most populated regions engaged in more income generation and have better literacy. They also have a better resource base and productive assets. In the context of shocks exposure, asset creation is a decisive contributor to RCI since it increases income and buffers themselves against shocks (Smith and Frankenberger, 2018). Better-off households have more durable assets and are likely to be more resilient.

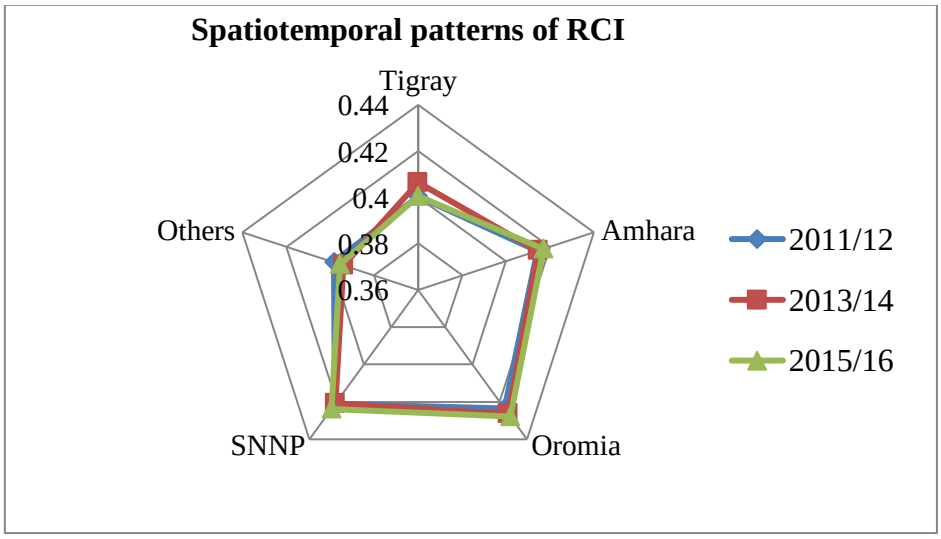


Figure 4.2: Spatiotemporal patterns of RCI

By contrast, Others score the lowest resilience capacity. The least resilience score is associated with low adaptive capacity, asset ownership, and access to social services. Households in this region show the worst access to social services and live in less proximity to all the most important services (Figure 4.3). They also have less diversified income sources and limited commercial orientation (Benti et al., 2022). Besides, the social safety nets in territorial regions areoverwhelmed with numerous challenges in terms of targeting efficiency and impact (Lind et al., 2018). This result is consistent with a high level of vulnerability to multidimensional poverty (10.45%) (OPHI, 2017).

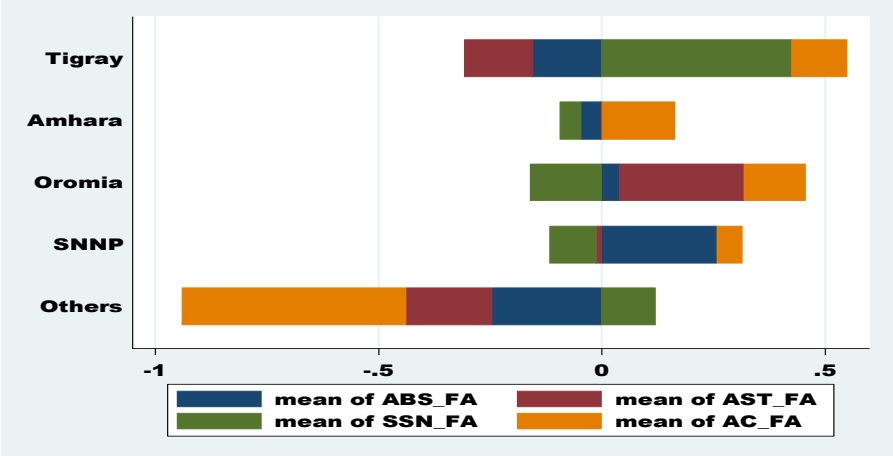


Figure 4.3: Regional distribution of resilience pillars

4.3.2. Shock exposure

Rural livelihood is often shaky due to recurrent shocks (Venton, 2018). Figure 4.4 portrayed the self-reported shocks exposure in the order of their severity. Price and climate-related shocks, and illness ranked as the most severe shocks. The price rise of food items, drought, illness, flooding, and input price hikes are reported by 18.43%, 18.27%, 15%, 12.19%, and 11.84% of the households. However, more than 60% of the sample households encountered at least one type of shock in the survey period.

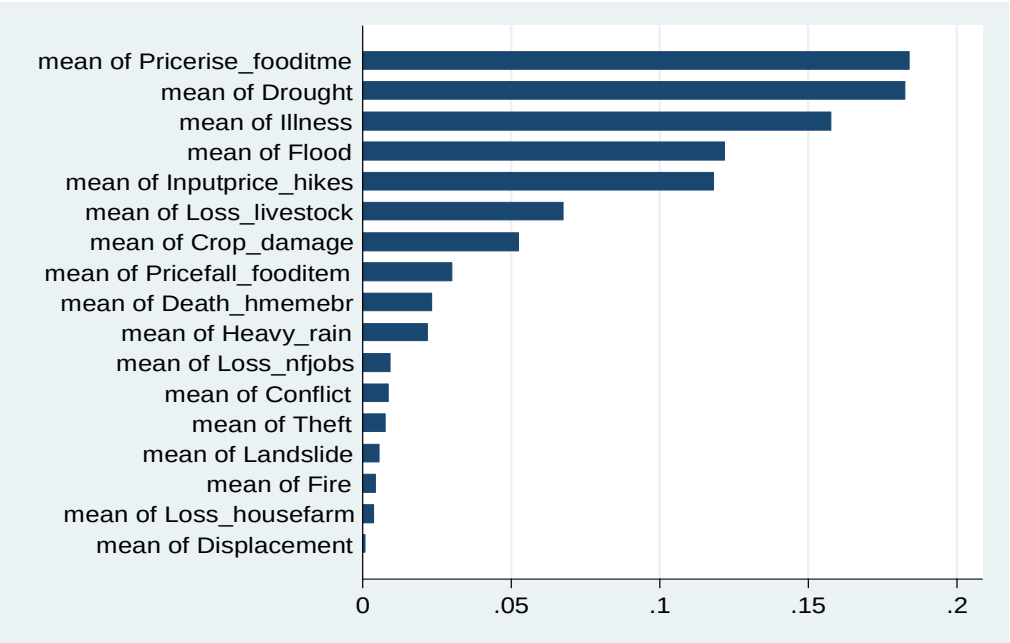


Figure 4.4: Self-reported shocks

Generally, rural households struck by shocks cost reduced income and consumption, destruction of assets, and jeopardizing their lives and livelihoods (Figure 4.5). Depicting the distribution of exposure of households to shocks is vital for understanding resilience capacities. The impacts exhibit heterogeneity across regions in Ethiopia (Mekuyie et al., 2018). Accordingly, the effect is more pronounced among Others, SNNP, and Oromia regions. The risk exposures to pastoral areas are disproportionally higher. Concurrence and recurrence of shocks markedly erode livelihood potential through deterioration of productive assets in the long run. Amhara and Tigray regions seem less vulnerable to all shocks.

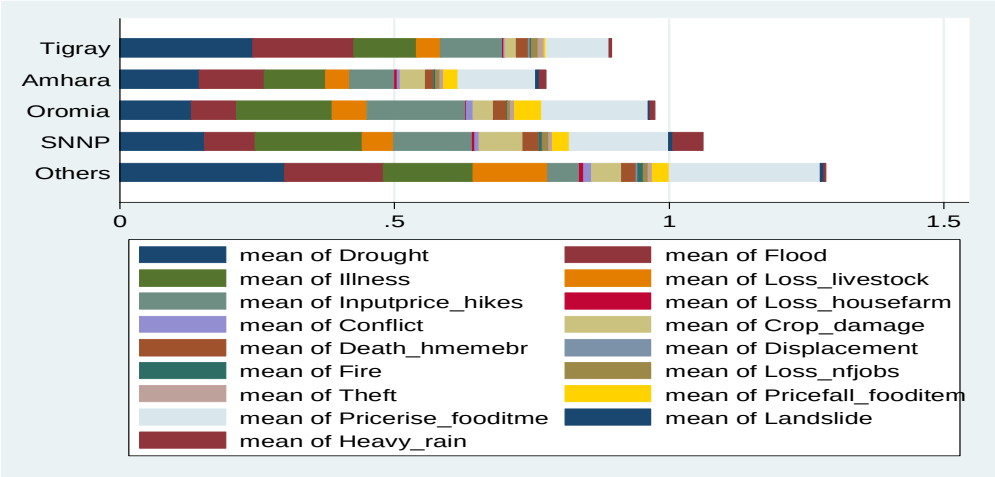


Figure 4.5: Regional distribution of shocks

4.3.3. Food and nutrition insecurity profile

4.3.3.1. Food energy intake and food poverty

This study employed a monthly food poverty line of 165.41 ETB and a nutritional requirement of 2200 kilocalories per adult equivalent. More than half of the population cannot get the minimum kilocalorie required, and a quarter of the households could not cover the costs of food bundles in all survey rounds. The food insecurity incidence slightly declined only in food poverty measure, whereas kilocalorie food insecurity worsens by 0.77%. The mean per capita daily energy intake declined by 120 kilocalories between 2011/12 and 2015/16. However, a 3.1% growth in the power of purchasing the food basket is achieved. On the other hand, 25.55% and 28.17% of households experienced loss in food expenditure and kilocalories between 2011/12 and 2013/14, and nearly half of them were able to recover between 2013/14 and 2015/16 (see Table 4.1).

Looking at the intensity of food energy intake revealed an increase of 0.68%, implying that the mean per capita shortfall of food energy intake relative to the daily nutritional threshold is deteriorated by 14.96 kilocalories. The average intensity of food poverty also declined by 0.32%, indicating that the food poor's mean per capita food expenditure shortfall relative to the food poverty line is reduced by 2.21 ETB. Taking 4.1 mean household sizes in adult equivalent, every rural household experiences 46.5 ETB, 47 ETB, and 44.28 ETB mean monthly aggregate income shortfall over the survey periods. Similarly, a 0.63% decline of the squared food insecurity gap of food energy intake showed that 14 ultra-food insecure experienced ascents. The weighted sum of food poverty gaps as a proportion of the food poverty line also confirmed that 18, 18, and 15 rural households were ultra-food poor in each survey round. A decline in the squared food poverty gap by 0.07% indicated an escape in 3 ultra-food poor.

Table 4.1: Measures of FGT indices

	Food energy intake			Food poverty		
Food insecurity at	2011/12	2013/14	2015/16	2011/12	2013/14	2015/16
$\alpha = 0$	0.546	0.524	0.554	0.237	0.215	0.206
$\alpha = 1$	0.209	0.197	0.202	0.069	0.070	0.065
$\alpha = 2$	0.108	0.102	0.102	0.030	0.032	0.029

4.3.3.2. Multidimensional food insecurity

MFII sharply declined from 42.4% to 39.04%. Yet, a substantial number of households remained food insecure. Indeed, there is marked spatial heterogeneity. Oromia and SNNP

regions possessed the bulk of food insecurity, while Tigray and Others experienced less. In Tigray, SNNP, Oromia, and Amhara, which are home to the immensity of food insecurity, incidences fell with 6.6%, 3.6%, 6%, and 2.5%. Others confirmed a low prevalence of food insecurity in 20111/12 and 2013/14, and the situation reduced considerably by 1.8% in 2015/16. What is distinctive is the lower incidence in Others across the survey rounds. It indicated that (agro) pastoral areas have good collective risk-sharing strategies to buffer against shocks (Table 4.2).

Table 4.2: Spatiotemporal patterns

	Tigray	Amhara	Oromia	SNNP	Others	Total
2011/12	0.380	0.437	0.527	0.546	0.127	0.424
2013/14	0.352	0.410	0.495	0. 486	0.094	0.385
2015/16	0.314	0.412	0.491	0.510	0.109	0.390

Many households experienced asymmetric flow of ascents and descents. The co-movement divided the households into food secure, potentially food secure, potentially food insecure, and chronically food insecure. A total of 44.04% of the households are potentially food insecure. In contrast, 32.69% constitute potentially food secure. However, 55.96%and 67.31% of them remain sustainably food secure and chronically food insecure. This higher inertia showed that households could not escape once they descents it (Table 4.3).

Table 4.3: Transition matrices

	2015/16	Food insecure	Food secure
2011/12	Food insecure	67.31	32.69
	Food secure	44.04	55.96
	Total	55.78	44.22

5.3.3.3. Convergence or divergence of food and nutrition insecurity

The Venn diagrams show that 13% of food insecurity is identified by kilocalorie and multidimensional measures. As much as 10% of the food insecurity is detected with food poverty and kilocalorie. And only 1% is profiled food poor and multidimensionally food insecure. However, only 7% of the households are captured food insecure in all measures. Over one-third were only food insecure in anyone measure (Figure 5.6). The finding suggests that the use of multiple measures portrays distinct groups and limited overlap. A survey by Souza and Jolliffe (2016) also revealed that multiple perspectives lead towards a low correlation. Exclusive use of a single measure overlooks the multifaceted approach and its change.

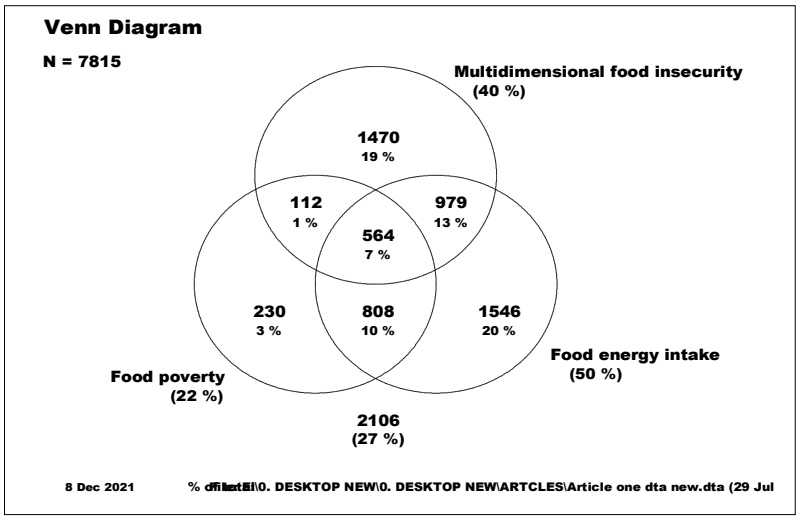


Figure 4.6: Food and nutrition insecurity overlap and mismatches

4.3.3.4. Dietary diversity and food consumption scores

The average DDS shows that each household consumes 6.48 food groups with a standard deviation of 0.0195, which signifies a better dietary diversity. It is low compared to the dietary diversity scores of Kenya (Kassie et al., 2020). Figure 4.7 exhibits the categorization and trajectories of DDS and FCS of rural households in the survey period. The finding reveals a steady decline in the proportion who consume less than three food groups (10.6%) and between 4 to 5 food groups (23.51%) over the survey period. In contrast, households with consumption of over six food groups sharply rose over time, implying that households consume a better diet to secure food because of the ability to gain a variety of foods. On the other hand, those who stayed in acceptable FCS remain very low across the survey rounds (<3%). Over three-fourths of the households remain in poor consumption scores, while nearly a quarter of households have borderline diets. Mobility across the consumption scores is relatively stagnant. Only 3.07% of households escaped from poor food security between 2011/12 and 2015/16. The borderline and acceptable have experienced 3% and 0.03% upward mobility, respectively.

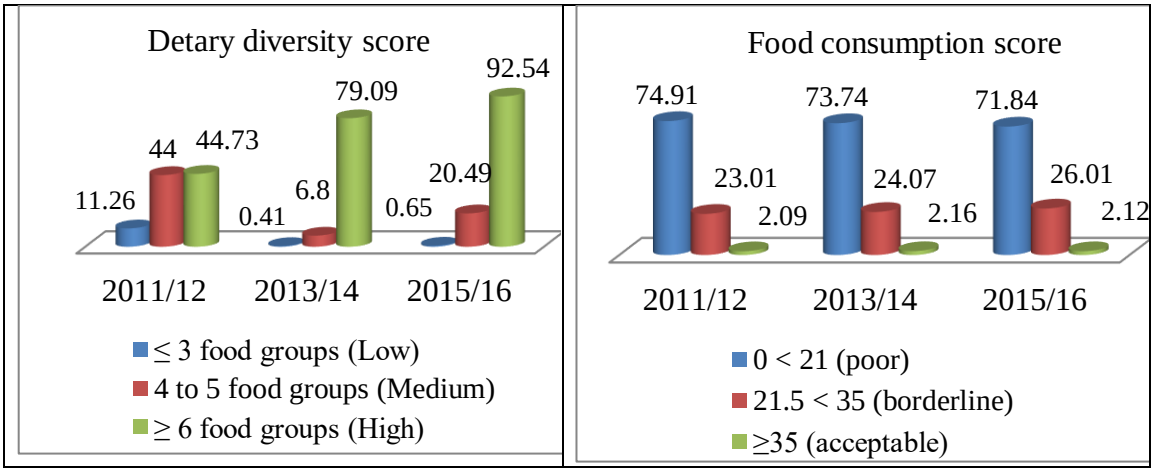


Figure 4.7: DDS and FCS distributions

4.3.4. Econometric results

4.3.4.1. Determinants of resilience

Table 4.4 presents the maximum likelihood estimation result of the MIMIC model. The results show that the estimated coefficients of all pillars are statistically significant ($p<0.01$). Households with better adaptive capacity, access to basic services, and assets will have a great level of resilience in rural Ethiopia. Nevertheless, the model reveals that the role played by SSN is contrary to our proposition. Safety nets enhance entitlement to food and the ability to cover basic needs and reduce suffering from significant negative setbacks (Bahru et al., 2020). According to Bahru and Zeller (2021), households participating in safety nets are often persistently less resilient. Therefore, safety nets could not be able to improve resilience in the long run unless complemented with sustainable livelihood activities and greater investment in health and education. The negative coefficient underscores the lack of complementarities to address emergencies, build resilience, and promote development.

The statistics on model performance reveal a good fit with a comparative fit index (CFI) and Tucker–Lewis index (TLI) of greater than 0.80 and a root means square error of approximation (RMSEA) value of 0.031. The CFI report indicates that the models does 90% better than a null model in which we assume the items are all unrelated to each other. An RMSEA value less than 0.05 is considered to indicate good model fitness.

Table 4.4: MIMIC determinants and indicators

	ML	Z statistics
Assets (AST)	0.085***	12.15
	(0.007)	
Access to basic services (ABS)	0.076***	10.53
	(0.007)	
Adaptive capacity (AC)	0.025***	3.90
	(0.006)	
Social safety net (SSN)	- 0.017***	-2.65
	(0.006)	
Dietary diversity score	1	
	(0)	
Food consumption score	0.655***	
	(0.047)	
Per capita kilocalorie consumption	0.014***	
	(0.033)	
Per capita consumption expenditure	0.600***	
	(0.045)	
Chi^2	127.2	
Prob > Chi^2	0.000	
RMSEA	0.034	
Pr RMSEA	1	
CFI	0.900	
TLI	0.843	
Observations	7101	

Note: Standard errors in parentheses *** p < 0.01

4.3.4.2. The effect of resilience on food poverty and kilocalorie loss and recovery

Table 4.5 reports the probit analysis estimates of the role of RCI and other covariates on the likelihood of food security loss and recovery. Accordingly, better resilience is significantly related to the lower probability of suffering a food security loss and facilitating the recovery after a loss. This finding substantiates the role of linking the humanitarian efforts with longer-term development in eradicating food and nutrition insecurity. Promoting interventions that enhance resilience capacities among rural households is vital for curbing food and nutrition insecurity validating studies in other developing countries (Smith and Frankenberger, 2018; D'Errico and Pietrelli, 2017; D' Errico et al., 2017).

The leading culprit among smallholders in rural Ethiopia is the high risk of vulnerability to shocks (Hussain et al., 2020). The empirical analysis also reveals the worsening of food insecurity by crippling covariate and idiosyncratic shocks in multiple channels. Concurrent and recurrent shocks cause such a wide range of adverse consequences as a decline in crop

productivity, agricultural incomes, and per capita consumption, and deteriorate the welfare of rural households (Dimitrova, 2021; Borgomeo et al., 2018; Gebrechorkos et al., 2020). They also obliterate households' asset gains and eventually cause social instability asserting prior evidence (Woodson et al., 2016; Smith and Frankenberger, 2015).

The finding agrees with the presumption that the movement away from subsistence agriculture towards market orientation serves as hedges against food insecurity. Extension and irrigation are also significant breakthroughs in protecting the probability of losing and enhancing recovery. It is worth noting that effective extension enhances economic participation, technology adoption, and switching to more market orientation. Withal, irrigators increase crop yield, income diversification, commercialization, and adaptability to climate variability (Gebregziabher et al., 2009). Nonetheless, smallholder farming is often associated with land fragmentation. The parameter estimates of numbers of farm plots, used as a proxy for land fragmentation (Postek, 2019), appear to be detrimental to rural welfare. The non-farm economy is a widely acknowledged strategy pursued to achieve food security. We found that an increase in the share of non-farm income protects food insecurity. Literacy also decreases the likelihood of descent and strengthens ascents in food poverty and energy intake. It supports the notion that households with literate heads tend to be more resilient and gaining better knowledge and experience leads to better technology adoption, resource management, and enhanced food security.

Age of household head and household size significantly determine the probability of food security loss and recovery. The finding indicates that households headed by olds and having large sizes are more likely to remain food insecure. This may be because a household with more dependents possesses lower income per capita and a higher need for more food availability and more resources to buy food. This result is in line with the study carried out by Gebre and Rahut (2021) in Kenya.

Table 4.5: The role of RCI on food insecurity suffering and recovery

	Food expenditure				Kilocalorie consumption			
	Loss		Recovery		Loss		Recovery	
	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE
Resilience capacity	-5.028***	1.033	1.164***	0.379	-1.644**	0.650	0.279**	0.121
Age of the head	0.346*	0.198	-0.950**	0.448	0.118**	0.060	0.227	0.184
Household size	0.243***	0.022	-0.349**	0.156	0.120***	0.045	0.189	0.189
Education	-0.159*	0.083	0.169***	0.064	-0.830***	0.264	0.157**	0.061
Commercialization	-0.118	0.073	0.014*	0.008	-0.205**	0.099	0.272	0.184
Access to extension	-0.283**	0.126	0.206*	0.118	-0.184*	0.099	0.012*	0.007
Access to irrigation	-0.004**	0.001	0.396***	0.141	-0.102	0.102	0.082***	0.010
Non-farm income share	-0.127***	0.019	0.524**	0.264	-0.293***	0.103	0.151***	0.026
Number of farm plots	0.095	0.110	0.004	0.004	0.157*	0.087	-0.283*	0.153
Covariate shocks	0.077	0.079	-0.342***	0.119	0.128**	0.057	-0.464**	0.234
Idiosyncratic shocks	1.222*	0.667	-2.333*	1.270	-0.129	0.105	0.360***	0.117
Constants	-0.151	0.323	0.671	0.521	0.625	0.463	-2.183	0.241
LR $chi^2(11)$	201.11		48.60		48.37		199.92	
Prob > chi^2	0.0000		0.0000		0.0000		0.0000	
Pseudo R^2	0.0748		0.0580		0.0172		0.2237	
Observations	2365		605		2,365		667	

Note: *** p < 0.01, ** p < 0.05, and * p < 0.10

4.3.4.3. The effect of resilience on MFII ascents and descents

Reducing MFII through targeted efforts will be assisted by knowing the reasons that support escapes and being responsible for descents (Table 4.6). Once these factors are known, they can easily contend. Escaping and falling into MFII are not symmetric in terms of reasons. People mount food insecurity due to one set of reasons, but people fall on account of a different set of reasons. Targeting drivers and interrupters together is necessary. The growth of the problem is contained even as the size of the problem is reduced.

Multiple linked factors propel descents and hinder ascents from MFII. The finding verified the malign effects of shock exposure on transitory or persistent welfare losses. Shocks make rural households food insecure, keep them food insecure, and prevent them from escaping food insecurity. Variability of rainfall and drought followed by heavy floods becomes the norm. The effect of conflict and the death of a household member is also virulent. Accordingly, resilience capacity significantly protects the risk of impoverishment and enhances the probability of escaping MFII. Therefore, higher asset endowments, social services, adaptive capacity, and

social safety net are the key builder of resilience capacity to escape from food insecurity. Having a savior role in averting downward mobility of food security is acknowledged. This result validates the crucial aspect of a twin-track approach of humanitarian efforts and longer-term development in eradicating multidimensional food insecurity.

Resilience needs supplicant of productive farming, and emergent rural non-farm economy to ensure an equitable rural livelihood. The sheer size of smallholder farming implies that it remains enormously important in the foreseeable future to achieve food security. Evidence also revealed that intensifying agriculture through extension service is a significant breakthrough in promoting escapes. Commercialization also facilitates the smooth process of transforming smallholder agriculture (Linderhof et al., 2019; Radchenko and Corral, 2018). The finding agreed that the commercial transformation of subsistence agriculture improves food security. Since farming is less remunerative, the non-farm economy is the critical shaper of rural livelihood (Pritchard et al., 2019). Agricultural productivity grows not in isolation but through positive farm and non-farm linkages. Vitalizing the relationship is a crucial solution for the growth of the rural non-farm sector too. The finding also reflects that a higher share of non-farm income is associated with higher ascents and lower descents of food security.

Education is the quintessential human capital credential for sturdy food insecurity-exit effects. We find that literacy of the head apart from age and size of households and dependency ratio significantly affect the probability of ascents and descents of food insecurity, relying on knowledge, experience, and the relative strength of size economies against the diminishing return. The negative impact of the demographic variables is attributed to the dependency burden (Libois and Somville, 2018; Tsehay and Bauer, 2012). Female heads tend to make it harder to escape food insecurity due to the low entitlement to valuable resources in rural Ethiopia.

Table 4.6: The role of RCI on MFII ascents and descents

	Assents			Descents		
	Coef.	Std. Err.	dy/dx	Coef.	Std. Err.	dy/dx
Resilience capacity	0.215***	0.068	0.018	-0.483***	0.110	-0.023
Age of household head	-0.006	0.005	-0.0003	-0.013**	0.006	0.0001
Female household heads	-0.586***	0.226	-0.005	0.096	0.206	-0.007
Household size	-0.114***	0.040	-0.008	0.043	0.041	0.004
Dependency ratio	-0.514**	0.241	-0.036	0.223	0.225	0.016
Education	-0.145	0.176	0.007	-0.416**	0.195	0.013

Access to extension	0.364*	0.187	0.013	0.244	0.202	0.009
Access to credit	0.011**	0.005	0.001	0.006	0.005	0.000
Share of non-farm income	0.079***	0.011	0.004	-0.099***	0.019	-0.005
Commercialization index	-0.055	0.074	-0.004	-0.208***	0.063	0.014
Rainfall variability	-0.389*	0.226	-0.007	0.785***	0.266	0.019
Drought	-0.186**	0.091	-0.034	0.154**	0.077	0.025
Flood	0.104	0.098	-0.007	0.202**	0.099	-0.026
Death of a household member	-0.006***	0.002	-0.0004	0.001	0.001	-0.001
Conflict	0.001	0.001	0.0000	0.002***	0.001	0.0001
Constants	-2.154***	0.409		-2.828***	0.464	
Observations	2365					
Log-likelihood	-1092.16					
LR $chi^2(15)$	235.89					
Prob > chi^2	0.0000					
Pseudo R^2	0.0975					

Note: *** p < 0.01, ** p < 0.05, and * p < 0.10

4.3.4.4. The effect of RCI on DDS and FCS in the presence of shocks and interactions

In Table 4.7, we report the generalized ordered logit model result examining the role of RCI on household DDS and FCS. Since the dependent variables have three categories, two coefficients are estimated for each explanatory variable. One coefficient stands for the outcomes of the poor/low relative to borderline/moderate, and acceptable/high dietary diversity and food consumption scores. The others represent outcomes of the poor and borderline compared with the acceptable dietary diversity and food consumption scores.

A series of Wald tests on each explanatory variable revealed that the null hypotheses of equal coefficients are rejected for household size, the square of household size, female household head, saving account, distance to the market in DDS, and age of household head in FCS. The global Wald model specification tests with constraints are statistically insignificant with high p-values (0.897 and 0.996).

There is a significant and positive association between RCI and DDS and FCS in that the more resilient households have better access to more diverse diets and food consumption. The positive role of resilience for the preferred food and nutrition security measure is because of households' asset endowments, adaptive capacity, social safety net, and access to social services. The finding corroborates earlier empirics in Malawi and Zimbabwe (Murendo et al., 2020; Murendo et al., 2020). The lagged resilience capacity is significant in both indicators,

and this could imply that last year's resilience capacity is a good predictor of current food security. Dietary diversity and consumption patterns of rural households are adversely affected by shocks. In accord with our expectation, exposure to covariate shocks is significantly and negatively associated with FCS. Covariate shocks are more malicious than idiosyncratic ones. Coping with covariates than idiosyncratic shocks is more difficult consistent with (Dercon et al., 2005).

Does resilience capacity reconcile the linkage between the covariate and idiosyncratic shocks and the DDS and FCS? Following (Murendo et al., 2020; Smith and Frankenberger, 2018), we turn to the interaction terms between shock exposure and resilience capacity. The coefficients on the interaction terms between resilience capacity and covariate shocks are positive and significant towards DDS and FCS. This evidence supports the potential redeemer of dietary diversification and consumption smoothing in the presence of shocks. Hence, the total effect of resilience capacity on dietary diversity and food consumption scores might be higher when covariate shocks intensify.

The well-being of rural households is related to smallholder agricultural performance. As expected, access to irrigation affects dietary diversity and food consumption. Therefore, irrigators boost their productivity, cropping intensity, income, consumption, and savings. It expands the farm and non-farm employment too. Food and nutrition security is sustained with better literacy of the household head. However, smallholder farming in Ethiopia is associated with land fragmentation (Paul and Gĩthĩnji, 2018). The parameter estimate of the numbers of farm plots is found to be negative and significant implying that an increase in farm plots deteriorates food consumption. The plausible explanation is that fragmented parcels are associated with higher production costs and lower agricultural outputs and also hamper mechanization. Distance to the market also significantly and negatively determines dietary diversity consistent with (Usman and Callo-Concha, 2021). Household size and square of the household size have contrasting effects. It implies that food and nutrition insecurity would gradually decrease as household size increases. Moreover, the household headed by females and olds appears to be associated with a lower dietary diversity and food consumption.

Relying on rain-fed farming results in entrenched food and nutrition insecurity. Economic diversification augments farm income and buffers food and nutrition insecurity in developing countries (Pritchard et al., 2019). Enhancing the emergent rural non-farm economy is imperative. The finding also confirmed that the higher share of non-farm income enriched

dietary diversity and food consumption scores. A more substantial percentage of the non-farm activities signify a robust rural economy because of the more significant share of wage labor and access to formal jobs that help build a productive asset base. Increased spending on rural-urban connectivity has opened up wage labor employment opportunities and allows rural households to generate more income. The finding awkwardly shows that wage labor participation hurts FCS. Ethiopia's rural labor markets are underdeveloped, and the demand for farming and non-farm activities is rare. However, this does not mean that farming can be left on its own and expect livelihood to transition out of agriculture for improved welfare outcomes. It is not also logical to overlook the non-farm sector for considerable progress on rural households.

Table 4.7: Resilience for DDS and FCS

	DDS				FCS			
	Low DDS		Moderate DDS		Poor DDS		Borderline DDS	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Resilience capacity	2.878***	1.031	2.878***	1.031	7.821***	1.184	7.821***	1.184
Age of household head	-0.006**	0.003	-0.006**	0.003	0.001	0.003	-0.044***	0.013
Household size	0.494***	0.093	0.217***	0.070	0.268***	0.089	0.268***	0.089
Household size square	-0.038***	0.008	-0.015***	0.006	-0.020***	0.007	-0.020***	0.007
Female household head	-0.369***	0.102	-0.369***	0.102	-0.120	0.124	-0.120	0.124
Education	0.012*	0.007	0.012*	0.007	0.022***	0.006	0.022***	0.006
Share of non-farm income	0.509***	0.095	0.509***	0.095	0.355***	0.102	0.355***	0.102
Wage labor participation	-0.282**	0.112	-0.282**	0.112	-0.123	0.136	-0.123	0.136
Access to irrigation	0.448**	0.188	0.448**	0.188	0.316*	0.183	0.316*	0.183
Distance to the market	-0.009***	0.001	-0.004***	0.001	-0.002	0.001	-0.002	0.001
Number of farm plots	-0.189	0.159	-0.189	0.159	-0.659***	0.238	-0.659***	0.238
Covariate shocks	-0.523	0.324	-0.523	0.324	-0.803**	0.380	-0.803**	0.380
Idiosyncratic shocks	0.284	0.585	0.284	0.585	-0.901	0.676	-0.901	0.676
Resilience * covariate shocks	2.719**	1.290	2.066*	1.240	2.708*	1.416	2.708*	1.416
Resilience * idiosyncratic shocks	-1.249	2.217	-1.249	2.217	3.648	2.510	3.648	2.510
Constants	0.873*	0.502	-0.956**	0.473	-5.142***	0.574	-6.298***	0.761
Log-likelihood	-1989.4				-1413.6			
LR $chi^2(19)$	231.53				178.87			
Prob > chi^2	0.0000				0.0000			
Observations	2365				2365			

Note: *** p < 0.01, ** p < 0.05, and * p < 0.10

4.4. Conclusions

Understanding the potential gains from building resilience is crucial to ending hunger, food insecurity, and malnutrition. The causal pathways through which resilience affects food and nutrition insecurity, modeled separately, are rarely considered in empirical analyses. We study the impact of resilience capacity on food and nutrition insecurity in rural Ethiopia.

Assets, access to basic services, and adaptive capacity are the most important components of resilience capacity. Food and nutrition insecurity declined through slight growth in resilience capacity. The improvement is more substantial in dietary diversity, food poverty, and multidimensional measures. The food consumption scores are still off-track to achieve some strides. Kilocalorie intake and expenditure measures witnessed a higher level of fluctuations. This study combined five strands of food and nutrition insecurity measures because the inclination of many studies toward different perspectives implicitly captures distinct features. There is also low static correlation and dynamic mismatch among alternative measures. The overlap is much less than 10%, implying that improvements in one approach do not reveal improvements in another. Some households are only food insecure in either of the approaches, notwithstanding the complementarities.

Analyzing food insecurity dynamics demands identifying the factors associated with loss and recovery. The probit model results evidenced the savior role of resilience capacity in reducing the likelihood of suffering food security loss and facilitating recovery. Findings suggest that resilience builds a better and more stable food and nutrition security system in the presence of shocks. The food insecure households possess fewer resources and constrain the benefit of resilience capacity. Besides, the bulk of food insecurity depends on the sector that remains fraught with many structural challenges. Even for better-off households pursuing a better livelihood strategy, the recurrent idiosyncratic and covariate shocks coupled with weak recovery hinder their ability to build resilience and achieve food and nutrition security. Additionally, rural households encounter food poverty and kilocalorie loss on account of land fragmentation, economically non-active members, and the old age of the household head. In contrast, they experienced recovery from food and nutrition insecurity loss due to fostering access to irrigation, extension, and commercialization. Growing the non-farm income share and literacy are also very helpful in improving food and nutrition security. Rural livelihoods tailored to the non-farm economy complement farming activities exhibit better food and nutritional security.

The multinomial logit model also identified who is most at risk of falling and the best prospects of escaping from multidimensional food insecurity. Multiple linked factors propel the asymmetric flows. Accordingly, enhancing resilience capacity, commercialization, access to extension and credit services, non-farm income share, and literacy constitutes the reasons for overwhelmingly influencing households' upward mobility and protecting them from falling into multidimensional food insecurity. The last year's resilience capacity is a good predictor of the current mobility of food security. In contrast, the finding underscores the malign effect of shocks such as annual rainfall variability, drought, flood, conflict, and death of a household member in exacerbating the falling tides and hindering ascents.

The generalized ordered logit model results showed that resilience capacity is positively associated with household dietary diversity and food consumption. Households with better resilience in an initial period are less likely to suffer food and nutrition insecurity in the future in the face of shocks. Better resilience capacity increases the probability of quick recovery from food and nutrition security loss because of shocks in previous periods. We also found that literacy, access to irrigation, and a rising share of non-farm income have potentially diversified diets and smooth food consumption during times of shocks. In contrast, wage labor participation, distance to the market, land fragmentation, and households headed by old and females reduced dietary diversity and food consumption scores.

We interpret the results as pointing to the importance of the following policy implications. First, the elusive concepts of food and nutrition insecurity and the absence of an all-inclusive proxy call for blended approaches that subtly overcome the methodological flaws. The complementary measure is of great value as it can give a clearer-cut description of food and nutrition insecurity's complex problems and patterns. Integrating the alternative measurement approaches heightens the targeting efficiency of food and nutrition security.

Second, the evidence supports the notion that resilience capacities are likely to protect food and nutrition insecurity in the presence of shocks. Resilience serves as a palliative response to solve the underlying problem and opens up the prospect of reducing food and nutrition insecurity. The doubts that smallholder agriculture is unviable in the long run for the steadily growing population are the increasing concern. Resilience is not also the absolute abiding antidote to food and nutrition insecurity. More support to the farming economy is essential, but reducing food and nutrition insecurity requires multifaceted options. The optimal pathways that

reinforce resilience to ensure food and nutrition security are agricultural intensification, promoting human capital formation, access to productive assets, and livelihood diversification.

Technologies are rudimentary and need more investment to expand and improve irrigation practices. Institutional measures that enhance growth from below would also go a long way in building resilience and breaking the vicious cycle of subsistence and vulnerability of smallholder farming. Growth from below focused on tackling food and nutrition insecurity from the bottom up. It is small-scale, often at the household level, and informal investments to the economy. It depends on financial inclusion, migration to towns for work, enterprise and asset developments, and household level diversification intertwined with farming. Interventions must also stay fresh with ascents and descents by relevance and effectiveness. It is paramount to formulate policies to address both reasons as they function within the country. Hence, we need to find the right food and nutrition security intervention and target primarily on the reasons than the people to manage the asymmetric flow configurations.

Third, farming is no longer the sole source of subsistence and economic growth for many rural households. Because of exposure to concurrent and recurrent shocks, the non-farm livelihoods should not be overlooked. An emerging line of inquiry for the viability and development of rural areas highlighted the vital role of enhancing the rural non-farm economy, diversifying income sources, and enhancing livelihood opportunities. Improved rural-urban connectivity, mobility, livelihood diversification, and broader agri-food systems transformation are also requisite. Lastly, sustainable food and nutrition security need productive inclusion measure as it augments household earnings while also helping households withstand and recover from shocks. Besides, our findings strongly suggest that proximity to towns and markets provides a clear route out of food and nutrition insecurity. Apart from market integration, investment in rural infrastructure, small-town development, and migration out of agriculture yield a faster pace of sustained escaping out of food and nutrition insecurity. Urbanization, therefore, is crucial development alongside human capital development to ensure that no one is left behind.

Chapter 5: Resilience Capacities and Multidimensional Destitution in the Presence of Shocks: Unmasking the Spatial and Temporal Patterns in Rural Ethiopia

Abstract

The quest to end poverty in Ethiopia has suffered its worst setback because of concurrence and recurrence of shocks. Passing through this sturdy terrain successfully depends on the upward mobility of the destitute. The empirical evidence about the linkages between resilience capacity and destitution is scarce in rural Ethiopia. This study attempts to investigate the role of shocks on destitution and vulnerability to destitution and the mediating role of resilience between shock exposure and destitution using the random-effects probit and fixed-effect ordered logit models. Alkire and Foster's method is employed to compute the destitution index. The findings show that destitution exacerbates due to shock exposure. The result also reveals that the distribution of the destitute exhibits a distinct spatial disparity where regions more vulnerable to shocks tending to have ultra-poor. The econometric results confirm that enhancing the rural non-farm economy and investing in irrigation, market, and road infrastructures have roles in fighting destitution. However, idiosyncratic and covariate shocks, land fragmentation, loan, female headship, and dependency ratio put households at risk of falling into destitution. The redeeming ability of commercialization and literacy are also imperative. Building resilience comes up as the vital mediator in escaping destitution in the presence of shocks. The spatial disparity highlight the need for strategies designed using a territorial approach. Critical for policy uptake, the findings suggest putting in place coherent preemptive and redemptive strategies to have a far-reaching impact on reducing destitution and vulnerability destitution.

Keywords: *Shocks, destitution, random effect probit, panel data, rural Ethiopia*

5.1. Introduction

Poverty is a debilitating problem in the developing world. Following the commencement of succeeding development goals, many countries have implemented different policy initiatives. As a result, they have made great strides in poverty reduction. However, millions of households remain pulverized so that large pockets of poverty perpetuates with high uncertainties and indiscretion in Africa (Alkire and Housseini, 2014). Sub-Saharan Africa (SSA) is home to roughly one-third of all poor people (Alkire et al., 2017). Ethiopia is registered to be the poorest in SSA having a multidimensional poverty index of 0.687 with a last rank next to Niger (OPHI, 2022). More than half of the multidimensional poor are destitute in Ethiopia (Alkire and Hosseini, 2017).

Notwithstanding the rising tide of economic growth (Shimeles, 2019), ultra-poverty in Ethiopia stayed so obstinately high. The dissonance between growth performance and the country's being home to the highest proportion of destitute is a striking phenomenon that demands an

explanation. It is fair to ask why eliminating destitution is an arduous goal. The process has suffered the worst setback due to four daunting challenges.

First, rural households are subjected to exposure to idiosyncratic and covariate shocks. For example, climate-induced (Hirvonen et al., 2020), price-related (Hill and Porter, 2017), and health-related (Gebremariam and Tesfaye, 2018) shocks exacerbate welfare problems by way of reduced education, labor market participation, and agricultural output that subsequently drive a decline in incomes and consumption (Ngoma et al., 2019). Shocks compromise the abilities to develop households' stock of wealth and stifle them to use it effectively to sustain improvements in their lives. As a result, they lack the required assets to convert into income requirements. When prolonged and multiple, shocks result in a downward spiral of asset loss and impoverishment that ultimately limit years of development gains and efforts to eradicate welfare problems (Campos et al., 2014).

The second important reason to explain is the complexity of the concept and methodological flaws. Destitution is conceptualized in the multidimensional notions of poverty. We make use of Alkire et al. (2014)'s meaning of destitution as a condition that households' deprivation score is greater than a more stringent poverty cut-off. They are a subset of the multidimensionally poor who are more deprived in some dimensions to a greater extent. Ethiopia's official destitution statistics follow the conventional approaches (MoFED, 2017; 2012). However, these approaches have been criticized for their failures to capture multifaceted attributes (Krishna, 2017). Likewise, households experiencing destitution also describe their deprivation beyond low income (Alkire and Foster, 2011b).

Third, destitution is inherently dynamic. Rural households churn around the destitution cut-off, while impoverishment and transitory escape overshadows the trajectories (Scott et al., 2014). Coexisting streams flowing in parallel reconfigure the stock of the destitute (Krishna, 2017). Experiencing ascents is insufficient to reduce the problem unless we simultaneously address descents. According to Krishna (2010), fundamental causes and large-scale events are not all that matter. Reducing those welfare problems more effectively in the future demands ins and outs of the rural households. A thorough and context-specific understanding of asymmetric reasons is imperative for developing more effective policy designs.

Fourth, interventions yet have been polarized and usually perceive a serious divide between relief and development. Humanitarian efforts are aimed to respond to crises by protecting the life and livelihoods after a shock. As such, they often deals with coping strategies and absorptive capacities. These redemptive approaches reduce sufferings, and save lives and livelihoods (Hoddinott, and Taffesse, 2019), though they have not led to any meaningful mechanism for mitigating the adverse effects of shocks. Therefore, many poor end up neglected in the alleviation efforts. In contrast, development efforts are mostly aimed at addressing long-term issues of societal changes. As such, they are closely linked to the adaptive capacity leading to incremental adjustment and transformational changes (Béné et al., 2016). The absence of more dedicated and integrated interventions drives millions of rural Ethiopians into the lower ladder (Krishna, 2007). With this caveat in mind, resilience is introduced to transcend the pitfalls of earlier interventions in achieving the long and hard road to zero poverty. It has made its way to the forefront as a catalytic element to integrate the myriad of activities. It is also becoming the central paradigm in many sectors, suggesting that it is well on its way to be mainstreamed in the development practices (Hoddinott, 2014).

Despite the added-value of resilience, it has to be embodied in a more rigorous empirical analysis. The studies so far focus on the apparent link between resilience and food security. They operationalized the concept of resilience and have created an impetus for numerous scholarly efforts. However, resilience is still fairly new in the context of poverty. The goal of eliminating poverty in all its forms leads to the growing interest that singled out the destitute as a population of concern (World Bank, 2020b). Progress depends to a large extent on what happens to these uncounted pockets of poverty in the fight against poverty (Campos et al., 2014). There is a paucity of empirical evidence about the linkages amongst shocks, resilience capacity, and destitution. In light of this, we attempts to examine the effect of shocks and other covariates in driving destitution and the role of resilience s a mechanism to deal with shocks and destitution in rural Ethiopia. The paper is motivated by the fact that resilience appears to play an important catalytic element that permits programmatic rapprochement of integrating relief and development in sustaining destitution reduction in rural Ethiopia.

The rest of the paper proceeds as follows. Section 5.2 briefly describes the data sources and the empirical strategies. The methodological steps for carrying out the destitution index estimation at the household level are explained here. Section 5.3 thoroughly discussed the results of the paper. Section 5.4 summarizes and concludes the most important findings.

5.2. Materials and methods

5.2.1. Data source

We use three rounds of panel data from the ESS collected by the Ethiopian CSA in collaboration with the World Bank's LSMS-ISA in 2011/12, 2013/14, and 2015/16. The data represent rural, small towns, and urban areas of all regions in Ethiopia. The first wave covered only rural and small-towns while expanding to urban areas in the subsequent waves. The ESSs followed two-stage stratified sampling procedures (CSA and World Bank, 2017). Our analysis is limited to the panel sample, nationally representative of all rural areas in Ethiopia. The ESS is a rich multitopic data set containing several socio-economic variables at the individual, household, and community levels. The dataset encompasses detailed information on households' living conditions, including demography, health, education, food security, access to water and sanitation, employment, mobility, access to financial services, consumption and expenditure patterns, asset holdings, shocks, and other individual and household level variables. The community data includes community services, social networks, mobility, religious practices, land use, access to road and transport facilities, development interventions, and business activities. It also comprises geo-referenced variables, livestock, crop production, post-harvest analysis, and post-planning.

5.2.2. Shocks and resilience measure

Resilience is computed following the FAO-RIMA methodology (FAO, 2016) and its successors (Sibrian et al., 2021; Errico et al., 2017). It is a two-stage process that employs factor analysis (FA) and structural equation modeling, multiple indicators multiple causes (MIMIC). The variables used for estimation are presented on Table 5.9 of the appendix. Our understanding is guided by Constas et al. (2014) which stated resilience is "a capacity that ensures adverse stressors and shocks do not have long-lasting adverse development consequences".

The shocks exposure data are computed through a shocks module in the LSMS-ISA which request whether the household was affected by covariate and idiosyncratic shocks. Covariate shocks comprise extreme events affecting all households in the village as drought, heavy rain, flood, conflict, input price hikes, displacement for government projects, fire. In contrast, idiosyncratic shocks such as the death of a household member, illness, loss of livestock, crop damage, theft, loss of non-farm jobs, loss of house or farm, and fire are limited to the individual

or household levels (Pradhan and Mukherjee, 2018). They are continuous variables showing the number of occurrences in the community during the past 12 months.

5.2.3. Multidimensional destitution measures

This study employed the Alkire and Foster (2011) methodology to estimate multidimensional destitution. The methodology entails identification and aggregations. Identification determines whether each individual is destitute using two kinds of censoring, each of which follows the application of deprivation and destitution cut-offs. Alkire and Santos (2014) outlined the steps one should follow in constructing a multidimensional destitution index. First, we need to define a set of indicators which will be considered in the multidimensional measure. There is no hard and fast rule for selecting and defining the set of indicators. However, one should use normative judgment in choosing the indicators which explain the three key dimensions of the destitution measures. We, therefore, determine the attributes and indicators utilized to measure destitution in a multidimensional perspective based on progress in the country's Sustainable Development Goals and data availability.

The index takes in 10 indicators that reflect the multiple deprivations experienced by people across the dimensions of health, education, and living standards. Two variables were used to construct the health dimension. It is claimed that literacy of the household head reduces a household's well-being. Therefore, we used two variables to construct the education dimension: years of schooling and school attendance. These indicators capture basic skills and education attainments of household heads. Electricity, improved sanitation, safe drinking water, types of floor, cooking fuel and assets were the variables used for constructing the standard of living dimension. Detailed information on the thresholds for destitution dimensions and indicator weights are shown in Table 5.1. Each indicator is equally weighted within its dimension, so the health and education indicators are weighted 0.166 each, and the standard of living indicators are weighted 0.055 each.

Table 5.1: The deprivation thresholds of those who are multidimensionally destitute

Dimensions	Indicators	Deprived if	Weight
Education	Years of schooling	No one has completed five years of schooling	0.166
	School attendance	At least one school age child not enrolled in school	0.166
Nutrition	Child malnutrition	At least one member is malnourished	0.166
	Child mortality	Any household member has experienced illness in the previous one month prior to the survey	0.166
Standard of living	Electricity	No access to electricity	0.055
	Improved sanitation	House has no toilet with septic tank and shares public toilet	0.055
	Safe drinking water	No access to safe drinking water	0.055
	Flooring	The household has a dirt, sand, or dung floor	0.055
	Cooking fuel	The household cooks with dung, wood, and charcoal	0 .055
	Assets	Household does not own car, refrigerator, radio, bicycle, mobile phone, livestock, TV	0.055

For each proxy indicator p (p = 1, 2 … 10), a threshold Z_p is a deprivation cut-off (defined as the minimum achievement required to be non-deprived). Deprivation cut-offs are collected in the d-dimensional vector Z = (Z_1 … Z_d). Given each individual's achievement in each dimension X_{ip}, the sample weight assigned to each individual i (i = 1, 2 … n (number of households)) is denoted by $W_i > 0$, which reflects the representativeness of each unit to the concerned population. Assigning equal weights for each dimension and indicator within a dimension as in Alkire and Foster (2011), $W_j = W_1, W_2, \ldots\ldots\ldots, W_{10}$ are the relative weight attached to the ten indicators such that $W_j > 0$ and $\sum_{p=1}^{10} W_j = 1$. If the i^{th} individual's achievement level in a given indicator j falls short of the respective deprivation cut-off Z_j, the person is said to be deprived in that indicator (if $X_{ip} < Z_p$). If the individual's level is at least as great as the deprivation cut-off, the individual is not deprived in that indicator. Each individual is assigned a deprivation status value g_{ip}, such that $g_{ip} = 1$ if household i is deprived in indicator p, and $g_{ip} = 0$, otherwise for all j indicators and n households.

The deprivation score of each household $C_i \in [0, 1]$ is aggregated as for each household i, such that $C_i = \sum_{p=1}^{10} W_p g_{ip}$. Let the number of destitute be q (C; C (k)) where C_i (k) has been censored of all deprivations that are less than the value of k and C = (C_1 … C_q) is the vector of deprivation score of each household in increasing order. Thus, when $C_1 \geq k$, then C_i (k) = C_i (deprivation score of the household), but if $C_i < k$ then C_i (k) = 0. Households are destitute if their deprivation score C_i is greater than the destitution cut-off C_i (k) ≥ 333 where $k \in (0, 1]$ and

non-destitute, otherwise. The censored deprivation score of individual i is denoted by C_i (k), and can be obtained as $C_i(k) = \sum_{p=1}^{d} W_p g_{ip}^0(k)$.

Next, the destitute are identified by applying the destitution cut-off and thus a new matrix can be obtained from the deprivation matrix: the censored deprivation matrix, which is denoted by $g^0(k)$. Each element in $g^0(k)$ is obtained by multiplying the corresponding element in g^0 by the identification function. Following Foster et al. (2010), the parametric multidimensional destitution measures are given as follows:

Headcount ratio (H) is the first that refers to the ratio of multidimensional destitute to the total population. Let the indicator function I_i equals 1, if the individual is deprived in indicator i and 0 otherwise, this partial index is expressed as:

$$H = \frac{q}{n}, \qquad q = \sum_{i=1}^{n} I(C_i \geq k)$$

Intensity (A) is the average deprivation score across the multidimensionally destitute. It conveys the intensity of destitution in that the destitute who experience simultaneous deprivations in a higher fraction of dimensions have a higher intensity of destitution and hence are more destitute than others having a lower intensity. Intensity entails adding up the censored deprivation scores C_i of the destitute q and dividing them by the total number of destitute. It is formally expressed as:

$$A = \frac{1}{q} \sum_{i=1}^{q} C_i(k)$$

Finally, the censored headcount ratio (M_0) combines the proportion of households whose weighted deprivation is greater than or equal to the destitution cut-off and the average deprivation score of the destitute. As a simple product of the two partial indices, it reflects the share of weighted deprivations experienced by the multidimensionally destitute divided by the maximum possible deprivations that could be experienced if all people were destitute and were deprived in all dimensions. Analogously, M_0 can be obtained as the mean of the vector of censored deprivation scores, which is also the sum of the weighted deprivations that the destitute experience, divided by the total population. In sum, then it is defined as:

$$M_0 = HxA = \frac{1}{n}\sum_{i=1}^{n}\sum_{p=1}^{d} W_p g_{ip}^{0}(k)$$

We also compare M_0 and its associated sub-indices over time using the absolute pace of change across periods. According to Alkire et al. (2015), the absolute rate of change is the difference in levels between two survey rounds. Changes (increases or decreases) in destitution across two time periods are reported as a relative rate. The relative rate of change is the difference in levels across two periods as a percentage of the initial period.

The absolute rate of change (Δ) is simply the difference in adjusted headcount ratios and partial indices between two periods. Besides, the relative rate of change (δ) is the difference in adjusted headcount ratios and partial indices as a percentage of the initial destitution level. Denoting the achievement matrices for period t^1 and t^2 by X_{t^1} and X_{t^2} respectively, they are computed as:

$$\Delta M_0 = M_o\,(X_{t^2}) - M_o\,(X_{t^1}) \text{ and } \quad \delta M_0 = \frac{M_0(X_{t^2}) - M_0(X_{t^1})}{M_0(X_{t^1})}\, x\ 100$$

Following the Shapley value developed by Duclos and Araar (2006), the multidimensional destitution indices were decomposed into their constituent components or dimensions. The construction of the destitution index or adjusted head count ratio (M_0) and its partial indices have rigorously been done using the Distributive Analysis Stata package (DASP) developed by (Araar and Duclos, 2013).

5.2.4. Vulnerability to multidimensional destitution

The vulnerability to the multidimensional destitution index (VMPI) is computed as proposed under a mean-risk behavior approach by Gallardo (2019). It is similar to the comprehensive poverty line approach used by the OPHI. The threshold was set at k = 0.15 and k = 0.225 to identify the vulnerable non-destitute. It implies that those households with a deprivation score of $0.15 \leq k < 0.333$ were considered at risk of becoming multidimensionally destitute. They become destitute if they are deprived of one more core welfare indicator.

After identifying the vulnerable non-destitute, the next step was to solve the aggregation problem of quantifying the vulnerability to destitution in a population in summary. The most straightforward vulnerability measure would be the headcount ratio (V^H), the percentage of

people vulnerable to multidimensional destitution in a population. This measure can be defined as follows:

$$V^H = \frac{1}{n}\sum_{i=1}^{n} I_{S_i^v \geq k}$$

Where $S_i^v \geq k$ is an indicator function that equals one if the person i is vulnerable non-destitute and 0 otherwise. V^H is equivalent to the headcount ratio H in the Alkire and Foster multidimensional poverty framework.

The general vulnerability to destitution measure of α order, which belongs to the Alkire and Foster family of multidimensional measures and is therefore associated with the Foster et al. (1984) class of poverty measurements, is defined as:

$$V^{\alpha} = \frac{1}{n}\sum_{i=1}^{n}\sum_{p=1}^{d} W_p g_{ip}^{\alpha} I_{S_i^v \geq k}$$

For α = 0, the VMPI is the adjusted headcount ratio (V^0). Note also that V^0 is analogous to M_0 in the MPI framework. It is the product of headcount ratio H and the average intensity of deprivation A. Similarly, V^0 is the product of the headcount vulnerability ratio V^H and the average vulnerability intensity V^A. For α = 1 and α = 2, the adjusted multidimensional vulnerability gap V^1 and the adjusted multidimensional vulnerability quadratic gap V^2 were obtained, respectively.

5.2.5. Econometric strategy

5.2.5.1. Random effect probit model

For a binary dependent variable (destitute or non-destitute) in panel data, the most popular model to be used is the unobserved effects probit model. The outcome variable of a household i at time t is a function of covariates across households. We choose the random-effects probit model as it provides better control for the influence of individual differences among the units of analysis.

Following Greene (2012), the random effects probit model specified as:

$$\Pr(y_{it} = 1|x_{it}, \alpha_i) = \Phi(x_{it}\beta + v_{it}),\ t = 1, \ldots\ldots\ldots, T$$

$$v_{it} = \alpha_i + u_{it} \text{ and } \quad y_{it} = \begin{cases} 1, \text{ if destitute, } y_{it}{}^{*} > 0 \\ 0, \text{ if non- destitute, } y_{it}{}^{*} \leq 0 \end{cases}$$

Where, Pr is the probability of a household to be destitute. $y_{it}{}^{*}$ denotes the unobservable variable. y_{it} is destitution status of household i in year t. x_i is shocks, resilience capacity, and other observable time-varying and time-invariant vectors of strictly exogenous characteristics which influence $y_{it}{}^{*}$ ($x_i$contains x_{it} for all t). Φ is the standard normal (probit) distribution function, $\beta_t$is a vector of coefficients associated with the x_i, and α_i denotes the individual specific unobservable effect and u_{it} is a random error. We also assumed that u_{it} ~ IN (0,σ_u^2).

5.2.5.2. Fixed effect ordered logit model

The fixed effects ordered logit model is used in empirical research such as life satisfaction (Baetschmann, 2012), happiness (Ferrer-i-Carbonell and Frijters, 2004), and retirement (Abramowska-Kmon and Łątkowski, 2021). It estimates causal effects by controlling for unobserved individual heterogeneity. While several estimators exist in model estimation, we employed the blow-up and cluster (BUC) estimator proposed by Baetschmann et al. (2020). The model is proven that the BUC estimator has good features, and is as efficient as more complex estimators.

In this paper, we estimated a fixed-effects ordered logit model that relates the latent variable y_{it}^{*} for individual i at time t to a linear index of observable characteristics $x_{it}$and unobservable characteristics α_i and ε_{it}. The model is specified as:

$$y_{it}^{*} = x_{it}'\beta + \alpha_i + \varepsilon_{it} \qquad i = 1 \ldots N \qquad t = 1 \ldots T$$

Where y_{it}^{*} stands for unobserved vulnerability to destitution. x_{it} is a vector of observed individual characteristics. β refers to a vector of coefficients. α_i is an individual-specific intercept. ε_{it} refers to time-varying unobservable terms. They are independent and identically distributed with a standard logistic cumulative density function. The observed vulnerability to destitution (y_{it}) is related to the modeled unobserved y_{it}^{*} in the following way

$$y_{it} = \begin{cases} 1 & if\ y_{it}^{*} \leq \mu_1 \\ 2 & if\ \mu_1 < y_{it}^{*} \leq \mu_2 \\ 3 & if\ \mu_3 < y_{it}^{*} \end{cases}$$

The time-invariant part of the unobservable (α_i), called the fixed effect, can be statistically dependent on x_{it}. Where the thresholds τ are assumed to be strictly increasing: $\tau_{i1} = -\infty$; $-\infty < \tau_{ik} < \tau_{ik+1} < \infty$) and $\tau_1 = -\infty, \tau_{ik+1} = \infty, \forall \kappa = 2, \dots\dots, K-1$; $\tau_{ik+1} = \infty$, the latent variable y_{it}^* is tied to the observed ordered variable y_{it} by the following observation rule:

$$y_{it} = k \text{ if } \tau_{ik} < y_{it}^* \leq \tau_{ik+1}, k = 1, \dots\dots k,$$

The specification of the fixed effects ordered logit model is also completed by assuming that the time-varying unobservable terms,ε_{it} are conditionally independent and identically distributed standard logistic cumulative density function of

$$F(\varepsilon_{it}|x_{it},\alpha_i) = F(\varepsilon_{it}) = \frac{1}{1+exp(-\varepsilon_{it})} \equiv \Lambda(\varepsilon_{it})$$

Hence, the probability of observing outcome k for individual i at time t which depends not only on the parameter of primary interest,β, and x_{it}, but also on α_i and τ_{ik},$\tau_{ik+1}$is:

$$Pr(y_{it} = k|x_{it}, \alpha_i) = \Lambda(\tau_{ik+1} - x_{it}'\beta - \alpha_i) - \Lambda(\tau_{ik} - x_{it}'\beta - \alpha_i)$$

5.2.5.3. Dynamic random effect probit model with Unobserved Heterogeneity

In dealing with the dynamics of dichotomous outcomes, a wide range of studies such as poverty (Bigsten and Shimeles, 2008; Islam and Shimeles, 2007), welfare (Bhuller et al, 2017), unemployment behaviour (Flaig et al, 1993), among others use a dynamic random effect probit model. The advantage over non-linear dynamic models is accounting for state dependence that captures the amount of inertia of the lag on the outcome variable. The outcome probability (destitution) is hypothesized to depend on the destitution in the previous period. Thus, a current state of destitution is modelled as a function of destitution in the previous period. Besides, unobserved heterogeneity that make specific groups prone to destitution should be accounted for while modelling destitution (Grotti and Cutuli, 2018).

The model is specified as:

$$y_{it}^* = \gamma y_{i,t-1} + x'_{it}\beta + \alpha_i + u_{it} \quad (i = 1, 2\dots N;\ t = 2 \dots T),$$

Where y_{it}^* is the latent indicator of destitution and y_{it} is the observed binary outcome variable (destitution status) defined as,

$$y_{it} = \begin{cases} 1\ if\ y_{it}^{*} \leq 0 \\ 0, otherwise \end{cases}$$

i indexes households and *t* indexes time, $y_{i,t-1}$ is the lagged destitution status used to measure state dependence, x_{it} is vector of explanatory variables, α_i is unobserved individual-specific time-invariant heterogeneity effect, $u_{it} \sim iid\ N(0\ \sigma_u^2)$ is the error terms. The parameter γ represents true state dependence whereby household destitution in the past can influence the persistence of the present destitution; and β is a set of associated parameters to be estimated.

The presence of unobserved heterogeneity and the presence of past value of destitution status results an initial conditions problem. This might happened since the start of the initial panel wave did not correspond with the start of the stochastic process generating households' destitution status. The households in the data existed before the initial panel wave might already have been at risk of destitution. Thus, the earlier history of destitution might cause destitution in the initial period apart from some unobserved characteristics. For an initial condition problem, literature suggests either modelling of the initial response jointly with the subsequent response as proposed by Heckman (1981) or conditioning on the response at the initial period y_{i0} as proposed Wooldridge (2012). This study employed modelling of unobserved effects through the inclusion of the values of the time-varying explanatory variables at each period and their within-unit averages in the model following Grotti and Cutuli (2018).

Assuming unobserved heterogeneity is captured by C_i, the lagged value of destitution represents genuine state dependence. The unit specific unobserved effect C_i can be written as follows:

$$C_i = \alpha_0 + \alpha_1 y_{i0} + \bar{z}_i\ \alpha_2 + \bar{z}_{i0}\ \alpha_3 + \alpha_i$$

Where, y_{i0} and Z_{i0} refer the initial value of destitution and time-varying explanatory variables respectively, $\bar{z}_i = 1/T \sum_{i=0}^{T} z_{it}$ stands for the within-unit averages of the explanatory variables where the averages are based on all period's t = 0 ... T. Lastly, α_i is a unit-specific time-constant error term normally distributed with mean 0 and variance σ_α^2.

5.3. Results and discussions

5.3.1. Descriptive statistics

Table 5.2 reported the data on livelihood resources, subsistence needs, strategies pursued by different households, shocks exposure, and the general condition households' face while reconstructing livelihood. Literacy is an intangible asset that contributes to upward trajectories out of destitution. It remains limited and even more so amongst the destitute. While education is necessary for alleviating destitution, so, too, are demographic changes. The result shows that the incidence is higher for large households and households headed by females and young. It is worth reminding that the mean age of the household head for the non-destitute is higher than destitute of all survey rounds. The common assumption that the poorest possess high dependency ratios also holds. It also consistently rose over across survey years. The non-destitute households are predominantly female-headed. One in four households headed by a female (26.3%) is non-destitute, while nearly one in five female-headed (20%) is destitute.

Household resources endowments also play a vital role in reducing the risk of destitution. Being resource-constrained is a defining feature of destitution. Nevertheless, the non-destitute households own substantially fewer land and livestock asset bases than the destitute. The average size of cultivated land is nearly half a hectare for rural households in 2011/12 and 2015/16. The non-destitute own less land than the destitute, but land fragmentation is stern among the latter. They also lose control of half their land through renting or sharecropping it out. Access to credit and irrigation is also central to improving the quantity of output. Less than 10% of the households accessed irrigation facilities. The proportion of households who accessed irrigation facilities is very insignificant. More than three-quarters of the rural households could not get credit across the survey rounds.

The classification of households as destitute or non-destitute is validated by supporting evidence that our destitute can meet their subsistence needs than households classified as non-destitute. Household activities reduce the likelihood of impoverishment into destitution. The risk of destitution reduces due to a higher share of non-farm income. However, those who took part in wage labor are higher among the destitute than the non-destitute.

While many household characteristics and resources provide different drivers of trajectories, these tangible and intangible assets may break down in the face of shocks. The poorest households in Ethiopia face productive asset constraints which inhibit their ability to construct viable livelihoods and leave them highly vulnerable to shocks. We have found repeated exposure to rainfall variability and other covariate shocks to cause a multifaceted problem.

Covariate shocks are the principal source of destitution. Destitution is likely to become increasingly common as price production-related and climate-induced shocks spread throughout rural Ethiopia. Households that come upon drought, flood, conflict, input price hikes, and crop failure are at serious risk of becoming destitute. Almost as severe are the idiosyncratic shocks exposure such as loss of adult males because of death and illness that impose devastating costs of caring on the household and deprive them of scarce productive labor. Household resilience capacities, derived from measures taken to protect against shocks, are significantly different between 2011/12 and 2015/16.

Table 5.2: The mean comparison tests by survey year and destitution status

	Survey year		test	Destitution status		test
	2011/12	2015/16	statistics	Destitute	Non destitute	statistics
Age of household head	46.71	46.22	1.0761	45.39	47.04	3.4866***
Household size	4.336	5.296	-14.74***	5.429	4.904	-8.8063***
Dependency ratio	0.816	1.117	-11.81***	1.082	0.999	-3.5586***
Female heads (Yes = 1)	0.239	0.237	0.0418	0.198	0.263	35.283***
Share of nonfarm income (%)	0.266	0.289	-2.179**	0.282	0.291	0.9919
Wage labor participation (Yes = 1)	0.110	0.116	-0.5967	0.128	0.107	6.5410**
Education (Literate = 1)	0.318	0.338	2.1155	0.389	0.289	69.84***
Livestock owned (TLU)	4.783	4.405	1.9888**	4.780	4.589	-1.0968
Number of plowing oxen	0.922	0.924	-0.0613	0.955	0.901	-1.7911*
Size of cultivated land (Hectare)	0.438	0.619	-3.9208***	0.563	0.499	-1.6557*
Number of farm plots	8.529	8.333	1.0011	8.566	8.445	-0.6868
Distance to the market (Km)	40.95	41.03	-0.0756	73.545	67.772	-4.4122***
Distance to the town (Km)	69.59	69.56	0.0193	42.085	40.492	-1.8817*
Access to credit (Yes = 1)	0.239	0.247	0.3721	0.225	0.242	2.4752
Access to irrigation (Yes = 1)	0.084	0.090	0.5969	0.091	0.087	0.3034
Rainfall variability	104.3	104.7	-0.4370	104.98	104.55	-0.5596
Drought (Yes = 1)	0.165	0.189	5.0427**	0.179	0.185	0.366
Flood (Yes = 1)	0.103	0.125	5.6521**	0.112	0.126	2.8997*
Conflict (Yes = 1)	0.008	0.011	1.0530	0.008	0.009	0.0019
Input price hikes (Yes = 1)	0.239	0.187	19.0281***	0.193	0.179	1.9643
Crop failure (Yes = 1)	0.203	0.345	119.94***	0.242	0.219	4.1739**
Death of household member (Yes = 1)	0.026	0.016	5.3518**	0.024	0.023	0.2624

Note: *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.10$

5.3.2. Resilience information pack

We found the mean resilience capacity index to be 0.414. The score has recorded a very slight growth over the survey period. Figure 5.1 presents non-parametric kernel density estimates of resilience distributions among regions over time. It shows more relatively comparable levels of resilience, meaning that there are no extreme differences among households. It reveals a clear distinction in distributions of resilience between the four most populated regions and Others. However, Oromia, SNNP, and Amhara seem to have more relatively similar levels of resilience. Nevertheless, every region has achieved slight growth in resilience over time.

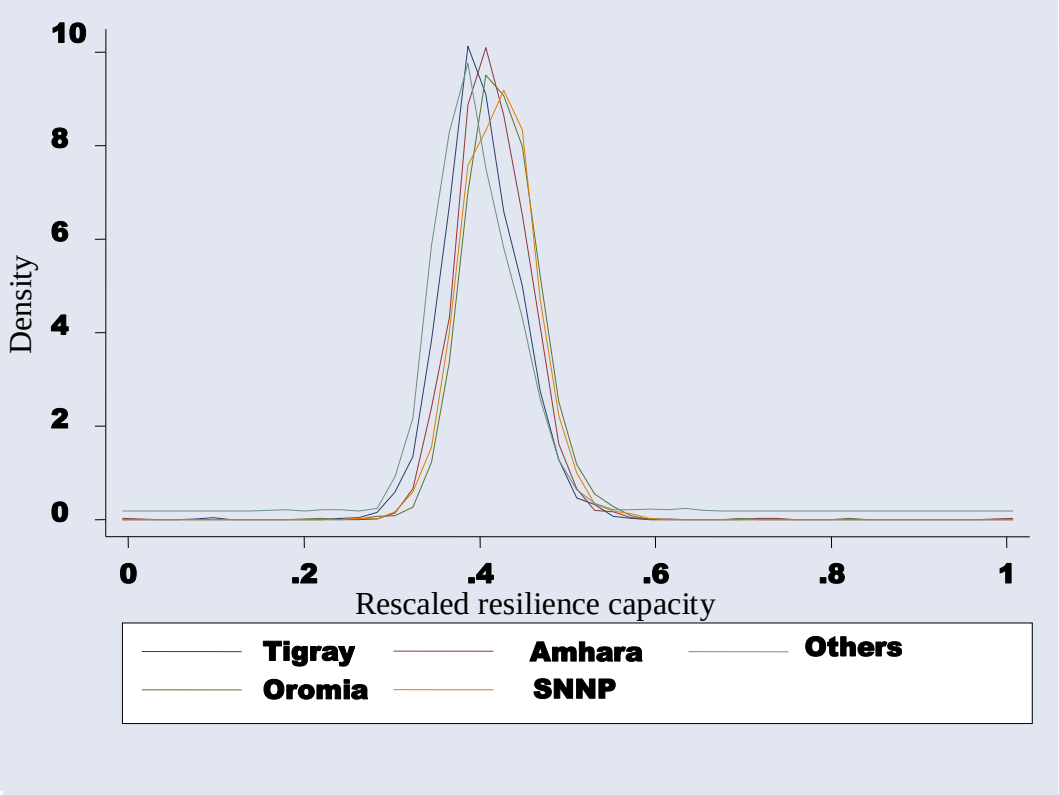


Figure 5.3: Kernel density estimates of RCI

Figure 5.2 indicated resilience persistence disaggregated among regions. Nationally, the proportion of households who were least resilient throughout the survey period consists of 40%. However, only 10.3% of households were always the most resilient. The remaining households experience at least once (30.06%) and twice (19.54%) across all waves. Regionally, about 33% of households in other categories, more than 26% in SNNP, 17% in Oromia, 15.9% in Amhara, and only 7.5% in Tigray were consistently non-resilient in all rounds, while 58.2%, 28%, and 13.4% respectively for others, Amhara and Tigray were consistently resilient.

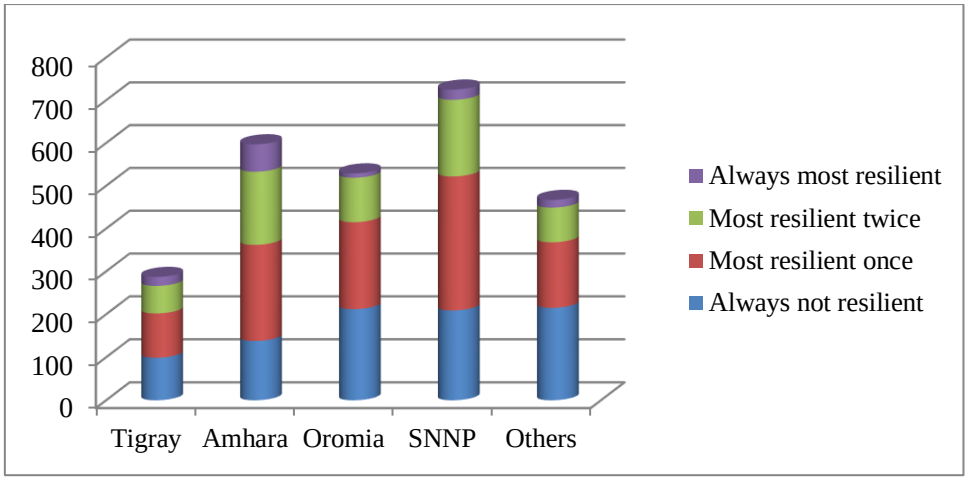


Figure 5.4: Resilience persistence (2011/12 – 15/16)

5.3.3. Spatiotemporal patterns of destitution in rural Ethiopia

5.3.3.1. Spatial distribution

Table 5.3 depicts the spatial distribution of the destitution indices among regions in Ethiopia. The figure also exhibits the relative contribution of regional destitution indices to the national score. The first three rows show the contributions of each subgroup of the population to the overall index and sub-indices. These values are constructed by dividing the weighted measures of each sub-group by the general index, with weights given by the related population share. The last row shows the related population shares. When we consider destitution among regions, an even starker pattern emerges during all periods. The magnitude of destitution was overwhelmingly higher in Oromia (36.4%) and SNNP (33%) than the Tigray (29.3%) and Amhara (27.7%). The substantially higher score is because of the higher deprivation levels of health, the standard of living, and education, respectively, in the rural areas of Ethiopia.

Table 5.3: Decomposition of destitution and its partial indices among regions

	Tigray	Amhara	Oromia	SNNP	Others
H	0.293	0.277	0.364	0.330	0.304
A	0.569	0.556	0.571	0.563	0.566
M_0	0.167	0.154	0.208	0.186	0.172
Population share	0.113	0.237	0.200	0.261	0.189

Dimensional analyses are vital and motivating because any reduction in dimensional deprivation will certainly reduce M_0. To understand what matters more in destitution index assessment, Table 5.4 shows the regionally disaggregated contribution of each dimension and pillar to the general index. Results show that the quality of education (46%), followed by

standard of living (34.6%) and health (19.4%) appears to be the most important contributor. Despite a similar trend of dimensional contributions, there is a notable difference for indicators where school attendance (25.3%) is the highest provider followed by years of schooling (20.7%) and child mortality (12.5%). In contrast, the contributions of improved waters (0.8%) and (0.2%) flooring made have shown non-significant changes. The results suggest that destitution is more associated with poor literacy and health systems.

Table 5.4: Contribution of each dimension and indicator for M_0

	Tigray	Amhara	Oromia	SNNP	Others	Total
Education	0.428	0.456	0.459	0.475	0.463	0.460
Years of schooling	0.187	0.213	0.195	0.212	0.220	0.207
School attendance	0.241	0.243	0.264	0.263	0.243	0.253
Health	0.219	0.201	0.191	0.185	0.185	0.194
Child mortality	0.136	0.132	0.126	0.110	0.130	0.125
Nutrition	0.083	0.069	0.065	0.075	0.055	0.069
Standard of living	0.352	0.343	0.3501	0.339	0.352	0.346
Electricity	0.091	0.092	0.091	0.094	0.086	0.091
Improved sanitation	0.094	0.100	0.096	0.097	0.096	0.097
Improved waters	0.007	0.007	0.011	0.005	0.011	0.008
Flooring made	0.006	0.002	0.0001	0.002	0.004	0.002
Cooking fuel	0.097	0.099	0.097	0.098	0.098	0.098
Asset ownership	0.057	0.043	0.055	0.043	0.057	0.050
Total	1.000	1.000	1.000	1.000	1.000	1.000

5.3.3.2. Temporal distribution

Table 5.5 presents the regionally-decomposed annualized absolute and relative rates of change in the headcount, intensity of deprivations, and censored headcount index over time. The proportion of multidimensionally destitute in Tigray, Amhara, and SNNP get worsened by 4.4%, 3.5%, and 3.9%. In contrast, Oromia and Others recorded a small decline in the censored headcount index by 1.1% and 1.8%. Overall, Amhara is identified as the severely destitute region with 19.3% in 2015/16. The intensity of deprivation shows a lot of variation in the incremental changes in 2015/16 compared to the period. Some regions showed progress while the remaining revealed deterioration. SNNP and Others showed a substantial decline of 2.4% and 1.1%. Destitution dropped by 4.4%, 0.7%, and 0.5% in SNNP, Tigray, and Amhara while Oromia and Others deteriorated by 4.6% and 1%.

The absolute and relative rate also reported changes (increases or decreases) in destitution and its partial indices across two time periods in Table 5.5. The highest reduction is achieved in SNNP (5.8% and 14.4%) followed by Tigray (0.3% and 0.9%) and Amhara (0.3% and 1%)

regions. Significant deterioration in absolute and relative terms has happened in Oromia and Others regions. The intensity of deprivation of the multidimensionally destitute worsened in absolute and relative terms in all regions except Others. The set of deprivations that poor households in SNNP, Tigray, Amhara, and Oromia could have experienced has been eradicated by 2.9%, 1.7%, 1.2%, and 0.8%. In relative terms, reductions in intensity were very strong in SNNP (4.9%), Tigray (2.9), Amhara (2.1%), and Oromia (1.4%) showing the important progress made to reduce the share of hardships experienced by those who are destitute. The intensity of deprivation in the Others region is deteriorated by 0.7% and 0.4% in absolute and relative terms. We have seen a similar trend of the annualized relative and absolute rate of changes. SNNP followed by Tigray and Amhara showed relatively higher reduction shifts while Oromia and Others show deterioration from 1% to 4.6% in absolute and 4.3% to 26.1% in relative shifts.

Table 5.5: Changes in headcount, intensity, and censored headcount in Ethiopia

				Annualized rate of change	
	2011/12	2013/14	2015/16	Absolute	Relative
Destitution headcount ratio					
Tigray	0.318	0.247	0.315	-0.003	-0.9%
Amhara	0.304	0.226	0.301	-0.003	-0.1%
Oromia	0.395	0.278	0.418	0.023	5.8%
SNNP	0.402	0.243	0.344	-0.058	-14.4%
Others	0.309	0.217	0.387	0.078	25.2%
Intensity of destitution					
Tigray	0.582	0.565	0.565	-0.017	-2.9%
Amhara	0.563	0.553	0.551	-0.012	-2.1%
Oromia	0.582	0.554	0.574	-0.008	-1.4%
SNNP	0.587	0.543	0.558	-0.029	-4.9%
Others	0.570	0.574	0.574	0.004	0.7%
Censored headcount index					
Tigray	0.185	0.139	0.178	-0.007	-3.8%
Amhara	0.171	0.125	0.166	-0.005	-2.9%
Oromia	0.230	0.154	0.240	0.010	4.3%
SNNP	0.236	0.132	0.192	-0.044	-18.6%
Others	0.176	0.119	0.222	0.046	26.1%

The spider diagram in Figure 5.3 portrayed the share of each indicator on the extent of deprivations in rural Ethiopia. Generally, the standard of living takes the highest deprivation, followed by health and education. The trend continued across all rounds in a similar fashion. To get poverty to zero, looking at the indicators has paramount importance in designing and implementing the right policies. The country slightly improved school enrollment and years of schooling in the educational dimension, while adult illiteracy remains consistently high over

the survey period. On the other hand, child malnutrition and mortality steadily declines and contributes a lot in the fight against destitution. We exhibits the highest-burden of destitution in the standard of living dimension due to asset deprivation and poor rural technology and cooking fuel use that corroborates with Diwakar (2016). The World Bank (2015) also confirmed that 6 out of 10 rural households still do not have improved water sources.

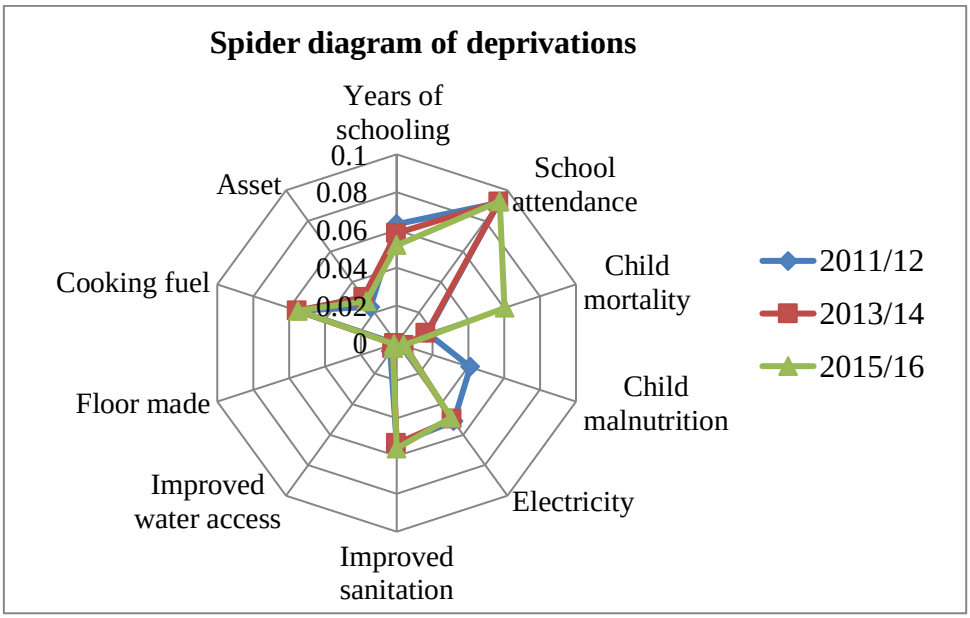


Figure 5.3: Contribution of each indicator in destitution

Table 6 depicts the contributions of indicators and dimensions to destitution over time. The highest fluctuations in the deprived level of education and health characterize the temporal trends in the magnitude of destitution, followed by standard of living and health. Deprivation levels varied significantly over the survey period. The trends in the change in the deprivation levels are inconsistent. The contribution of education declined by 2.6% whilst health and standard of living intensified by 1.4% and 1.1%. The adjusted headcount ratio shows that years of schooling and school attendance took the highest ranks in terms of contribution over the survey period. The part from malnutrition steadily declined over time, whereas child mortality aggravated.

Table 5.6: Contribution of each dimension and indicator to M_0

	2011/12	2013/14	2015/16
Education	0.451	0.525	0.425
Years of schooling	0.212	0.248	0.175
School attendance	0.239	0.278	0.251
Health	0.211	0.119	0.225
Child mortality	0.061	0.091	0.211
Malnutrition	0.150	0.027	0.014
Standard of living	0.338	0.356	0.349
Electricity	0.091	0.095	0.089
Improved sanitation	0.094	0.100	0.099
Improved waters	0.011	0.007	0.006
Flooring made	0.002	0.002	0.003
Cooking fuel	0.096	0.101	0.098
Asset ownership	0.045	0.052	0.054

5.3.3.3. Robustness of destitution estimates

We begin our robustness analysis by assessing dominance with respect to changes in the destitution cut-off. Alkire and Foster (2011) developed the conditions for M_0 orderings across k values, based on the vectors of weighted attainments. We test the robustness of dominance relationships among regions to the selection of the k destitution cut-off within a range of admissible values, in this case between k = 0.1 and k = 0.8. The selection of 0.333 as a cut-off captures those who do not meet minimum agreed standards in multiple indicators of basic functioning simultaneously. The normative argument for the lower bound is that while a household may have one shortfall of indicator, it is more likely that households with multiple deprivations are destitute. Indicators may be inaccurate proxies for deprivation occasionally. On the other extreme, the cut-offs above 0.4 can be considered excessively demanding.

The dominance relations among the regions to test the sensitivity of the destitution index to different cut-offs, are shown in Figure 5.4. Each curve shows the destitution level among the regions when k is varied. If a curve lies below or above another curve, we can say a dominance relation exists between the two states. When two curves cross each other, there is no clear dominance. The result shows that regardless of k-values, rankings for all regions are stable at both maximum and minimum values of M_0. The estimates of M_0 declined with an increase in the destitution cut-off. The result suggests that the rankings are highly robust to the changes in the destitution cut-offs.

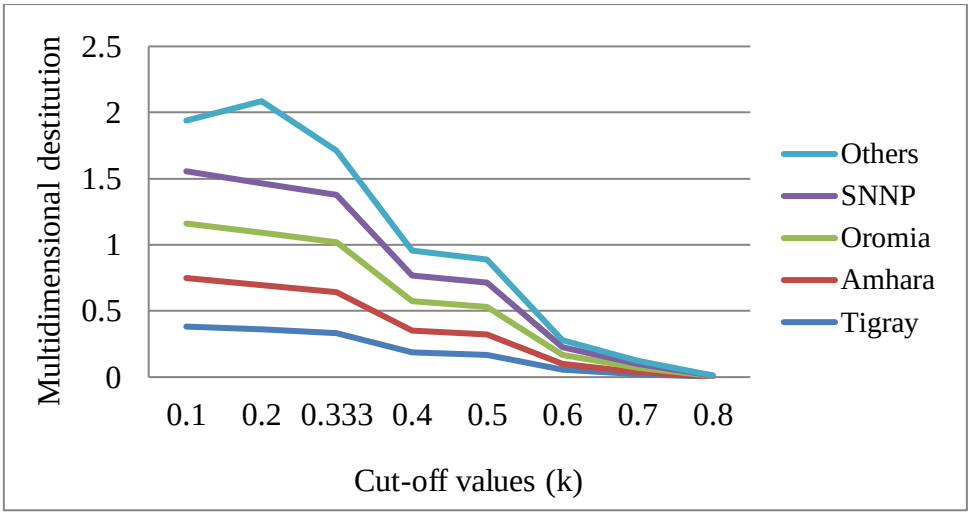


Figure 5.4: M_0 comparisons as the cut-off k varies among regions

5.3.4. Econometric results

5.3.4.1. The role of resilience on destitution in the presence of shocks

Rural households are subject to several shocks. In Table 5.7, we present the results of the panel probit model. The empirical analysis reveals a significant effect of rainfall variability in exacerbating destitution. This is because rainfall variability heightens destitution through multiple channels in developing countries. It has direct and indirect effects on agricultural incomes and thus can harm food security (Demeke et al., 2011). The adverse effect on crop yields, income, and food, specifically on the asset poor, deteriorates the welfare of rural households (Boansi et al., 2021). Rainfall shock leads to persistent multidimensional poverty and poverty traps.

Our findings confirmed the sturdy adverse effects of flooding, conflict, input price hikes, and production shocks on destitution in rural Ethiopia. The finding corroborates shreds of evidence (Woodson et al., 2016; Smith and Frankenberger, 2015). The country is often affected by climate shocks, with severe droughts followed by heavy floods expected to become a norm. Shocks ultimately reduce the amount of land used for agriculture and decrease crop productivity (Dimitrova, 2021; Gebrechorkos et al., 2020; Borgomeo et al., 2018). The lowlands are more susceptible to flooding caused by river overflows (Melketo et al., 2021). Climate shocks exacerbate disease outbreaks and infestations of crops, insects, and pets. Since the water becomes contaminated due to compromised sanitation facilities and the difficulty of maintaining hygienic, floods often speed up the spread of cholera. Following certain months of eking out to survive, rural households faced formidable challenges of heavy rain. This

ultimately causes a range of adverse consequences such as losses in incomes, crops, and livestock, a decline in per capita consumption, social instability, and eventually obliterates asset gains poor households attain.

The linkage between resilience capacity and destitution is negative and statistically significant. This implies that higher asset endowments, adaptive capacity, social safety nets, and access to social services better protect destitution. Promoting interventions that build resilience capacities in smallholder farming communities is paramount for protecting destitution. Table 5.7 also shows the mediating role of resilience capacities between shocks and destitution. Resilience capacity and annual rainfall variability interaction terms are negative and significant. This could show that the total effect of resilience on destitution might be lower as annual rainfall variability intensifies. This implies that enhancing resilience capacity imminently protects destitution in the presence of rainfall shocks.

The share of non-farm income correlates negatively and significantly with destitution. Non-farm economic activities are a growing and vital source of income for reducing destitution in rural households. Some people escape destitution by successfully resorting to non-farm activities to gain resources they can invest in assets. There is also a significant and positive relationship between credit and distance to the market and towns with destitution. The linkages between credit and destitution in rural areas are complex. Failure to repay loans is a chronic factor that saps financial resilience, while the onset of a high debt repayment schedule can trigger acute causes of destitution. Loans often taken for agricultural inputs combined with crop failures cause indebtedness, forcing households to sell productive assets, becoming destitute. Trading is an escape route out of destitution. Those living close to towns and markets strengthen their resilience capacity consistent with (McManus et al., 2012) over time as we may fully integrate them into the market and the non-farm economy.

Dependency ratio and female headship in intensifying destitution are also nontrivial. There was a higher chance of being destitute if a household had a higher dependency ratio. As the number of economically non-active member increases, there would be less expenditure on education and healthcare services to satisfy the basic needs of survival. Results show a higher prevalence of destitution in households headed by females substantiating (Espinoza-Delgado and Klasen, 2018). Literacy of the head is significantly and negatively associated with the likelihood of being destitute, as it opens up opportunities to create potential pathways for reducing poverty confirmed by (Hanjra et al., 2009).

Table 5.7: Random effect probit estimates (multidimensional destitution)

	Coef.	Std. Err.
Resilience capacity	-1.2993**	0.6563
Rainfall variability	0.2273***	0.0404
Drought	-0.0426	0.4060
Flooding	0.0002**	0.0001
Conflict	0.0193***	0.0066
Input price hikes	0.0009**	0.0005
Death of a household member	0.5826	0.3993
Production shock	0.1063***	0.0102
Household size	-0.0615	0.0973
Dependency ratio	0.0784*	0.0421
Female household head	0.1188**	0.0565
Education	-0.0010**	0.0005
Irrigation	-0.0811*	0.0467
Oxen number	-0.0290	0.0180
Share of non-farm income	-0.0497**	0.0225
Distance to the market	0.0013***	0.0004
Distance to the towns	0.0775**	0.0383
Access to credit	0.1510**	0.0617
Resilience capacity * Drought	0.3753	1.5466
Resilience capacity * Rainfall variability	-0.0044***	0.0016
Resilience capacity * Conflict	-1.5726	1.4936
Constants	-1.4639***	0.2468
/lnsig2u	-0.9415	0.1105
sigma_u	0.6245	0.0345
Rho	0.2806	0.0223

Note: *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.10$

5.3.4.2. Effect of shocks and resilience on vulnerability to destitution

Table 5.8 provides the fixed effect ordered logit model estimates of the linkages between shocks and resilience capacities on vulnerability to destitution. The output shows that the algorithm for maximizing the log-conditional likelihood converged after three steps. The ordered dependent variable has three categories, so two different dichotomizations are possible. All variables are jointly statistically significant, as revealed by the Wald test.

Exposure to concurrent and recurrent shocks is a pernicious phenomenon in rural Ethiopia. The finding also revealed that rainfall variability, input price hikes, drought, and production shocks

exacerbate vulnerability to destitution. Covariate shocks are more virulent than idiosyncratic ones (Dercon et al., 2005). Rainfall shocks are one of the major shocks driving the welfare problems in developing countries. The result also confirmed that vulnerability is almost an inevitable result of rainfall variability and drought under which farmers struggle daily to make a living. Shocks exacerbate destitution by way of reduced education, labor market participation, and agricultural output that subsequently drive a decline in incomes and consumption (Ngoma et al., 2019). They compromise the abilities to develop households' stock of wealth and stifle them to use it effectively to sustain improvements in their lives. As a result, they lack the required assets to convert into income requirements. When prolonged, shocks result in a downward spiral of asset loss and impoverishment that ultimately limit years of development gains and efforts to eradicate welfare problems (Campos et al., 2014).

In contrast, households with a greater resilience capacity tend to be less vulnerable due to their higher assets endowments, access to basic services, social safety nets, and adaptive capacity. There still remains the potential for farming to be an integral part in the process of reducing vulnerability to destitution. The potential has to be unlocked through commercialization, extension and irrigation. The result also evidence their redeeming abilities against vulnerability to destitution. The findings indicate that the farmers highly integrated to the market, get better skill on price of product and appropriate information to produce market-based products and makes better welfare outcomes. The role of agricultural extension and irrigation services on vulnerability to destitution are also positive. Holding all else constant, better extension and irrigation services are less vulnerable because they meet the requirements of smallholder farmers and improve their farming practices and livelihoods (Gebrekidan and Bizuneh, 2021).

Since the sector is fraught with shocks and less remunerative (Dagunga et al., 2020), the non-farm economy is associated with reduced vulnerability to destitution. The results also revealed that a better share of the non-farm income have a negative and significant impact. A better share of the non-farm economy signifies a strong rural economy because of the greater share of casual laborers' access to formal jobs and enhanced productive asset base. This provides strong evidence for the argument that vulnerable households diversify their livelihood activities as a risk management strategy, and to supplement their inadequate harvests. The finding also shows that wage labor participation has a significant impact on reducing vulnerability to destitution. This highlights the significance of non-formal employment in rural areas, as distinct from more transient farming income sources.

Table 5.8: Fixed effect ordered logit estimates

	Coef.	Robust Std. Err.	Odds Ratio	Robust Std. Err.
Resilience capacity	-0.117***	0.019	0.890***	0.017
Rainfall variability	0.271**	0.113	1.312**	0.149
Drought	0.248***	0.033	1.281***	0.042
Input price hikes	0.250***	0.096	1.285***	0.123
Conflict	0.001	0.002	1.001	0.002
Production shock	0.231***	0.075	1.260***	0.095
Number of idiosyncratic shocks	0.004	0.005	1.004	0.005
Age of household head	0.004	0.002	1.004	0.002
Female headship	0.065	0.071	1.068	0.076
Household size	0.138	0.088	1.148	0.101
Commercialization	-0.416***	0.064	0.660***	0.042
Share of non-farm income	-0.009***	0.002	0.991***	0.002
Wage labor participation	-0.217***	0.081	0.805***	0.065
Irrigation	-0.179**	0.077	0.836**	0.065
Extension	-0.140***	0.050	0.869***	0.043
Observations	7125		7125	

Note: *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.10$

5.3.4.3. State dependence of multidimensional destitution

Table 5.9 depicted model estimates of the dynamics of multidimensional destitution. The first coefficient, lagged destitution, is the lagged value of the dependent variable capturing genuine state dependence. Once controlled for the initial condition and the role of unobserved heterogeneity, the estimated lag dependent effect or true state dependence is significant. The positive coefficient of the lagged destitution indicates the presence of significant dynamics of genuine state dependence. This means that the households who were destitute during the preceding year have a higher probability of staying destitute than the household who was non-destitute the previous year. The past experience was connected to the status of destitution in the future. The finding is consistent with a study in Ethiopia by Tefera et al (2017).

The reports of the coefficients for control variables, as expected, indicated that households with large size and subjected to covariate shocks are more prone to experience destitution, while households with better resilience capacity and land quality significantly insulate themselves against destitution. Next, we observed the set of coefficients of variables capturing unobserved heterogeneity: the initial value and the within-unit averages of time-varying explanatory

variables. Here we find out a statistically significant and substantial positive effect of the initial value of multidimensional destitution, household size and idiosyncratic shocks and within unit averages of the household size and exposure to a number of covariate shocks.. This indicates that these characteristics are correlated with unobserved factors positively associated with destitution. However, initial values of share of non-farm income and within unit averages of resilience capacity and land quality index have significant negative effects.

Table 5.9: Dynamic random effect probit model estimates

	Coef.	Std. Err.
Lagged multidimensional destitution	0.213***	0.048
Initial multidimensional destitution	-0.148***	0.037
Resilience capacity	-15.89***	0.856
Household size	0.255***	0.020
Share of non-farm income	-0.052	0.053
Land quality index	-0.021***	0.002
Covariate shocks	0.004***	0.001
Idiosyncratic shock	0.0314	0.032
Resilience capacity__0	-0.182	0.754
Household size__0	0.046**	0.021
Share of non-farm income __0	-0.121*	0.065
Land quality index __0	-0.014	0.013
Covariate shocks__0	0.009	0.023
Idiosyncratic shock__0	0.071**	0.035
m__ Resilience capacity	-11.63***	1.396
m__ Household size	0.011***	0.002
m__ Land quality index	-0.081***	0.030
m__ Share of non-farm income	0.130	0.086
m__ Covariate shocks	0.369**	0.143
m__ Idiosyncratic shock	0.029	0.088
Constants	5.679***	0.311
/lnsig2u	-1.616	0.225
Sigma_u	0.446	0.050
Rho	0.166	0.031

Note: *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.10$

5.4. Conclusions

This paper examines the effect of shocks on destitution and vulnerability to destitution, and the role of resilience as a mechanism between shocks and destitution in rural Ethiopia. The results are sobering when looking at the spatial heterogeneity and temporal shifts of destitution. We detect a profound divide among the destitute. The result revealed that destitution falls asymmetrically among regions. This is because the distribution of shocks finds out a large spatial heterogeneity with the highly vulnerable regions belonging to have more destitute. Progresses in SNNP, Amhara, and Tigray regions drove brawny national contribution in destitution reduction. However, destitution gets exacerbated because of Oromia and Other regions. This is because the destitute face resource constraints of all kinds, which inhibit their ability to construct viable livelihoods and leave them highly vulnerable to shocks that, could push them over the edge. Likewise, reductions in the incidence and intensity of destitution have been awkward and uneven among regions. The intensity of deprivation has gradually declined in all regions, except Others. With joint deprivations, a staggeringly high proportion of the destitute is deprived concurrently of education and standard of living.

We find strong state dependence on multidimensional destitution in rural Ethiopia. A household that is destitute in any given period is more likely to be destitute in the subsequent period. This provides evidence of the presence of destitution trap, an equilibrium level of destitution that is difficult to exit from without external interventions. The result revealed that exposure to shocks such as rainfall variability, flooding, conflict, drought, input price hikes, and production shocks exacerbate destitution. The other strand of challenge that contributes to the growing destitution and vulnerability to destitution is dependence on rain-fed farming, accompanied with inadequate rural infrastructure, weak markets, few non-farm employment opportunities, and constrained access to agricultural inputs. Farming on its own does not lift households out of destitution. Already risky, shocks that lead to further impoverishment and lower profitability of agriculture worsen the farming practices. Households subject to female headship and high dependency ratio are more likely to fall into destitution. Rural households can also be at risk of destitution when they can access loans because of a short period of repayment. Failure to repay loans is a chronic factor that debilitates resilience, while the onset of a high debt repayment schedule can trigger acute causes of destitution.

In contrast, we found that resilience capacity had a savior role and mediates the effect of shocks on destitution. The evidence supports the notion that some households escape destitution and

vulnerability to destitution by successfully resorting to strategies that enhance resilience capacity in the presence of shocks. Farming lifts many people out of destitution and vulnerability to destitution. This can be done through improving access to modern agricultural inputs, public investment in extension services and small-scale irrigation, and human capital formation. Furthermore, an important source of protection from vulnerability to destitution stems from growth in the share of non-farm income, wage labor participation, and traditional social support networks.

Our analysis sheds light on some important policy implications. First, the spatial disparity highlights the need for strategies to overcome destitution designed using a territorial approach. Regionally disaggregated policies that consider the heterogeneity are urged to improve social convergence to minimums.

Second, plenty of emphasis, a substantial budget, and policies are offered for agriculture. However, the sector is fraught with shocks. It is not also remunerative to lift households out of destitution and vulnerability to destitution. Since dependence on rain-fed agriculture exposes smallholders to repeated shocks, investing in irrigation and extension as a palliative response to solve the underlying problem opens up the prospect of reducing destitution and vulnerability. Investing in human capital formation should not be overlooked.

Third, farmland is diminishing, so a complementary pathway out of destitution to agriculture is increasingly needed. The emerging sustainable line of inquiry to mitigate shocks and improve household welfare highlighted the crucial role of resilience capacity. Greater non-farm income through diversification of economic activities has played a significant role in ensuring escape from destitution. Fighting destitution reduction demands multifaceted and complementary support to farming and the rural non-farm economy. Therefore, the findings strongly suggest that proximity to towns and markets provides a clear route out of destitution. Investment in rural infrastructure and migration out of agriculture yield a faster pace of sustained escape out of destitution. Urbanization is essential alongside human capital development to ensure that no one is left behind. To have a far-reaching impact on reducing destitution both safety and cargo-net policies must be implemented.

Chapter 6: Synthesis: Recapitulation, Major Findings, Policy Implications, and Caveats and Future Research

6.1. Recapitulation

The challenges to ending extreme poverty and eliminating hunger, food insecurity, and all forms of malnutrition keep growing. Destitution is also of great concern. The world embraced the SDGs' targets to eradicate them at the end of 2030. Therefore, numerous countries and governments adopted these declarations and mainstream them in their national policies, plans and strategies. To that end, many developing countries substantially reduce those welfare problems. However, the pattern is uneven, and SSA reflects a disappointing pattern. The region still harbors a significant share of its population living in extreme poverty, food and nutrition insecurity, and destitution. And it is also projected that these welfare problems increasingly remain potent.

A growing proportion of households in rural Ethiopia fail to make a viable living without large-scale humanitarian assistance, even in relatively good harvest years. Although the country has exhibited rapid economic growth in recent years, the numbers of poor, food and nutrition insecure and destitute remain colossal. Many explanations were found possible for these ostensibly conflicting narratives. Firstly, the difference could be one of the high rates of impoverishment since a significant portion of the population is vulnerable to unabated recurrent and concurrent shocks. A second explanation could be that the different poverty, food and nutrition insecurity and destitution perspectives measure distinctive and non-commensurate aspects which in turn misleads policymaking. The other equally important reason could be that the welfare problems are influenced by a rising and falling tide of those welfare problems in tandem. Therefore, the stock of the poor, food and nutrition insecure, and destitute often reconfigured everywhere.

Due to the growing scale of human suffering brought about by welfare problems, the fight against them via resilience appears an important paradigm over the past two decades. The concept of resilience has emerged as a vanguard in the development lexicon. However, it needs to be embodied in a more rigorous empirical and theoretical framework. In light of this, we contribute to this emerging theme of development research by analyzing the linkages between shocks, resilience, and welfare problems in rural Ethiopia.

Shocks jeopardizing the welfare of rural households in Ethiopia do not come as a surprise as many rely on rain-fed and subsistence agriculture which is subjected to uncertainties. The

official poverty statistics evidenced from household surveys that poverty being sharply fallen since the early 1990s contradicts OPHI's rank of being second from the last (Niger) in the empirical context. Due to the commutative humanitarian crises, relief efforts are on the brink of failure to sustainably reduce welfare problems. Enhancing resilience to fight against welfare problems has gained growing popularity in recent policy discourse. Adapted from food and nutrition insecurity, we tried to make poverty very much at the heart of this discourse. Henceforth, Article 1 examines the role of building resilience in reducing multidimensional poverty and its dynamics in rural Ethiopia. In our understanding, this study is the first to document the role of harmonizing relief and development in curbing multidimensional poverty in developing countries. We also attempted to tests an alternative measure of resilience capacity index to the FAO-RIMA approach.

Eradicating extreme poverty to zero demands an alternative and valid predictor of poverty. Conceptually, numerous studies revealed that assets reflecting the long-term wealth and subjected to less measurement error form a more robust basis for detecting the poor than the conventional measure. Asset poverty is multidimensional and can offer multiple policy solutions for poverty reduction. An accumulating body of empirical evidence strongly underlined the need to have a forward looking and dynamic framework that consistently predicts future poverty. The asset-based poverty measure is an issue in the Ethiopian context that little rigorous work has been done using nationally representative household data. Reformulating poverty analysis explicitly on an asset basis offers advantages to exploring the third generation poverty measures: structural and stochastic poverty. Therefore, Article 2 examines the effect of shocks on structural and stochastic poverty and transitions. It also focuses on resilience capacity as a mechanism for dealing with shock and stochastic and structural poverty.

While poverty reduction is a development objective in many developing countries, food and nutrition insecurity is central in the policy arena. Ending hunger and reducing food and nutrition insecurity are the other SDG targets. Food and nutrition insecurity is often interlinked with poverty and creates a vicious cycle so that efforts are needed to tackle these issues concomitantly. Empirical evidence provides mutually reinforcing pathways to break the vicious cycle of poverty and food and nutrition insecurity. Thus, Article 3 aims to shed light on the linkages between shocks and food and nutrition insecurity and underscore the role of resilience capacity in mediating between shocks and food and nutrition insecurity. It also

highlights how the conceptualization of resilience, which incorporates the combination of access to social services, assets, adaptive capacity, and social safety net dimensions, allows for capturing the wide range of responses and strategies we put in place to respond to shocks.

Poverty in rural Ethiopia fell sharply in the last two decades. However, there is still a formidable core of ultra-poor people. The concerns about how to focus global efforts on the uncounted pockets of poverty remain a mainstay of the debate on SDGs. Therefore, putting an end to the worst forms of poverty as the new development agenda is a growing consensus. The multidimensional poverty measurement approach provides a high-resolution lens to deal with destitution. Article 4, thence, attempts to examine the destitution effect of shocks. We also addressed the conciliating role of resilience capacity between shocks and destitution.

In a nutshell, the analysis builds on the ESS dataset. Four articles employed a nationally representative panel of household data from the Ethiopian Socioeconomic Survey. We also applied a metadata set for quantitative research synthesis. In light of the research inquiry, this chapter synthesizes and discusses the findings of the five self-contained papers constituting the dissertation. It also discusses the studies' contributions to the empirical body of development theories and practices, policy implications and caveats, and additional lessons for future research.

6.2. The major findings

Rural households in Ethiopia are vulnerable to numerous covariate and idiosyncratic shocks. Investigating the welfare impact of these shocks and the savior role of building resilience and agricultural productivity has been essential themes of this dissertation. Therefore, we applied statistical tools, micro-econometric and Meta-regression models to analyze the stated objectives in five self-contained but closely related essays. The studies pursue to introduce readers with the following key findings.

6.2.1. Profiles of welfare problems and resilience

Paving the way to reduce poverty, food and nutrition insecurity, and destitution framed in the context of SGDs that set specific quantitative targets to be achieved within a specified time framework have gained considerable popularity. Profiling these welfare problems therefore play a vital role in understanding the extent of problems and embarking and/or evaluating the strategies and policies. This section deals with exhibiting the extent and distribution of poverty, food and nutrition insecurity, and destitution profiles in different

domains. It also provides a nuanced picture of the dynamics of these welfare problems. Needless to say that monitoring the welfare problem at an aggregated level is imperative because policymakers want to know if the government strategies and policies are helping those in needs. Equally important is the need to disaggregate spatiotemporal patterns and dynamic distribution since cumulative statistics tend to inflate or hide the considerable disparities among regions over time.

Generally, Ethiopia experienced a steady decline in multidimensional poverty in both absolute and relative terms. The highest improvements in headcounts occurred between 2011/12 and 2013/14 than henceforth. The result also reveals that 10.1% of the total possible set of deprivations that poor households in that society could have experienced has been eradicated; 42.9% remains. The relative rate of change between 2011/12 and 20115/16 is 0.238, which tells us that M_0 has gone down by 23.8% compared to the initial level. Noteworthy features of this decomposition are that the incidence contributes more than intensity, likewise, movers probably contributed more than stayers to multidimensional poverty reduction. Furthermore, multidimensional poverty has high inertia.

In contrast, the recent trend in poverty reduction in Ethiopia strongly suggests that the pace of structural and stochastic poverty reduction is weak and lack momentum. These results reveals that structural and stochastic poverty heightened by 3.8% and 0.39% between 2011/12 and 2015/16. Upward mobility was predominantly experienced by the stochastic over the structural ones. However, it is not easy to interpret the percentage decline as they are cheering or disappointing results. The pool of structural and stochastic poverty is constantly refreshed by concurrent ebbs and grows. When zooming in the regional distributions, there is broad heterogeneity in both measures. The inter-regional gap is also enormous. Accordingly, the Tigray region experienced the lowest structural and stochastic poverty. Unfortunately, the current war makes the region emblematic to livelihood crises. The poverty-stricken areas by and large are located in ecologically vulnerable regions with poor living conditions, frequent shocks, lagging economic foundations, poor infrastructure, and inadequate public services.

Food and nutrition insecurity on the other hand experienced steady declines. We juxtapose the alternative measures and compare levels and trends. Nationally and regionally, the results confirm that food insecurity in kilocalorie term is higher than the multidimensional and food poverty approaches. Food insecurity in kilocalorie slightly declined between 2011/12 and 2013/14 and nearly half of them were able to recover subsequently. Multidimensional food

insecurity has reduced much faster than others at the national level. There is also higher inertia of multidimensional food insecurity in that households could not escape once they descend it. The regionally disaggregated values also confirm a significant decline of multidimensional food insecurity in Tigray and Oromia. At the national level, it is evident that food insecurity in multidimensional and food poverty terms reduced much faster than others, almost in parallel trends. Generally, multiple food insecurity measures identified distinct groups that depict limited overlap.

Even though Ethiopia has made cheering momentum in reducing poverty and food and nutrition insecurity, destitution remains high. Quantifying destitution is also charged with conceptual, methodological, and analytical pitfalls. This study therefore adopted the Alkire and Foster methodology to construct destitution. Accordingly, destitution is a significant and deepening phenomenon that remains stagnated over time. There is also a marked geographical disparity and starker pattern in the destitution index during all periods. Destitution is largely driven by living standard dimension. The education dimension still contributed the most to destitution alleviation, which is the most important field that curbs destitution recurrence in the future. There were slight improvements in the destitution only through education dimensions and such indicators as years of schooling, malnutrition, electricity, and improved access to drinking water. The contribution accounts for more than half of the national destitution index. Our analysis also shows that regions with less number of destitute (16.06%) are located in the north (Amhara and Tigray). However, regions with more destitute (19.73% and 17.23%) are distributed in the south (Oromia and SNNP) and Others. A region with a high initial destitution may be able to reduce it in absolute and relative terms much more than the one having a low initial level of destitution. Lastly, almost all regions reduced multidimensional poverty faster than destitutions.

There are good reasons for welcoming the emergence of resilience as a useful concept to capture all possible well-being pathways in the presence of shocks. The resilience capacity index of rural households in the Ethiopia changed over the period, slightly decreasing between 2011/12 and 2013/14 but increasing sensibly between 2013/14 and 2015/16. The SNNP and Oromia regions scored better resilience index across the survey rounds. On the contrary, Others Amhara, and Tigray regions achieved the lowest score. Given colossal regional inequality, attention requires to the pastorals and drought prone areas, where the bulk of poor households are concentrated.

6.2.2. Does resilience matters for multidimensional poverty?

Multidimensional poverty is an economic drain, which we all pay. The arduous task of eliminating extreme poverty in all its forms to zero in Ethiopia, where smallholder farming is the dominant livelihood activity and the source of vulnerability is an overriding objective of the incumbent government. In light of this, Article 1 reveals the causal pathways through which resilience curbs multidimensional poverty. The finding provide evidence that enhancing the resilience of smallholders and their farming systems plays an indispensable role in multidimensional poverty reduction. However, resilience is not a panacea. Commercialization, raising the share of non-farm income, literacy, a household size vindicated with the existence of more economically active members, and saving serves as a hedge against multidimensional poverty. In contrast, the recurrence of multiple idiosyncratic shocks accompanied by credit and renting out land occupies a central place in hindering multidimensional poverty reduction. There is also a genuine state dependence on multidimensional poverty. Therefore, past poverty experience increases the multidimensional poverty risk in the future.

6.2.2. Resilience for structural and stochastic poverty in the presence of shocks

Ending poverty in all forms and shared prosperity demands actions beyond the economic domain. Yet the conventional measures could not portray the starkly different poverty categories. It was therefore vital to apply a forward-looking and dynamic framework that consistently predicts future poverty. Thence, we reformulate poverty analysis that explicitly integrate monetary and asset basis to address the structural and stochastic poverty transitions. Structural and stochastic approaches thus have considerable potential to contribute to a profound understanding of poverty processes and in helping formulate targeted poverty reduction strategies. Article 2, thus, scrutinizes the effect of shocks on structural and stochastic poverty, transitions, and the role of resilience as a mechanism for dealing with shock and stochastic and structural poverty. The study finds evidence that experiencing shocks have damaging impacts on structural and stochastic poverty. In contrast, we revealed that resilience curbs structural and stochastic poverty as idiosyncratic and covariate shocks intensified. Besides, access to irrigation, literacy, good vegetation cover and non-farm economic activities augment structural and stochastic poverty reduction. Identifying drivers and interrupters also refine the understanding of the causes of ascent and descent of structural and stochastic poverty which is crucial for designing more effective policy interventions. Therefore, the underlying poverty transition patterns also evidenced that rainfall variability, drought, conflict, input, and

output price volatility, and idiosyncratic shocks are principal drivers and interrupters of structural and stochastic poverty.

6.2.3. Food and nutrition security effects of resilience

Food and nutrition insecurity are often interlinked with poverty, creating a vicious cycle with each fueling the other. Achieving food and nutrition security for all is an ever-growing challenge in rural Ethiopia and has remained a more fundamental policy concern. The vulnerability of rural households in the context of shock has long been highlighted. Shocks are the major impediments to food and nutrition security efforts. Idiosyncratic and covariate shocks have adverse effects because of the presence of hysteresis that generates indiscriminating or differential rates of recovery. The links between resilience, food, and nutrition security seem therefore easy enough to draw. Yet the resilience discourse in this area is also relatively vague and shifting, and faces significant scarcity in empirics. The distortionary effects of redemptive interventions' potential gain accompanied by the malign impacts of shock necessitate a more systematic and integrative approach. Given this, Article 3 posits that the hypothesis serves the main added-value of using resilience as an integrative nature worth protecting food and nutrition security loss and fostering recovery. Furthermore, resilience is positively related to future food and nutrition security outcomes, decreasing the probability of suffering a future food and nutrition security loss and facilitating recovery after the loss instances. These results are robust to the model specifications. The resilience capacity index mitigates the negative impact of idiosyncratic and covariate shocks. The findings evidenced the savior role of resilience capacity in reducing the likelihood of suffering food security loss and facilitating recovery. We also found that literacy, access to irrigation, and growth in the share of non-farm income have potentially diversified diets and smooth food consumption during times of shock. In contrast, wage labor participation, distance to the market, land fragmentation, and households headed by old and females reduced dietary diversity and food consumption scores.

6.2.4. The linkages between shocks, destitution, and resilience

The quest to end multidimensional poverty has suffered its worst setback because of shocks. Poverty levels remained virtually unchanged because of the vexing challenge of impoverishment and transitory escapes. With the principal objective of providing options for the hard road to zero multidimensional poverty in all its forms everywhere, we singled out the destitute as a population of concern. Article 4, therefore, attempts to examine the effect of shocks on destitution and vulnerability and the mediating role of resilience capacity between

shocks and destitution. It also disclosed the spatial heterogeneity and temporal shifts of destitution, shocks, and resilience linkages in rural Ethiopia. A marked progress has not been achieved in destitution reduction at the national level. However, the results are sobering in that destitution falls asymmetrically among regions. The distribution of shocks also reveals geographic disparities with the highly vulnerable region belonging to harboring many destitute. SNNP, Amhara, and Tigray regions drove brawny national contributions to reducing destitution. In contrast, destitution exacerbates because of Oromia and Others. One strong assumption of the AF dual cut-off approach is using fixed destitution cut-offs. In response, we employed a sensitivity analysis for changes in destitution cut-offs. The study evidenced that multidimensional destitution is less sensitive to downward as opposed to an upward revision of the destitution cut-off. Econometric results show that building resilience emerged as the guardian of curbing destitution. Furthermore, the results confirm that enhancing the rural non-farm economy and investing in irrigation, market, and road infrastructures have a role in reducing destitution. However, idiosyncratic and covariate shocks, land fragmentation, loan, female headship, and dependency ratio put households at risk of falling into destitution. The redeeming ability of commercialization and literacy are also imperative against destitution. The result also provides evidence that the detrimental effect of shocks on destitution is mitigated by resilience.

6.3. Concluding remarks

Ethiopia has exhibited rapid economic growth over two decades. Human capital formation, infrastructure growth, increased agricultural production and productivity, public investments in social safety nets, increased assets and their returns, and reducing the effect of shocks are all parts of the changing economic scenery. Despite the unprecedented economic growth, less of it is translated into vigorous achievements in eliminating welfare problems. Growth alone is not enough to achieve the stated objective on any significant scale. As a result, the country still harbors a compelling share of its population in poverty, food and nutrition insecurity, and destitution.

While agricultural policy often gets plenty of emphasis and a substantial budget allocation, the sector remains fraught with many threats. The bulk of rural household works on small farms that hold their potential for economies of scale or is landless and depends heavily on earnings from supplying unskilled wage labor. They also faced many livelihood security challenges such as limited access to capital, tenure insecurity, climate variability, land fragmentation, declining

soil fertility, population growth, weak or flawed markets, and poor technological breakthrough that create and perpetuate welfare problems. It, thence, seizes opportunities at which farm productivity produces more improvements for the poor, food and nutrition insecure, and destitute. Besides, it has long been highlighted that maintaining welfare gains appears to be a fundamental challenge as adverse shocks increase vulnerability and inhibit progress. Hence, understanding the welfare impacts of shocks, and the role of resilience and agricultural productivity in the presence of shocks, highly relevant for policymakers, are the major themes of this dissertation. Therefore, all the chapters contributed to this line of inquiry organized into five themes a) disentangling the trend, trajectories, and transitions of welfare problems b) the multidimensional poverty reduction role of building resilience c) the effect of shocks on structural and stochastic poverty and the reconciling role of resilience capacity between shocks and structural and stochastic poverty d) food and nutrition security and resilience linkages, and e) how shocks impacts on destitution can be reduced by enhancing resilience. The findings are encouraging and the following crucial conclusions are drawn.

This study disentangles the trends of welfare problems in rural Ethiopia. The overall body of evidence paints a picture of substantive improvements in living standards throughout the survey. The general story that emerged from the analysis is one of steady but uneven progress, witnessing heterogeneous movement along the trajectories. Moreover, while slightly more muted, other measures confirm the general pattern of improvements. A decline in multidimensional poverty is emanated mainly from incidence than the intensity. The share of hardships experienced by those who are poor remains stagnant. There is also higher inertia and strong state dependence. Therefore, households that experienced poverty in the preceding year are at a higher risk of staying in poverty. The higher inertia implies households are not likely to move in and out of poverty rapidly since the non-poor necessitate the accumulation of assets and increased investment in health and education. Aggregate statistics portray dismal pictures of large numbers living in structural and stochastic poverty. The rising and falling tides constantly reconfigure the pool of the structural and stochastic poor. In these simultaneous ebbing and growing, the country outweighs transitory escapes and impoverishment.

The low degree of dissonance among measures in identifying the poor and food and nutrition insecure is not entirely surprising. Many similar results have been evidenced in other developing countries. This suggests that having information on one measure over time does not necessarily predict changes in others, and vice versa. Employing a single measurement approach underestimates the multifaceted nature of poverty and food and nutrition insecurity

and its dynamics. Exclusive reliance on a single measure risks emphasizing factors that may not deal beyond the temporary boosting of a single indicator of households. The finding has implications for assessing progress in improving household well-being over time. Until each measure precisely tells, policymakers should not miss real changes in well-being with conventional approaches. There is also a low static correlation and dynamic mismatch among alternative food insecurity measures that they could not serve as a proxy for each other.

The resilience score has recorded a slight growth over the survey period. Besides, the score shows disparities in dimensions, social groups, and spatiotemporal patterns. Many attributes have been vital for enabling households' resilience. The adaptive capacity, assets, and access to basic services are potential supporting factors in the ability to withstand shocks that could be the focus of program interventions and policies. However, the social safety net is found to be a critical disrupter of resilience capacity.

The first theme of this dissertation help policymakers pledges the role of building resilience capacity in eliminating multidimensional poverty. Furthermore, article 1 explores other drivers and interrupters of multidimensional poverty. Accordingly, raising the share of non-farm income, literacy, having more economically active members, and saving contribute to poverty alleviation. The strong state dependence, on the other hand, reveals that household experiencing poverty in the preceding year is found to be at a higher risk of staying in it. This provides evidence of the likelihood of a multidimensional poverty trap. High persistence arises from the consequences of the past and adverse features concede them more prone. This could be because policies were successful in alleviating immediate poverty, rather than trying to break the cycle of poverty.

Article 2, on the other hand, assures the detrimental effect of shocks on structural and stochastic poverty. In contrast, the result concedes the role of resilience capacity as a mechanism for dealing with shock and structural and stochastic poverty. There remains the potential for smallholder farming to be an integral part of protecting structural and stochastic poverty. This potential is tapped through improving commercialization and public acquisition in irrigation, roads and marketing, and human capital formation. Nevertheless, the sector is fraught with shocks and is not sufficiently remunerative to lift households out of structural and stochastic poverty. Therefore, creating more and better non-farm jobs for the rural poor is surmountable. Besides, the role of irrigation is enhanced more quickly through complementary investments in the non-farm economy.

The effects of shocks on food and nutrition insecurity and the role of household resilience to future food and nutrition security are examined in article 3. We find that rainfall variability, drought, flood, conflict, and death of a household member hamper the ability to achieve food and nutrition security, intensified the falling tides, and impede ascents. There is also strong evidence that food and nutrition insecurity outcomes are affected by other variables concomitantly. Nonetheless, resilience capacity serves as a buffer to future household food security outcomes, decreasing the probability of suffering a future food security loss and facilitating recovery after loss. We also find that the likelihood of experiencing food insecurity is reduced with the initial level of resilience. More resilient households have a higher prospect of maintaining or diversifying their diets even in the face of shocks. Resilience serves a preemptive and redemptive role in the underlying problem and spurs better food and nutrition security. Furthermore, the interaction terms between resilience capacity and specific shocks reveal that resilience capacity can dampen the impact of such a shock. Rural households encounter food security loss and dietary diversity and food consumption downturn due to land fragmentation, distance to the market, wage labor participation, economically non-active members, and households headed by old and females. In contrast, households experience recovery due to fostering the non-farm economy, access to irrigation, and literacy complementing farming activities.

Article 4 offers new insights into destitution measurement since it is the key to implementing and formulating effective alleviation strategies. High dissonance between growth performance and poverty makes millions of households remain pulverized so that uncounted pockets of poverty bolster. This co-existence underscores that causal structures have broadened and deepened and that appropriate policy responses are inadequately understood. More than one-third of the poor people are destitute which requires a strategic imperative and offering a roadmap for change. They face unique isolation that precludes them from most existing poverty eradication efforts. However, the analysis reveals spatiotemporal heterogeneity with the highly vulnerable regions harboring many destitute. The destitute often face resource constraints of all kinds. This inhibits their ability to construct viable livelihoods and leaves them highly vulnerable to shocks that could push them over the edge. Likewise, reductions in the incidence and intensity have been awkward and uneven among regions. The change is largely driven by a decline in intensity. The intensity of deprivation declined in all regions except Others.

6.4. Policy implications

Ethiopia is a hotbed of intermingled social pathologies for a long. Poverty, food and nutrition insecurity, and destitution took the lion's share. People who rely on agriculture are the worst affected as highlighted by many studies. Plenty of measures, in silos, have been taken to reduce them, if not to eliminate them. When designed and implemented well, humanitarian assistance, climate change adaptation, disaster and risk reduction, and social protection may be most suitable to prevent vulnerable households from falling into welfare problems but are not sustainable options to fight a situation of entrenched problems. Humanitarian responses serve simple mechanical filling of shortfalls of poverty, food and nutrition insecurity, and destitution. Other responses to shocks have saved lives, but in many cases, they have done little to help people thwart the subsequent shocks. Therefore, its ability to improve resilience in light of reducing welfare problems is patchy unless complemented with sustainable livelihood activities and investment in health and education. Many households teetering on the edge require a blend of safety and cargo net policies. Cognizant of these facts, we draw significant policy implications from the findings of those studies.

Interventions succeeding in alleviating one welfare measure are not necessarily effective in reducing others (and vice versa). Relying only on single measures can send less accurate signals to policymakers regarding the optimal design of social policies and monitoring their effectiveness. We realized that the previous one-size-fits-all policy would no longer work. Therefore, the study suggests multiple measures to underwrite the design of strategies to eliminate poverty, food and nutrition insecurity, and destitution. It will not only circumvent the shortcomings of the different measures but also reflect the complexity of welfare problems.

The apparent failure to sustainably reduce poverty, food and nutrition insecurity and destitution which has suffered from a recurring cycle of shocks needs resilience as a conduit mechanism. Generally, the four articles evidenced that resilience is more likely to recuperate from welfare problems in the presence of shocks. Moreover, resilience mitigates the negative effect of shocks on welfare problems. Thus, policies aimed at eradicating those welfare problems would do well when focusing on enabling factors that can enhance the resilience of smallholders and their farming systems. All pillars, except the social safety net, are recognized as a strategy for developing the resilience of farming households. Therefore, better adaptive capacity, access to social services, and productive assets play a significant role in enhancing resilience while simultaneously reducing poverty, food and nutrition insecurity, and destitution. Several interventions that aim to mitigate shocks and build resilience are needed to fight against

poverty, food and nutrition insecurity, and destitution in rural Ethiopia. Regardless of the increasingly facing vulnerabilities, there remains the potential for smallholder farming to be an integral part. More support to the farming economy is essential, but reducing those welfare challenges requires other multifaceted options. Principally, the farming potential is tapped through improving commercial orientation and public acquisition in irrigation, extension, roads and marketing, and human capital formation. Nevertheless, the sector is less remunerative. The findings accentuate the need for policy intervention to reinforce productive farming and further long-term development interventions other than social protection to provide equitable rural livelihoods. Livelihood diversification and productive inclusion measure augment household earnings while helping households withstand and recover from shocks. Food and nutrition insecurity are often interlinked with poverty and destitution creating a vicious cycle and thus, great efforts and an integrated approach are needed to tackle them.

Resilience, however, is not the sole abiding antidote to poverty, food and nutrition insecurity, and destitution. An emerging line of inquiry for the viability and development of rural areas highlighted the vital role of growth from below. It entails diversifying income sources and enhancing the rural non-farm economy and enhancing livelihood opportunities. The growth of non-farm activities is often driven by farm productivity and can stimulate local employment creation. Smallholder agriculture, if well-integrated into a diversified rural economy can contribute to halting the cycles of poverty, food and nutrition insecurity, and destitution. Improved rural-urban connectivity, mobility, livelihood diversification, and broader agri-food systems transformation are of utmost importance. Likewise, rural revitalization emerges as the crucial option needed to reduce those welfare problems. Furthermore, critical for policy uptake, promoting synergistic rural-urban linkages ensures a balanced mix of infrastructure development that would bolster the rural non-farm sector, commercialization, human capital formation, and livelihood diversification. Households choosing non-farm economic activities and rural out-migration as the fundamental livelihood strategy are more likely to escape from structural and stochastic poverty.

We also attempted to evaluate the empirical literature on the effect of agricultural productivity on poverty and explain the heterogeneities in reported estimates. The result pointed to the fact that the indirect pathways through which farm productivity affects poverty in a microeconomic framework are barely explicitly considered in empirical analyses. In light of these, we suggest a model which addresses these pathways.

6.5. Caveats and future research

The conclusions and policy implications drawn are in light of some caveats. First, the LSMS-ISA supports multiple rounds of a nationally representative panel with a multi-topic approach designed to improve the understanding of the links between agriculture and the welfare of rural households. Thus far, the ESS offers four rounds. However, ESS 4 is not a follow-up of the previous waves but a new panel. It is a baseline survey for the subsequent waves (Panel 2) that we could not embody it. Second, production is estimated based on randomly selected crops in each EAs. This is scaled up to project the production of crops at the EAs level. However, it does not allow for holder-specific production analysis in the first round of the panel.

One of the most likely pitfalls, common to all longitudinal studies, arises from the failures of qualitative analysis. Recently, research has witnessed an increasing rapprochement between qualitative and quantitative methods. To bridge the methodological divide more systematic study that integrates qualitative and quantitative approaches of the contemporary Q-squared methodology is surmountable. Perhaps the most fundamental lesson of the earlier literature on rural poverty is the need to distinguish the money metric from a multidimensional approach. The dissertation offer clues towards an emerging area of research for understanding the multifaceted welfare problems of rural households. Much remains to learn from the empirics of structural and stochastic poverty. Furthermore, the long and hard road to zero poverty, food insecurity, and destitution demand multiple-pronged approaches to sustain escape. To date, relatively little knowledge is available that explains why some households fail to sustainably escape. Therefore, it needs further study of the literature to develop an understanding of why some households managed to sustain their escapes while others fell back into it.

While efforts to eradicate poverty, food and nutrition insecurity, and destitution strengthen, we must recognize that the problems persist in multifaceted forms. This calls for complementary ways of measurement that recognize the limitations in all their dimensions. We also see considerable potential for combining alternative measures. Building on the strengths of each approach, it is certainly possible to design a blend of different perspectives. Above all, we encourage studies to capitalize on the advantages that multiple perspectives offer in promoting diverse and comprehensive approaches to welfare measures.

Until the FAO RIMA-II is introduced, the existing approaches so far relied heavily on approaches that lack rigor, replicability, and breadth. Indicators of resilience are expected to reflect and capture the multidimensional and multi-scale nature of the concept. Besides, the

dynamic and unpredictable nature of idiosyncratic and covariate shocks and responses that occur at different levels should also be taken into account (Béné et al., 2015). Therefore, high-frequency surveys are necessary to monitor and assess the changes occurring in these different dimensions and aggregation of resilience.

Agricultural developments, including crops and livestock, are crucial for poverty, food insecurity, and destitution ascents in many developing countries. Regardless of the stringent inclusion criteria, data dredging is the main pitfall in reaching reliable conclusions from meta-regression. Some studies are hard-to-get studies because published through obscure journals or working paper series that are very difficult to access. Thus, a more conclusive statement on this matter demands refinements on the data used and further analysis. Hence, we feel that our study gives relevant insights for policy despite noted possible concerns.

References

Abebaw, D., and Admassie, A. (2014). Rural Poverty and Marginalization in Ethiopia: A Review of Development Interventions. In J. von B. and F. W. Gatzweiler (Ed.), *Marginality: Addressing the Nexus of Poverty, Exclusion and Ecology*. Springer Open.

Abramowska-Kmon, A., and Łątkowski, W. (2021). The Impact of Retirement on Happiness and Loneliness in Poland—Evidence from Panel Data. *International Journal of Environmental Research and Public Health*, *18*(18). https://doi.org/10.3390/ijerph18189875

Abro, Z. A., Alemu, B. A., and Hanjra, M. A. (2014). Policies for Agricultural Productivity Growth and Poverty Reduction in Rural Ethiopia. *World Development*, *59*, 461–474. https://doi.org/10.1016/j.worlddev.2014.01.033

Adamseged, M. E., Frija, A., and Thiel, A. (2019). Dynamics of Rural Livelihoods and Rainfall Variability in Northern Ethiopian Highlands. *Climate Risk Management*, *25*(July), 100195. https://doi.org/10.1016/j.crm.2019.100195

Adger, W. N., Brown, K., and Waters, J. (2012). Resilience. In and D. S. John S. Dryzek, Richard B. Norgaard (Ed.), *The Oxford Handbook of Climate Change and Society* (Political, Issue April, pp. 1–20). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780199566600.003.0047

Aguilar, G. R., and Sumner, A. (2020). Who are the World's Poor? A New Profile of Global Multidimensional Poverty. *World Development*, *126*, 104716. https://doi.org/10.1016/j.worlddev.2019.104716

Akresh, R., Lucchetti, L., and Thirumurthy, H. (2012). Wars and Child Health: Evidence from the Eritrean-Ethiopian Conflict. *Journal of Development Economics*, *99*(2), 330–340. https://doi.org/10.1016/j.jdeveco.2012.04.001

Al-Amin, A. K. M. A., and Hossain, M. J. (2019). Impact of Non-farm Income on Welfare in Rural Bangladesh: Multilevel Mixed-effects Regression Approach. *World Development Perspectives*, *13*(November 2017), 95–102. https://doi.org/10.1016/j.wdp.2019.02.014

Alem, Y., and Söderbom, M. (2012). Household-Level Consumption in Urban Ethiopia: The Effects of a Large Food Price Shock. *World Development*, *40*(1), 146–162. https://doi.org/10.1016/j.worlddev.2011.04.020

Alem, Y., and Tato, G. L. (2022). *Environment for Development Shocks and Mental Health Panel Data Evidence from South Africa* (No. 22–01; EfD Discussion Paper Series, Issue February).

Ambel, A., Parendi, M., and Biratu, Y. (2015). *Multidimensional Poverty in Ethiopia Changes in Overlapping Deprivations* (No. 7417; Policy Research Working Paper, Issue September).

Alinovi, L., D'Errico, M., Mane, E., and Donato, R. (2010). Livelihoods Strategies and Household Resilience to Food Insecurity: An Empirical Analysis to Kenya. In *Promoting Resilience through Social Protection in Sub-Saharan Africa,28-30 June, 2010* (pp. 1–52). Dakar, Senegal: Mobilising European Research for Development Policies.

Alinovi, L., Mane, E., and Donato. R. (2008). Towards the Measurement of Household Resilience to Food Insecurity: Applying a Model to Palestinian Household Data. In R. Sibrian (Ed.), *Deriving Food Security Information from National Household Budget Surveys: Experiences, Achievements, Challenges* (EC-FAO Foo, pp. 137-). Rome, Italy:

Food and Agriculture Organization of the United Nations.

Alinovi, L., Mane, E., and Romano, D. (2008). *Measuring Household Resilience to Food Insecurity: Application to Palastenian Households* (FAO Working Paper).

Alkire, S. (2011). *Ongoing Debates and Research Topics Ravallion's Critiques* (Issue August).

Alkire, S, Conconi, A., and Seth, S. (2014). Measuring Destitution in Developing Countries: An Ordinal Approach for Identifying linked Subset of the Multidimensionally Poor. In *OPHI Research in Progress* (No. 42a; OPHI Research in Progress Series, Vol. 42). http://www.ophi.org.uk/wp-content/uploads/OPHI-RP-42a.pdf

Alkire, S., Conceição, P., Barham, A., Calderón, C., Conconi, A., Dirksen, J., Espinal, F. C., Evans, M., Hall, J., Jahic, A., Kanagaratnam, U., Kivilo, M., Kovacevic, M., Kovesdi, F., Mitchell, C., Nogales, R., Vollmer, F., and Walkey, C. (2019). *Global Multidimensional Poverty Index 2019 Illuminating Inequalities*.

Alkire, S., Chatterjee, M., Conconi, A., Seth, S., and Vaz, A. (2014). Destitution: Who and Where are the Poorest of the Poor? In *OPHI Brief 22* (No. 22; OPHI Brief).

Alkire, S., Foster, J., Seth, S., Santos, M. E., Roche, J. M., and Ballon, P. (2015). *Multidimensional Poverty Measurement and Analysis* (First Edit). Oxford, United Kingdom: Oxford University Press.

Alkire, S, and Foster, J. (2011a). *Understandings and Misunderstandings of Multidimensional Poverty Measurement* (No. 43; OPHI Working Paper). Oxford Poverty & Human Development Initiative (OPHI)

Alkire, S, and Foster, J. (2011b). Counting and Multidimensional Poverty Measurement. *Journal of Public Economics*, *95*(7–8), 476–487. https://doi.org/10.1016/j.jpubeco.2010.11.006

Alkire, S., Jindra, C., Robles, A., G., and Vaz, A. (2017). Multidimensional Poverty Reduction Among Countries in Sub-Saharan Africa. In *Forum for Social Economics* (Vol. 46, Issue 2). https://doi.org/10.1080/07360932.2017.1310123

Alkire, S., and Robles, G. (2015). Multidimensional Poverty Index – Winter 2015 / 16: Brief Methodological Note and Results. In *The Oxford Poverty and Human Development Initiative (OPHI), Oxford Department of International Development, University ofOxford.* (No. 36; OPHI Briefing, Issue December).

Alkire, S., Roche, J. M., Seth, S., and Sumner, A. (2015). Identifying the Poorest People and Groups: Strategies using the Global Multidimensional Poverty Index. In *OPHI Working Paper* (No. 78; OPHI Working Paper, Vol. 27, Issue 3). https://doi.org/10.1002/jid.3083

Alkire, S., and Seth, S. (2015). *Identifying Destitution through linked subsets of multidimensionally poor* (No. 151; WIDER Working Paper, Issue December).

Alkire, S., and Housseini, B. (2017). Multidimensional Poverty in Sub-Saharan Africa. In Machiko Nissanke and Muna Ndulo (Ed.), *Poverty Reduction in the Course of African Development* (Vol. 15, Issue 1, pp. 583–605). Oxford University Press. https://doi.org/10.1093/acprof

Alkire, S., and Housseini, B. (2014). Multidimensional Poverty in Sub-Saharan Africa: Levels and Trends. In *Etica e Politica* (No. 81; OPHI Working Paper, Vol. 15, Issue 1). https://doi.org/10.1093/acprof

Alliance. (2022). *Global Hunger Index: Ethiopia Policy Brief* (Issue April). Alliance 2015 towards the eradication of poverty. April 2022.

Angelsen, A., and Dokken, T. (2018). Climate Exposure, Vulnerability and Environmental Reliance: A Cross-section Analysis of Structural and Stochastic Poverty. *Environment and Development Economics*, *23*(3), 257–278. https://doi.org/10.1017/S1355770X18000013

Ansah, I. G. K., Gardebroek, C., and Ihle, R. (2019). Resilience and Household Food Security: A Review of Concepts, Methodological Approaches and Empirical Evidence. *Food Security*, *11*(6), 1187–1203. https://doi.org/10.1007/s12571-019-00968-1

Apablaza, M., and Yalonetzky, G. (2013). *Decomposing Multidimensional Poverty Dynamics* (No. 101; Young Lives Working Paper, Issue October).

Araar, A., and Duclos, J. Y. (2013). DASP: Distributive Analysis Stata Package, User Manual, DASP Version 2.3. In *Université Laval, PEP, CIRPÉE and World Bank* (Issue June).

Aragie, E. A. (2013). *Climate change, Growth, and Poverty in Ethiopia* (No. 3; Climate Change and African Political Stability, Issue June).

Arellano, M. (2004). Panel Data Econometrics. In A. P. and M. W. Manuel Arellano, Guido Imbens, Grayham E. Mizon (Ed.), *Advanced Texts in Econometrics* (Vol. 114, Issue 499). Oxford University Press. https://doi.org/10.1111/j.1468-0297.2004.00258_13.x

Argaw, B. A. (2017). *Regional inequality of Economic Outcomes and Opportunities in Ethiopia: A Tale of Two Periods* (No. 118; WIDER Working Paper, Issue May).

Arndt, C., McKay, A., and Tarp, F. (2016). Growth and Poverty in Sub-Saharan Africa. In and F. T. Channing Arndt, Andy McKay (Ed.), *Growth and Poverty in Sub-Saharan Africa* (United Nat). Helsinki, Finland: Oxford University Press.

Assi, N., Maskal, A., Slimani, N., Viallon, V., Chajes, V., Freisling, H., Monni, S., Knueppel, S., Forster, J., Assi, N., Maskal, A., Slimani, N., Viallon, V., Chajes, V., Assi, N., Moskal, A., Slimani, N., Viallon, V., Chajes, V., … Weiderpass, E. (2018). A Treelet Transform Analysis to Relate Nutrient Patterns to the Risk of Hormonal Receptor-Defined Breast Cancer in the European Prospective Investigation into Cancer and Nutrition (EPIC). *Public Health Nutrition*, *19*(2), 242–254. https://doi.org/10.1017/S1368980015000294

Atara, A., Tolossa, D., and Denu, B. (2020). Analysis of Rural Households' Resilience to Food Insecurity: Does Livelihood Systems /Choice / Matter ? The Case of Boricha Woreda of Sidama Zone in Southern Ethiopia. *Environmental Development*, *35*(September), 100530. https://doi.org/10.1016/j.envdev.2020.100530

Attanasio, O., Meghir, C., Nix, E., and Salvati, F. (2017). Human Capital Growth and Poverty: Evidence from Ethiopia and Peru. *Review of Economic Dynamics*, *25*, 234–259. https://doi.org/10.1016/j.red.2017.02.002

Azzarri, C., and Signorelli, S. (2020). Climate and Poverty in Africa South of the Sahara. *World Development*, *125*, 104691. https://doi.org/10.1016/j.worlddev.2019.104691

Bader, C., Bieri, S., Wiesmann, U., and Heinimann, A. (2016). Differences Between Monetary and Multidimensional Poverty in the Lao PDR: Implications for Targeting of Poverty Reduction Policies and Interventions. *Poverty and Pub,Ic Policy A Global Journal of Social Security, Income, Aid, and Welfare*, *8*(2).

Baetschmann, G. (2012). Identification and Estimation of Thresholds in the Fixed Effects Ordered Logit Model. *Economics Letters*, *115*(3), 416–418. https://doi.org/10.1016/j.econlet.2011.12.100

Baetschmann, G., Ballantyne, A., Staub, K. E., and Winkelmann, R. (2020). feologit: A New Command for Fitting Fixed-effects Ordered Logit Models. *Stata Journal*, *20*(2), 253–275. https://doi.org/10.1177/1536867X20930984

Bahru, B. A., Jebena, M. G., Birner, R., and Zeller, M. (2020). Impact of Ethiopia's Productive Safety Net Program on Household Food Security and Child Nutrition: A Marginal Structural Modeling Approach. *SSM - Population Health*, *12*, 100660. https://doi.org/10.1016/j.ssmph.2020.100660

Bahru, B. A., and Zeller, M. (2021). Gauging the Impact of Ethiopia's Productive Safety Net Programme on Agriculture: Application of Targeted maximum Likelihood stimation Approach. *Journal of Agricultural Economics*, *January*, 1–20. https://doi.org/10.1111/1477-9552.12452

Baltagi, B. H. (2005). Econometric Analysis of Panel Data. In *Https://Medium.Com/* (Third edit). John Wiley and Sons Ltd. https://medium.com/@arifwicaksanaa/pengertian-use-case-a7e576e1b6bf

Barrett, C. B. (2005). Rural Poverty Dynamics: Development Policy Implications. *Agricultural Economics*, *32*((s1)), 45–60.

Barrett, C. B., and Constas, M. A. (2014). Toward a Theory of Resilience for International Development Applications. *Proceedings of the National Academy of Sciences of the United States of America*, *111*(40), 14625–14630. https://doi.org/10.1073/pnas.1320880111

Barua, S., and Banerjee, A. (2020). Impact of Climatic Shocks on Household Well-being: Evidence from Rural Bangladesh. *Asia-Pacific Journal of Rural Development*, *30*(1–2), 89–112. https://doi.org/10.1177/1018529120977246

Baye, T. G. (2017). Annals of Agrarian Science Poverty, Peasantry and Agriculture in Ethiopia. *Annals of Agrarian Sciences*, *15*(3), 420–430. https://doi.org/10.1016/j.aasci.2017.04.002

Bayudan-Dacuycuy, C., and Lim, J. A. (2013). Family Size, Household Shocks and Chronic and Transient Poverty in the Philippines. *Journal of Asian Economics*, *29*, 101–112. https://doi.org/10.1016/j.asieco.2013.10.001

Beegle, K., Christianensen, L., Dabalen, A., and Gaddis, I. (2016). *Poverty in a Rising Africa*. *Africa Poverty Report* (Vol. 59)

Beegle, K., and Christiaensen, L. (2019). Poverty in Africa. In Kathleen Beegle and Luc Christiaensen (Ed.), *Accelerating Poverty Reduction in Africa* (World Bank). International Bank for Reconstruction and Development / The World Bank. https://doi.org/10.1596/978-1-4648-1232-3

Bekele, Y. W. (2018). The Political Economy of Poverty in Ethiopia : Drivers and Challenges. *African Review*, *10*(1), 17–39. https://doi.org/10.1080/09744053.2017.1399561

Béné, C., Cannon, T., Gupte, J., Metha, L., and Tanner, T. (2014). Exploring the Potential and Limits of the Resilience Agenda in Rapidly Urbanizing Contexts. In *IDS Evidence Report* (Issue 63). https://opendocs.ids.ac.uk/opendocs/handle/123456789/3621

Béné, C., Headey, D., Haddad, L., and Von Grebmer, K. (2016). Is Resilience a Useful Concept in the Context of Food Security and Nutrition Programmes? Some Conceptual and Practical Considerations. *Food Security*, *8*(1), 123–138. https://doi.org/10.1007/s12571-015-0526-x

Béné, C., Wood, R. G., Newsham, A., and Davies, M. (2012). Resilience: New Utopia or New Tyranny? Reflection about the Potentials and Limits of the Concept of Resilience in Relation to Vulnerability Reduction Programmes. In *IDS Working Papers* (Vol. 2012, Issue 405). https://doi.org/10.1111/j.2040-0209.2012.00405.x

Benti, D. W., Biru, W. T., and Tessema, W. K. (2022). The Effects of Commercial Orientation on (Agro) Pastoralists' Household Food Security: Evidence from (Agro) Pastoral Communities of Afar, Northeastern Ethiopia. *Sustainability (Switzerland)*, *14*(2). https://doi.org/10.3390/su14020731

Berhane, G., Gilligan, D. O., Hoddinott, J., Kumar, N., and Taffesse, A. S. (2015). Can Social Protection Work in Africa? The Impact of Ethiopia's Productive Safety Net Programme. *Economic Development and Cultural Change*, *63*(3), 1–26. https://doi.org/10.1086/677753

Berkes, F., and Ross, H. (2013). Community Resilience: Toward an Integrated Approach. *Society and Natural Resources*, *26*(April 2013), 5–20. https://doi.org/10.1080/08941920.2012.736605

Bersisa, M., and Heshmat, A. (2016). Multidimensional Measure of Poverty in Ethiopia : Factor and Stochastic. In *Multidimensional Measure of Poverty in Ethiopia : Factor and Stochastic*. (Issue May). Springer International Publishing. https://doi.org/10.1007/978-3-319-30981-1

Bezu, S., and Holden, S. (2014). Are Rural Youth in Ethiopia Abandoning Agriculture? *World Development*, *64*, 259–272. https://doi.org/10.1016/j.worlddev.2014.06.013

Bhalla, A. S., and Lapeyre, F. (2004). Poverty and Exclusion in a Global World. In *Poverty and Exclusion in a Global World: Second Revised Edition* (Second Rev). Palgrave Macmillan. https://doi.org/10.1007/978-0-230-0056

Bhide, S., and Mehta, A. K. (2018). A Review of Poverty Dynamics Issues. In S. B. Aasha Kapur Mehta & and A. K. A. Shah (Eds.), *Poverty , Chronic Poverty and Poverty Dynamics Policy Imperatives*. Springer Nature Singapore Pte Ltd.

Bhuller, M., Brinch, C. N., and Königs, S. (2017). Time Aggregation and State Dependence in Welfare Receipt. In *IZA Discussion Papers* (No. 9785; IZA DP, Vol. 127, Issue 604). https://doi.org/10.1111/ecoj.12366

Bigsten, A., Kebede, B., Shimeles, A., and Taddesse, M. (2003). Growth and Poverty Reduction in Ethiopa: Evidence from Household Panel Surveys. *World Development*, *31*(1), 87–106. https://doi.org/10.1016/S0305-750X(02)00175-4

Bigsten, A., and Shimeles, A. (2008). Poverty Transition and Persistence in Ethiopia: 1994 – 2004. *World Development Vol.*, *36*(9), 1559–1584. https://doi.org/10.1016/j.worlddev.2007.09.002

Biørn, E. (2017). Regression Analysis: Random Effects Models. In *Econometrics of Panel Data* (First Edit). Oxford University Press. https://doi.org/10.1093/acprof:oso/9780198753445.003.0003

Boansi, D., Owusu, V., Tambo, J. A., Donkor, E., and Asante, B. O. (2021). Rainfall Shocks and Household Welfare: Evidence from Northern Ghana. *Agricultural Systems*, *194*(September), 103267. https://doi.org/10.1016/j.agsy.2021.103267

Bodin, P., and Wiman, B. L. B. (2004). Resilience and other Stability Concepts. *ESS Bulletin*, *2*(2), 33–43.

Boku, G. T. (2017). *Measuring Resilience to Climate Change* (No. 268; The High 5 Working

Paper Series).

Borga, L. G., and D'Ambrosio, C. (2021). Social Protection and Multidimensional Poverty: Lessons from Ethiopia, India, and Peru. *World Development*, *147*, 105634. https://doi.org/10.1016/j.worlddev.2021.105634

Borgomeo, E., Vadheim, B., Woldeyes, F. B., Alamirew, T., Tamru, S., Charles, K. J., Kebede, S., and Walker, O. (2018). The Distributional and Multi-Sectoral Impacts of Rainfall Shocks: Evidence From Computable General Equilibrium Modelling for the Awash Basin, Ethiopia. *Ecological Economics*, *146*(April 2017), 621–632. https://doi.org/10.1016/j.ecolecon.2017.11.038

Boukary, A. G., Diaw, A., and Wünscher, T. (2016). Factors Affecting Rural Households' Resilience to Food Insecurity in Niger. *Sustainability (Switzerland)*, *8*(3). https://doi.org/10.3390/su8030181

Broussar, N. H., and Tekleselassie, T. G. (2012). Youth Unemployment, Ethiopia Country Study. In *International Growth Centre (IGC) Working Paper* (No. 0592; IGC Working Paper).

Brück, T., and Pietrelli, R. (2019). *The Effects of Violent Conflict on Household Resilience and Food Security: Evidence from the 2014 Gaza Conflict*. *119*, 203–223. https://doi.org/10.1016/j.worlddev.2018.05.008

Brück, T., and Kebede, W. S. (2013). Dynamics and Drivers of Consumption and Multidimensional Poverty: Evidence from Rural Ethiopia. In *IZA Discussion Paper Series* (No. 7364; IZA Discussion Paper). https://doi.org/10.2139/ssrn.2263600

Burney, J. A., and Naylor, R. L. (2012). Smallholder Irrigation as a Poverty Alleviation Tool in Sub-Saharan Africa. *World Development*, *40*(1), 110–123. https://doi.org/10.1016/j.worlddev.2011.05.007

Campos, A. P. O., Villani, C., Davis, B., and Takagi, D. (2014). *Ending Extreme Poverty: Sustaining Livelihoods to Leave No one Behind*. *The World Bank*. Rome. Retrieved from http://www.worldbank.org/en/publication/global-monitoring-report/report-card/twin-goals/ending-extreme-poverty

Caravaggio, A., Gori, L., and Sodini, M. (2021). The State of Ethiopian Economy 2020/21: Population Dynamics and Economic Development. In Mengistu Ketema and Getachew Diriba (Ed.), *The State of Ethiopia Economy 2020/21* (Vol. 0, Issue February, p. 0). Ethiopian Economics Association (EEA). https://doi.org/10.3934/dcdsb.2021178

Carter, M. R., and Barrett, C. B. (2006). The Economics of Poverty Traps and Persistent Poverty: An Asset-based Approach *The Journal of Development Studies*, *42*(2), 178–199. https://doi.org/10.1080/00220380500405261

Carter, M. R., Little, P. D., Mogues, T., and Negatu, W. (2007). Poverty Traps and Natural Disasters in Ethiopia and Honduras. *World Development*, *35*(5), 835–856. https://doi.org/10.1016/j.worlddev.2006.09.010

Carter, M. R., and Lybbert, T. J. (2012). Consumption Versus Asset Smoothing: Testing the Implications of Poverty Trap Theory in Burkina Faso. *Journal of Development Economics*, *99*(2), 255–264. https://doi.org/10.1016/j.jdeveco.2012.02.003

Carter, M. R., and May, J. (1999). Poverty, Livelihood and Class in Rural South Africa. *World Development*, *27*(1), 1–20. https://doi.org/10.1016/S0305-750X(98)00129-6

Cazzuffi, C., Mckay, A., and Perge, E. (2018). *The Impact of Commercialization of Rice on Household Welfare in Rural Vietnam* (No. 130; WIDER Working Paper, Issue October).

Cazzuffi, C., McKay, A., and Perge, E. (2020). The Impact of Agricultural Commercialisation on Household Welfare in Rural Vietnam. *Food Policy*, *94*(December 2019), 101811. https://doi.org/10.1016/j.foodpol.2019.101811

Chambers, R., and Conway, G. R. (1992). Sustainable Rural Livelihoods: Practical Concepts for the 21st Century. In *IDS Discussion Paper* (No. 296; IDS Discussion Paper, Vol. 296).

Chamdimba, O. Y., Ortmann, G. F., and Wale, E. (2021). Resilience to Shocks and Food Insecurity: Determinants, and the Impact of Smallholder Jatropha Curcas Cultivation in Southern Malawi. *African Journal of Science, Technology, Innovation and Development*, *13*(5), 619–633. https://doi.org/10.1080/20421338.2020.1774962

Ciani, F., and Romano, D. (2014). Testing for Household Resilience to Food Insecurity : Evidence from Nicaragua. *Paper Prepared for Presentation at the EAAE 2014 Congress 'Agri-Food and Rural Innovations for Healthier Societies.'*

Cinner, J. E., and Barnes, M. L. (2019). Social Dimensions of Resilience in Social-Ecological Systems. *One Earth*, *1*(1), 51–56. https://doi.org/10.1016/j.oneear.2019.08.003

Cissé, J. D., and Barrett, C. B. (2018). Estimating Development Resilience: A Conditional Moments-based Approach. In *Journal of Development Economics* (Vol. 135, Issue 236). https://doi.org/10.1016/j.jdeveco.2018.04.002

COHA. (2014). *The Cost of Hunger in Ethiopia*. Implications for the Growth and Transformation of Ethiopia. The Social and Economic Impacts of Child Undernutrition in Ethiopia, Summary Report. World Food Program

Cohen, L., Manion, L., and Morrison, K. (2018). *Reserach Methods in Education* (Eighth Edition). Routledge Taylor and Francis Group.

Constas, M.A., Frankenberger, T., Hoddinott, J., Mock, N., Romano, D., Béné, C., and Maxwell, D. (2014). *A Common Analytical Model for Resilience Measurement Causal Framework aad methodological options Resilience Measurement Technical Working Group* (Issue 2). Food Security Information Network. http://www.fsincop.net/fileadmin/user_upload/fsin/docs/resources/FSIN_Paper2_WEB_1dic (WEB).pdf

Constas, M. A., Frankenberger, T. R., and Hoddinott, J. (2014). *Resilience Measurement Principles: Toward an Agenda for Measurement Design. Resilience* (Technical Series No. 1; Resilience Measurement Technical Working Group Resilience, Issue 1).

Cookson, M. D., and Stirk, P. M. R. (2019). *Mixed Method Research in Poverty and Vulnerability: Sharing Ideas and Learning Lessons* (Keetie Roelen and Laura Camfiel (ed.)). Palgrave Macmilaan.

Cox, D. R. (1972). Regression Models and Life-Tables. *Journal of the Royal Statistical Society.1*, *34*(2), 187–220.

Creswell, J. W. (2014). *Research Design: Qualitative, Quantitatve, and Mixed Methods Approaches* (Fourth Edi). SAGE Publications, Inc.

CSA and World Bank. (2017). *Ethiopia Socioeconomic Survey (ESS) Wave Three (2015/2016) Basic Information Document* (Issue February).

Dagunga, G., Ayamga, M. A., and Danso-Abbeam, G. (2020). To What Extent Should Farm Households Diversify? Implications on Multidimensional Poverty in Ghana. *World Development Perspectives*, *20*(September), 100264. https://doi.org/10.1016/j.wdp.2020.100264

Davies, M., Béné, C., Arnall, A., Tanner, T., Newsham, A., and Coirolo, C. (2013). Promoting Resilient Livelihoods through Adaptive Social Protection: Lessons from 124 programmes in South Asia. *Development Policy Review*, *31*(1), 27–58. https://doi.org/10.1111/j.1467-7679.2013.00600.x

Davies, S. (2010). Do Shocks have a Persistent Impact on Consumption? The Case of Rural Malawi. *Progress in Development Studies*, *10*(1), 75–79. https://doi.org/10.1177/146499340901000105

DeJuan, J. P., and J. Seater, J. (1999). The Permanent Income Hypothesis: Evidence from the Consumer Expenditure Survey. *Journal of Monetary Economics*, *43*(2), 351–376. https://doi.org/10.1016/S0304-3932(98)00063-4

Demeke, A. B., Keil, A., and Zeller, M. (2011). Using Panel Data to Estimate the Effect of Rainfall Shocks on Smallholders Food Security and Vulnerability in Rural Ethiopia. *Climatic Change*, *108*(1), 185–206. https://doi.org/10.1007/s10584-010-9994-3

Demeke, A. B., and Zeller, M. (2009). *Using Panel Data to Estimate the Effect of Rainfall Shocks on Smallholders Food Security and Vulnerability in Rural Ethiopia* (No. 2; Research in Development Economics and Policy Discussion Paper, Issue 2).

Dercon, S. (2006). Economic Reform, Growth and the Poor: Evidence from Rural Ethiopia. *Journal of Development Economics*, *81*(1), 1–24. https://doi.org/10.1016/j.jdeveco.2005.05.008

Dercon, S., Hoddinott, J., and Woldehanna, T. (2006). Consumption, Vulnerability and Shocks, 1999-2004. *Ethiopian Journal of Economics*, *xv*(1), 1999–2004.

Dercon, S., Hoddinott, J., and Woldehanna, T. (2005). Shocks and Consumption in 15 Ethiopian Villages, 1999-2004. *Journal of African Economies*, *14*(4), 559–585. https://doi.org/10.1093/jae/eji022

Dercon, S., and Porter, C. (2014). Live Aid Revisited: Long-term Impacts of the 1984 Ethiopian Famine on Children. *Journal of the European Economic Association*, *12*(4), 927–948. https://doi.org/10.1111/jeea.12088

D'Errico, M., and Giuseppe, S. D. (2018). Resilience Mobility in Uganda: A Dynamic Analysis. *World Development*, *104*, 78–96. https://doi.org/10.1016/j.worlddev.2017.11.020

D'Errico, M., and Pietrelli, R. (2017). Resilience and Child Malnutrition in Mali. *Food Security*, *9*(2), 355–370. https://doi.org/10.1007/s12571-017-0652-8

D'Errico, M., Garbero, A., and Constas, M. (2016). *Quantitative Analyses for Resilience Measurement: Guidance for Cnstracting Variables and Exploring Relationships among Variables* (No. 7; Resilience Measurement Technical Working Group, Issue 7).

D'Errico, M., Romano, D., and Pietrelli, R. (2018). Household Resilience to Food Insecurity: Evidence from Tanzania and Uganda. *Food Security*, *10*(4), 1033–1054. https://doi.org/10.1007/s12571-018-0820-5

Devereux, S. (2003). Conceptualising Destitution. In *Development* (No. 216; IDS Working Paper, Issue December).

Devereux, S., and Sharp, K. (2006). Trends in Poverty and Destitution in Wollo, Ethiopia. *Journal of Development Studies*, *42*(4), 592–610. https://doi.org/10.1080/00220380600681910

Diao, X., and Pratt, A. N. (2007). Growth Options and Poverty Reduction in Ethiopia - An Economy-wide Model Analysis. *Food Policy*, *32*(2), 205–228.

https://doi.org/10.1016/j.foodpol.2006.05.005

Dimitrova, A. (2021). Seasonal Droughts and the Risk of Childhood Undernutrition in Ethiopia. *World Development*, *141*, 105417. https://doi.org/10.1016/j.worlddev.2021.105417

Diriba, G. (2020). *Agricultural and Rural Transformation in Ethiopia Obstacles, Triggers and Reform Considerations* (01/2020; Policy Working Paper, Issue January).

Diwakar, V., and Shepherd, A. (2018). *Sustaining Escapes from Poverty* (No. 539; Overseas Development Institute (ODI) Working Paper, Issue October).

Diwakar, V. (2016). *Sustainable Poverty Escapes: Spotlight on Multidimensional Poverty LEO Report Number 50* (Issue November).

Domenech, L., Tesfatsion, S., Ringler, C., and Theis, S. (2019). Resilience Buiding in Ethiopia: Analysis of Key Informant Interviews. In and A. D. P. Jawoo Koo, James Thurlow, Hagar Eldidi, Claudia Ringler (Ed.), *Building Resilience to Climate Shock in Ethiopia* (A Peer-Rev, pp. 25–41). Washington, DC, USA: International Food Policy Research Institute A World free of Hunger and Malnutrition.

Duclos, J. Y. and Araar, A. (2006). *Poverty and Equity: Measurement, Policy, And Estimation with DAD* (J. Silber (ed.); Economic S). Springer Science+Business Media, LLC.

Dutta, S. (2021). Structural and Stochastic Transitions of Poverty using Household Panel Data in India. *Poverty and Public Policy*, *13*(1), 8–31. https://doi.org/10.1002/pop4.299

Dutta, S., and Kumar, L. (2015). Is Poverty Stochastic or Structural in Nature? Evidence from Rural India. *Social Indicators Research*, *128*(3), 957–979. https://doi.org/10.1007/s11205-015-1064-9

Ellis, G. F. . (1983). The Dimensions of Poverty. *Social Indicators Research*, *15*(1984), 229–253.

Espinoza-Delgado, J., and Klasen, S. (2018). Gender and Multidimensional Poverty in Nicaragua: An individual based Approach. *World Development*, *110*, 466–491. https://doi.org/10.1016/j.worlddev.2018.06.016

Ethiopian Public Health Institute (EPHI) [Ethiopia] and ICF. (2021). *Ethiopia Mini Demographic and Health Survey 2019: Final Report* (Mini Demog). EPHI and ICF. https://dhsprogram.com/pubs/pdf/FR363/FR363.pdf

FAO, IFAD, UNICEF, WFP, and WHO. (2022). *The State of Food Security and Nutrition in the World. Repurposing Food and Agricultural Policies to Make Healthy Diets More Affordable*. FAO. https://doi.org/https://doi.org/10.4060/cc0639en

FAO. (1983). *The State of Food and Agriculture World Review: The Situation in Sub-Saharan Africa Women in Developing Agriculture*. Food and Agricultural Organization of the United Nations.

FAO. (2016). *Analyzing Resilience for Better Targeting and Action: Resilience Index Measurement and Analysis - II* (FAO (ed.)). Food and Agriculture Organization of the United Nations.

FAO. (2021). Global Report on Food Crises: Joint Analysis for Better Decision. In *Food Security Information Network* (Issue September). https://www.wfp.org/publications/2020-global-report-food-crises

Ferrer-i-Carbonell, A., and Frijters, P. (2004). How Important is Methodology for the

Estimates of the Determinants of Happiness? *Economic Journal*, *114*(497), 641–659. https://doi.org/10.1111/j.1468-0297.2004.00235.x

Filmer, D., and Pritchett, L. (1998). *Estimating Wealth Effects without Expenditure Data or Tears: With an Application to Educational Enrollments in States of India* (WPS 1994; Policy Research Working Paper, Issue October).

Fiszbein, A., Kanbur, R., and Yemtsov, R. (2014). Social Protection and Poverty Reduction: Global Patterns and Some Targets. *World Development*, *61*, 167–177. https://doi.org/10.1016/j.worlddev.2014.04.010

Flaig, G., Licht, G., and Steiner, V. (1993). *Testing for State Dependence Effects in a Dynamic Model of MAle Unemployment Behaviour* (No. 93–07; ZEW Discussion Papers).

Folke, C. (2006). Resilience: The Emergence of a Perspective for Social-ecological Systems Analyses. *Global Environmental Change*, *16*(3), 253–267. https://doi.org/10.1016/j.gloenvcha.2006.04.002

Foster, J., Greer, J., and Thorbecke, E. (2010). The Foster-Greer-Thorbecke (FGT) Poverty Measures: 25 years Later. *Journal of Economic Inequality*, *8*(4), 491–524. https://doi.org/10.1007/s10888-010-9136-1

Foster, J., Greer, J., and Thorbecke, E. (1984). A Class of Decomposable Poverty Measures. *Econometrica*, *52*(3), 761. https://doi.org/10.2307/1913475

Frankenberger, T. R., Spangler, T., Nelson, S., and Langworthy, M. (2012). *Enhancing Resilience to Food Insecurity amid Protracted Crisis* (Issue High Level Export Forum September 13-14).

Fuje, H. (2018). Welfare Dynamics and Drought in Ethiopia. *CSAE Conference to Be Held from 18-20 March 2018*, *January*.

Gallardo, M. (2019). Measuring Vulnerability to Multidimensional Poverty. *Social Indicators Research*, *September*. https://doi.org/10.1007/s11205-019-02192-y

Gao, J., and Mills, B. F. (2018). Weather Shocks, Coping Strategies, and Consumption Dynamics in Rural Ethiopia. *World Development*, *101*, 268–283. https://doi.org/10.1016/j.worlddev.2017.09.002

Gebre, G. G., and Rahut, D. B. (2021). Prevalence of Household Food Insecurity in East Africa: Linking Food Access with Climate Vulnerability. *Climate Risk Management*, *33*(June), 100333. https://doi.org/10.1016/j.crm.2021.100333

Gebrechorkos, S. H., Hülsmann, S., and Bernhofer, C. (2020). Analysis of Climate Variability and Droughts in East Africa using High- Resolution Climate Data Products. *Global and Planetary Change*, *186*(January), 103130. https://doi.org/10.1016/j.gloplacha.2020.103130

Gebregziabher, G., and Holden, S. T. (2011). Distress Rentals and the Land Rental Market as a Safety net: Contract Choice Evidence from Tigray, Ethiopia. *Agricultural Economics*, *42*(SUPPL. 1), 45–60. https://doi.org/10.1111/j.1574-0862.2011.00551.x

Gebregziabher, G., Namara, R. E., and Holden, S. (2009). Poverty Reduction with Irrigation Investment: An Empirical Case Study from Tigray, Ethiopia. *Agricultural Water Management*, *96*(12), 1837–1843. https://doi.org/10.1016/j.agwat.2009.08.004

Gebrekidan, D. K., Bizuneh, A. M., and John C. (2021). Determinants of Multidimensional Poverty among Rural Households In Northern Ethiopia. *Journal of Rural and Community Development*, *16*(1), 133–151.

Gebremariam, G., and Tesfaye, W. (2018). The Heterogeneous Effect of Shocks on Agricultural Innovations Adoption: Microeconometric Evidence from Rural Ethiopia. *Food Policy*, *74*(April 2016), 154–161. https://doi.org/10.1016/j.foodpol.2017.12.010

Gebremeskel, G., Tang, Q., Sun, S., Huang, Z., Zhang, X., and Liu, X. (2019). Droughts in East Africa: Causes, impacts and resilience. *Earth-Science Reviews*, *193*(June 2018), 146–161. https://doi.org/10.1016/j.earscirev.2019.04.015

Ghebru, H., and Tafesse, A. S. (2019). Land Policy and the Youth 'Bulge' in Ethiopia: How Social and Economic Transformations are Scrutinizing the Status quo. *Paper Prepared for Presentation at the "2019 Conference on Land Policy in Africa ", July*.

Giller, K. E. (2020). The Food Security Conundrum of Sub-Saharan Africa. *Global Food Security*, *26*(July), 100431. https://doi.org/10.1016/j.gfs.2020.100431

Gilligan, D. O., Hoddinott, J., and Taffesse, A. S. (2009). The Impact of Ethiopia's Productive Safety Net Programme and its Linkages. *Journal of Development Studies*, *45*(10), 1684–1706. https://doi.org/10.1080/00220380902935907

Glick, P., and Sahn, D. (2005). Intertemporal Female Labor Force Behavior in a Developing Country: What Can We Learn from a Limited Panel? *Labour Economics*, *12*(1), 23–45. https://doi.org/10.1016/j.labeco.2004.03.001

Gorst-rasmussen, A. (2012). tt : Treelet Transform with Stata. *The Stata Journal*, *12*(1), 130–146. https://doi.org/10.1177/1536867X1201200108

Goshu, D. (2013). The Dynamics of Poverty and Vulnerability in Rural. *Ethiopian Journal of Economics*, *XXII*(2), 1–20.

Grandgirard, J., Poinsot, D., Krespi, L., Nénon, J. P., and Cortesero, A. M. (2002). Costs of Secondary Parasitism in the Facultative Hyperparasitoid Pachycrepoideus dubius: Does host size matter? *Entomologia Experimentalis et Applicata*, *103*(3), 239–248. https://doi.org/10.1023/A

Greene, W. H. (2012). *Econometric Analysis* (Internatio). Pearson Education Limited.

Grebmer, K. V., Bernstein, J., Patterson, F., Wiemers, M., Chéilleachair, R. N., Foley, C., Gitter, S., Ekstrom, K., and Fritschel, H. (2019). *Global Hunger Index: The Challenge of Hunger and Climate Change*. Dublin / Bonn.

Grotti, R., and Cutuli, G. (2018). xtpdyn: A Community-Contributed Command for Fitting Dynamic Random Effects Probit Models. *The Stata Journal*, *18*(4), 844–862. https://doi.org/10.1177/1536867X1801800406

Haile, D., Seyoum, A., and Azmeraw, A. (2021). Does Building the Resilience of Rural Households Reduce Multidimensional Poverty ? Analysis of panel data in Ethiopia. *Scientific African*, *12*, e00788. https://doi.org/10.1016/j.sciaf.2021.e00788

Hanjra, M. A., Ferede, T., and Gutta, D. G. (2009). Pathways to Breaking the Poverty Trap in Ethiopia: Investments in Agricultural water, education, and markets. *Agricultural Water Management*, *96*(11), 1596–1604. https://doi.org/10.1016/j.agwat.2009.06.008

Hansen, J., Hellin, J., Rosenstock, T., Fisher, E., Cairns, J., Stirling, C., Lamanna, C., van Etten, J., Rose, A., nd Campbell, B. (2019). Climate Risk Management and Rural Poverty Reduction. *Agricultural Systems*, *172*(January 2018), 28–46. https://doi.org/10.1016/j.agsy.2018.01.019

Harriss-White, B. (2005). Destitution and the Poverty of its Politics - With Special Reference to South Asia. *World Development*, *33*(6), 881–891. https://doi.org/10.1016/j.worlddev.2004.09.014

Headey, D., and Ecker, O. (2013). Rethinking the Measurement of Food Security: From First Principles to Best Practice. *Food Security*, *5*(3), 327–343. https://doi.org/10.1007/s12571-013-0253-0

Headey, D., Taffesse, A. S., and You, L. (2014). Diversification and Development in Pastoralist Ethiopia. *World Development*, *56*(December 2011), 200–213. https://doi.org/10.1016/j.worlddev.2013.10.015

Heckman, J. J. (1981). Incidental parameters Problem and the Problem of Initial Conditions in Estimating a Discrete Time-Discrete Data Stochastic Process. In *Structural Analysis of Discrete Data with Econometric Applications* (C. F. Mans, pp. 179–195). MIT Press. https://doi.org/10.1201/b10850-16

Hiensch, A. (2007). Surviving Shocks in Ethiopia: The Role of Social Protection for Food Security. Case Study # 4-2 of the Program: "Food Policy for Developing Countries: The Role of Government in the Global Food System"

Hill, R. V., and Porter, C. (2017). Vulnerability to Drought and Food Price Shocks: Evidence from Ethiopia. *World Development*, *96*, 65–77. https://doi.org/10.1016/j.worlddev.2017.02.025

Hirvonen, K., Sohnesen, T. P., and Bundervoet, T. (2020). Impact of Ethiopia's 2015 Drought on Child Undernutrition. *World Development*, *131*. https://doi.org/10.1016/j.worlddev.2020.104964

Hoang, T. (2018). The Economics of Poverty: History, Measurement, and Policy. *The Social Science Journal*, *55*(2), 210–211. https://doi.org/10.1016/j.soscij.2018.03.005

Hoddinott, J. (2014). Understanding Resilience for Food and Nutrition Security. *2020 Conference Paper 8*, *May*.

Hoddinott, J., and Taffesse, A. S. (2019). Social Protection in Ethiopia. In and A. O. Fantu Cheru, Christopher Cramer (Ed.), *The Oxford Handbook of the Ethiopian Economy* (Economics, Issue April, pp. 411–427). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780198814986.013.22

Holling, C. S. (1973). Resilience and Stability of Ecological Systems. *Annual Review of Ecology and Systematics*, *4*, 1–23. https://doi.org/10.1146/annurev.es.04.110173.000245

Huang, Q., Rozelle, S., Lohmar, B., Huang, J., and Wang, J. (2006). Irrigation, Agricultural Performance and Poverty Reduction in China. *Food Policy*, *31*(1), 30–52. https://doi.org/10.1016/j.foodpol.2005.06.004

Hulme, D., and Shepherd, A. (2003). Conceptualizing Chronic Poverty. *World Development*, *31*(3), 403–423. https://doi.org/10.1016/S0305-750X(02)00222-X

Hussain, A., Memon, J. A., and Hanif, S. (2020). Weather Shocks, Coping Strategies and Farmers' Income: A Case of Rural Areas of District Multan, Punjab. *Weather and Climate Extremes*, *30*(October), 100288. https://doi.org/10.1016/j.wace.2020.100288

Hyder Baloch, A., and Behrman, J. R. (2016). Climatic Shocks and Child Human Capital: Evidence from Ethiopia. *Journal of Asian and African Studies*, *51*(5), 594–618. https://doi.org/10.1177/0021909614552920

IFRC, and RCS. (2016). *Resilience: Saving Lives Today, Investing for Tomorrow.* World Disaster Report 2016. Geneva, Switzerland. International Federation of Red Cross and Red Crescent Societies.

Iqbal, N. and Nawaz, S. (2016). Education Poverty in Pakistan: A Spatial Analysis at District Level. *Indian Journal of Human Development*, *10*(J2), 270–287.

https://doi.org/10.1177/0973703016674081

Irshaidat, R. (2022). Interpretivism vs. Positivism in Political Marketing Research. *Journal of Political Marketing*, *21*(2), 126–160. https://doi.org/10.1080/15377857.2019.1624286

Islam, A. H. M. S., Von Braun, J., Thorne-Lyman, A. L., and Ahmed, A. U. (2018). Farm Diversification and Food and Nutrition Security in Bangladesh: Empirical Evidence from Nationally Representative Household Panel Data. *Food Security*, *10*(3), 701–720. https://doi.org/10.1007/s12571-018-0806-3

Kassie, M., Fisher, M., Muricho, G., and Diiro, G. (2020). Women's Empowerment Boosts the Gains in Dietary Diversity from Agricultural Technology Adoption in Rural Kenya. *Food Policy*, *95*(July), 101957. https://doi.org/10.1016/j.foodpol.2020.101957

Kawasaki, A., Kawamura, G., and Zin, W. W. (2020). A local Level Relationship between Floods and Poverty: A Case in Myanmar. *International Journal of Disaster Risk Reduction*, *42*, 101348. https://doi.org/10.1016/j.ijdrr.2019.101348

Kebede, T., Haji, J., Legesse, B., and Mammo, G. (2016). Econometric Analysis of Rural Households' Resilience to Food Insecurity in West Shoa, Ethiopia. *Journal of Food Security*, *4*(3), 58–67. https://doi.org/10.12691/jfs-4-3-2

Kennedy G., Ballard T., and Dop, M. (2010). *Guidelines for Measuring Household and Individual Dietary Diversity*. *FAO*.

Knippenberg, E., and Hoddinott, J. (2017). *Shocks, Social Protection, and Resilience: Evidence from Ethiopia* (No. 109; Ethiopian Strategy Support Program (ESSP), Issue August).

Köhlin, G., and Alem, Y. (2014). The Impact of Food Price Inflation on Subjective Well-being : Evidence From Urban Ethiopia. *Social Indicators Research*, *116*(3), 853–868.

Krishna, A. (2007). For Reducing Poverty Faster: Target Reasons Before People. *World Development*, *35*(11), 1947–1960. https://doi.org/10.1016/j.worlddev.2006.12.003

Krishna, A. (2010). *Why People Become Poor and How they Escape Poverty* (A. Krishna (ed.); One Illnes). Oxford University Press.

Krishna, A. (2017). The Dynamics of Poverty. In D. B. and L. M. Burton (Ed.), *The Oxford Handbook of the Social Science of Poverty* (The Oxford, Issue October 2018, pp. 1–30). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780199914050.013.14

Kuriakose, A. T., Heltberg, R., Wiseman, W., Costella, C., Cipryk, R., Cornelius, S., Kuriakose, A. T., Heltberg, R., Wiseman, W., Costella, C., Cipryk, R., and Cornelius, S. (2012). *Climate-Responsive Social Protection Climate - responsive Social Protection* (No. 67614; Background Paper for the World Bank 2012–2022 Social Protection and Labor Strategy A Joint Product of World Bank Social Development and Social Protection and Labor, Issue 1210).

Kuschminder, K., Andersson, L., and Seigel, M. (2018). Migration and Multidimensional Well-being in Ethiopia : Investigating the Role of Migrants Destinations. *Migration and Development*, *2324*, 1–20. https://doi.org/10.1080/21632324.2018.1463903

Lee, A. B., and Nadler, B. (2007). Treelets - A Tool for Dimensionality Reduction and Multi-scale Analysis of Unstructured Data. *Journal of Machine Learning Research*, *2*, 259–266.

Lee, A. B., Nadler, B., and Wasserman, L. (2008). Treelets-an Adaptive Multi-scale Basis for Sparse Unordered Data. *Annals of Applied Statistics*, *2*(2), 435–471. https://doi.org/10.1214/07-AOAS137

Letta, M., Montalbano, P., and Tol, R. S. J. (2018). Temperature Shocks, Short-term Growth and Poverty Thresholds: Evidence from Rural Tanzania. *World Development, 112*, 13–32. https://doi.org/10.1016/j.worlddev.2018.07.013

Libois, F., and Somville, V. (2018). Fertility, Household Size and Poverty in Nepal. *World Development, 103*, 311–322. https://doi.org/10.1016/j.worlddev.2017.11.005

Lind, J., Sabates-Wheeler, R., Hoddinott, J. F., and Taffesse, A. S. (2018). Targeting Social Transfers in Pastoralist Societies: Ethiopia's Productive Safety Net Programme Revisited. In *Strategy Support Program* (No. 124; ESSP Working Paper, Issue September).

Linderhof, V., Janssen, V., and Achterbosch, T. (2019). Does Agricultural Commercialization Affect Food Security: The Case of Crop-Producing Households in the Regions of Post-Reform Vietnam? *Sustainability (Switzerland), 11*(5). https://doi.org/10.3390/su11051263

Lipton, M. (1988). The Poor and the Poorest: Some Interim Finding. In *The Sociology and Politics of Health: A Reader* (No. 25; World Bank Discussion Papers, Issue April). https://doi.org/10.2307/j.ctt1t89jmr.24

Liu, Y. (2022). Paradigmatic Compatibility Matters: A Critical Review of Qualitative-Quantitative Debate in Mixed Methods Research. *SAGE Open, 12*(1). https://doi.org/10.1177/21582440221079922

Liverpool-Tasie, L. S. O., and Winter-Nelson, A. (2010). Asset Versus Consumption Poverty and Poverty Dynamics in Rural Ethiopia. In *Agricultural Economics* (Vol. 42, Issue 2). https://doi.org/10.1111/j.1574-0862.2010.00479.x

McKay, A. (2017). Multidimensional Poverty in Poverty Reduction in Sub Saharan Africa since 1990. In Machiko Nissanke and Muna Ndulu (Ed.), *Poverty eduction in the Course of African Development* (Vol. 3, pp. 103–111). Oxford University Press.

Maganga, A. M., Chiwaula, L., and Kambewa, P. (2021). Climate Induced Vulnerability to Poverty among Smallholder Farmers: Evidence from Malawi. *World Development Perspectives*, *21*(May 2020), 100273. https://doi.org/10.1016/j.wdp.2020.100273

Makate, C., Makate, M., Mutenje, M., Mango, N., and Siziba, S. (2019). Synergistic Impacts of Agricultural Credit and Extension on Adoption of Climate-smart Agricultural Technologies in Southern Africa. *Environmental Development*, *32*(April), 100458. https://doi.org/10.1016/j.envdev.2019.100458

Paul, M., and Gĩthĩnji, M. W. (2018). Small Farms, Smaller Plots: Land Size, Fragmentation, and Productivity in Ethiopia. *The Journal of Peasant Studies*, *45*(4), 757–775. https://doi.org/10.1080/03066150.2016.1278365

Martin-Shields, C., and Stojetz, W. (2018). Food Security and Conflict. Empirical Challenges and Future Opportunities for Research and Policy Making on Food Security and Conflict. In *FAO Agricultural Development Economics* (No. 18–04; Vol. 66, Issue 1).

Mariotti, C., and Diwakar, V. (2016a). *Ensuring Escape from Poverty are Sustained in Rural Ethiopia, Leveraging Economic Opportunities (LEO) Report Number 36* (Issue August).

Martorell, R., and Zongrone, A. (2012). Intergenerational Influences on Child Growth and Undernutrition. *Paediatric and Perinatal Epidemiology*, *26*(SUPPL. 1), 302–314. https://doi.org/10.1111/j.1365-3016.2012.01298.x

Matz, J. A., Kalkuhl, M., and Abegaz, G. A. (2015). The Short-term Impact of Price Shocks on Food Security-Evidence from Urban and Rural Ethiopia. *Food Security*, *7*(3), 657–

679. https://doi.org/10.1007/s12571-015-0467-4

Migotto, M., Davis, B., Carletto, C., and Beegle. K. (2008). Measuring Food Security Using Respondents' Perception of Food Consumption Adequacy. In and B. D. Basudeb Guha-Khasnobis, Shabd S. Acharya (Ed.), *Food Security: Indicators, Measurement, and the Impact of Trade Openness* (UNU-WIDER, pp. 1–400). Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199236558.001.0001

Maxwell, D., Vaitla, B., Tesfay, G., and Abadi, N. (2013). *Resilience, Food Security Dynamics , and Poverty Traps in Northern Ethiopia Analysis of a Biannual Panel Dataset , 2011 – 2013* (Issue October).

McManus, P., Walmsley, J., Argent, N., Baum, S., Bourke, L., Martin, J., Pritchard, B., and Sorensen, T. (2012). Rural Community and Rural Resilience: What is Important to Farmers in Keeping their Country Towns Alive? *Journal of Rural Studies*, *28*(1), 20–29. https://doi.org/10.1016/j.jrurstud.2011.09.003

Mekonnen, D. A., Talsma, E. F., Trijsburg, L., Linderhof, V., Achterbosch, T., Nijhuis, A., Ruben, R., and Brouwer, I. D. (2020). Can Household Dietary Diversity inform about Nutrient Adequacy? Lessons from a Food Systems Analysis in Ethiopia. *Food Security*, *12*(6), 1367–1383. https://doi.org/10.1007/s12571-020-01056-5

Mekuyie, M., Jordaan, A., and Melka, Y. (2018). Climate Risk Management Understanding resilience of Pastoralists to Climate Change and Variability in the Southern Afar Region , Ethiopia. *Climate Risk Management*, *20*(February), 64–77. https://doi.org/10.1016/j.crm.2018.02.004

Melketo, T., Schmidt, M., Bonatti, M., Sieber, S., Müller, K., and Lana, M. (2021). Determinants of pastoral household resilience to food insecurity in Afar region, northeast Ethiopia. *Journal of Arid Environments*, *188*(January), 104454. https://doi.org/10.1016/j.jaridenv.2021.104454

Mideksa, T. K. (2010). Economic and Distributional Impacts of Climate Change: The Case of Ethiopia. *Global Environmental Change*, *20*(2), 278–286. https://doi.org/10.1016/j.gloenvcha.2009.11.007

Milas, S., and Latif, J. A. (2000). The Political Economy of Complex Emergency and Recovery in Northern Ethiopia. *Disasters*, *24*(4), 363–379. https://doi.org/10.1111/1467-7717.00153

MoFED. (2017). *Ethiopia's Progress Towards Eradicating Poverty: An Interim Report on 2015/16 Poverty Analysis Study* (Issue March).

MoFED. (2012). *Ethiopia's Progress Towards Eradicating Poverty:An Interim Report on Poverty Analysis Study (2010/11)* (Issue March).

Moller, L. C., and Wacker, K. M. (2017). Explaining Ethiopia's Growth Acceleration—The Role of Infrastructure and Macroeconomic Policy. *World Development*, *96*, 198–215. https://doi.org/10.1016/j.worlddev.2017.03.007

Moser, C., Stein, A., Norton, A., and Georgieva, S. (2010). Pro-Poor Adaptation to Climate Change in Urban Centers : Case Studies of Vulnerability and Resilience in Kenya and Nicaragua. In *Report No.54947-GLB.*

Murendo, C., Aziz, T., Tirivanhu, D., Stack, J., Mutambara, S., Langworthy, M., Murendo, C., Aziz, T., Tirivanhu, D., and Mapfungautsi, R. (2020). Dietary Diversity and Food Coping Strategies in Zimbabwe: Do Resilience and Food Insecurity Status Matter ? *Ecology of Food and Nutrition*, *00*(00), 1–21.

https://doi.org/10.1080/03670244.2020.1808784

Murendo, C., Kairezi, G., and Mazvimavi, K. (2020). Resilience Capacities and Household Nutrition in the Presence of Shocks. Evidence from Malawi. *World Development Perspectives*, *20*(July), 100241. https://doi.org/10.1016/j.wdp.2020.100241

Nahid, N., Lashgarara, F., Farajolah Hosseini, S. J., Mirdamadi, S. M., and Rezaei-Moghaddam, K. (2021). Determining the Resilience of Rural Households to Food Insecurity during Drought Conditions in Fars Province, Iran. *Sustainability (Switzerland)*, *13*(15), 1–13. https://doi.org/10.3390/su13158384

Nakano, Y., and Magezi, E. F. (2020). The Impact of Microcredit on Agricultural Technology Adoption and Productivity: Evidence from Randomized Control Trial in Tanzania. *World Development*, *133*, 104997. https://doi.org/10.1016/j.worlddev.2020.104997

Ngoma, H., Mulenga, B. P., Snyder, J., Banda, A., and Chapoto, A. (2019). Poverty and Weather Shocks: A Panel Data Analysis of Structural and Stochastic Poverty in Zambia. In *Feed the Future Innovation Lab for Food Security Policy* (No. 154; Research Paper Series, Issue November).

Islam, N., and Shimeles, A. (2007). *Poverty Dynamics in Ethiopia : State Dependence and Transitory Shocks* (No. 260; Working Paper in Economics, Vol. 2473, Issue 260).

Olopade, B. C., Okodua, H., Oladosun, M., and Asaleye, A. J. (2019). Human Capital and Poverty Reduction in OPEC Member-Countries. *Heliyon*, *5*(8), e02279. https://doi.org/10.1016/j.heliyon.2019.e02279

OPHI. (2022). Global MPI Country Briefing 2018: (Sub-Saharan Africa). In *Poverty, Oxford House, Queen Elizabeth Surveys, Health* (Issue 2011). www.ophi.org.uk

OPHI. (2019). *"Ethiopia Country Briefing", Multidimensional Poverty Index Data Bank* (Issue July).

OPHI. (2017). *Ethiopia Country Briefing , Multidimensional Poverty Index Data Bank.* University of Oxford.

Pforr, K. (2014). Femlogit—Implementation of the Multinomial Logit Model With Fixed Effects. *Stata Journal*, *14*(4), 847–862. https://doi.org/10.1177/1536867x1401400409

Planning and Development Commission. (2018). *Poverty and Economic Growth in Ethiopia (1995/96-2015/16)* (Issue December).

Postek, P., Len, P., and Strek, Z. (2019). *The Proposed Indicator of Fragmentation of Agricultural Land*. *103*(March), 581–588. https://doi.org/10.1016/j.ecolind.2019.04.023

Pradhan, K. C., and Mukherjee, S. (2018). Covariate and Idiosyncratic Shocks and Coping Strategies for Poor and Non-poor Rural Households in India. *Journal of Quantitative Economics*, *16*(1), 101–127. https://doi.org/10.1007/s40953-017-0073-8

Pritchard, B., Rammohan, A., and Vicol, M. (2019). The Importance of Non-farm Livelihoods for Household Food Security and Dietary Diversity in Rural Myanmar. *Journal of Rural Studies*, *67*(February), 89–100. https://doi.org/10.1016/j.jrurstud.2019.02.017

Rabe-Hesketh, S., and Skrondal, A. (2012). Multilevel and Longitudinal Modeling using Stata. In *Volume II: Categorical Responses, Counts, and Survival* (3rd ed). TX: Stata Press.

Radchenko, N., and Corral, P. (2018). Agricultural Commercialisation and Food Security in

Rural Economies: Malawian Experience. *Journal of Development Studies*, *54*(2), 256–270. https://doi.org/10.1080/00220388.2017.1283014

Radeny, M. (2012). Rural Poverty Dynamics in Kenya : Structural Declines and Stochastic Escapes. *World Development*, *40*(8), 1577–1593.

Rahman, A., and Mishra, S. (2020). Does Non-farm Income Affect Food Security? Evidence from India. *Journal of Development Studies*, *56*(6), 1190–1209. https://doi.org/10.1080/00220388.2019.1640871

Rapsomanikis, G. (2015). The Economic Lives of Smallholder Farmers: An Analysis Based on Household Data from Nine Countries. In *Fao*. https://doi.org/10.5296/rae.v6i4.6320

Ravallion, M. (2016). The Economics of Poverty: History, Measurement, and Policy. In *The Social Science Journal* (Vol. 55, Issue 2). Oxford University Press. https://doi.org/10.1016/j.soscij.2018.03.005

RM-TWG. (2014). *Resilience Measurement Principles: Toward an agenda for measurement design. Resilience* (No. 1; Food Security Information Network Technical Working Series, Issue 1).

Luckham, R., Ahmed, I., Muggah, R., and White, S. (2001). *Conflict and Poverty in Sub-Saharan Africa: An Assessement of the Issues and Evidence* (IDS Working Paper No. 128). *IDS Workig Paper*. Brighton, England.

Roche, J. M. (2013). Monitoring Progress in Child Poverty Reduction: Methodological Insights and Illustration to the Case Study of Bangladesh. In *Oxford Poverty & Human Development Initiative (OPHI)* (No. 57; OPHI Working Paper).

Roche, M., Vaz, A. N. A., and Alkire, S. (2017). Changes Over Time in Multidimensional Poverty : Methodology and Results for 34 Countries. *World Development*, *94*, 232–249. https://doi.org/10.1016/j.worlddev.2017.01.011

Rutter, M. (2012). Resilience as a Dynamic Concept. *Development and Psychopathology*, *24*(2), 335–344. https://doi.org/10.1017/S0954579412000028

Saja, A. M. A., Goonetilleke, A., Teo, M., and Ziyath, A. M. (2019). A Critical Review of Social Resilience Assessment Frameworks in Disaster Management. *International Journal of Disaster Risk Reduction*, *35*(December 2018), 101096. https://doi.org/10.1016/j.ijdrr.2019.101096

Salecker, L., Ahmadov, A. K., and Karimli, L. (2020). Contrasting Monetary and Multidimensional Poverty Measures in a Low-Income Sub-Saharan African Country. *Social Indicators Research*, *151*(2), 547–574. https://doi.org/10.1007/s11205-020-02382-z

Salvucci, V., and Santos, R. (2020). Vulnerability to Natural Shocks: Assessing the Short-Term Impact on Consumption and Poverty of the 2015 Flood in Mozambique. *Ecological Economics*, *176*(May), 106713. https://doi.org/10.1016/j.ecolecon.2020.106713

Sarma, M., and Pais, J. (2008). Financial Inclusion and Development: A Cross Country Analysis. *In Annual Conference of the Human Development and Capability Association, New Delhi*, *168*(10–13), 1–30. https://doi.org/10.1002/jid

Schotte, S. (2019). *Structural Poverty Dynamics in Urban South Africa A Mixed-Methods Investigation* (No. 100; UNU-WIDER Working Paper, Issue December). https://doi.org/10.35188/UNU-WIDER/2019/736-1

Scott, L., Hanifnia, K., Shepherd, A., Muyanga, M., and Valli, E. (2014). *How Resilient are*

Escapes out of Poverty? (Issue March). Chronic Poverty Advisory Network, Overseas Development Institute.

Scott, L. Diwakar, V., and Okech, M. (2016). Ensuring Escapes From Poverty Are Sustained in Uganda Leveraging Economic Opportunities LEO Report Number 27. In *United States Agency for International Development* (Vol. 27, Issue 3).

Seff, I., Baird, S., and Jolliffe, D. (2018). Dynamics of Child Malnutrition in Rural and Small-Town Ethiopia. *South African Journal of Economics*, *86*(2), 127–152. https://doi.org/10.1111/saje.12190

Sen, A. (1981). *Poverty and Famines: An Essay on Entitlement and Deprivation*. Clarendon Press.

Sen, A. (1976). Poverty: An Ordinal Approach to Measurement. *Econometrica*, *44*(2), 219–231.

Shaffer, P. (2013). Combining Qualitative and Quantitative Approaches in Poverty Analysis. In *Q Squared* (First Edit, Vol. 4, Issue 1). Oxford University Press (OUP).

Sharp, K., Devereux, S., and Amare, Y. (2003). Destitution in Ethiopia's Norteastern Highlands (Amhara National Regional State). In *Final Report*. e:%5CArizona%5CResearch%5CTigray%5CInfo%5CDestitution final

Shaw, D. J. (2007). *World Food Security: A History since 1945*. Palgrave Macmillan.

Shehu, A., and Sidique, S. F. (2020). The Effect of Shocks on Household cConsumption in Rural Nigeria. *The Journal of Developing Areas*, *49*(3), 353–364.

Shimeles, A. (2019). Growth, Poverty, and Distribution in Ethiopia. In and A. O. Fantu Cheru, Christopher Cramer (Ed.), *The Oxford Handbook of the Ethiopian Economy* (Economics, Issue April, pp. 351–365). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780198814986.013.18

Sibrian, R., D'errico, M., De Fulladolsa, P. P., and Benedetti-michelangeli, F. (2021b). Household Resilience to Food and Nutrition Insecurity in Central America and the Caribbean. *Sustainability (Switzerland)*, *13*(16). https://doi.org/10.3390/su13169086

Smith, L. C., and Frankenberger, T. R. (2018). Does Resilience Capacity Reduce the Negative Impact of Shocks on Household Food Security? Evidence from the 2014 Floods in Northern Bangladesh. *World Development*, *102*, 358–376. https://doi.org/10.1016/j.worlddev.2017.07.003

Smith, L., and Frankenberger, T. (2015). *Case Study of the below Technique: Ethiopia Pastoralist Areas Resilience Improvement and Market Expansion (PRIME) Project Impact Evaluation: Baseline Survey Report* (Issue January).

Sou, G. (2019). Sustainable resilience? Disaster Recovery and the Marginalization of Sociocultural Needs and Concerns. *Progress in Development Studies*, *19*(2), 144–159. https://doi.org/10.1177/1464993418824192

Souza, A. D., and Jolliffe, D. (2016). A Profile of Food Insecurity Dynamics in Rural and Small Town Ethiopia. *Ethiopian Journal of Economics*, *25*(2), 78–112.

Speranza, C. I. (2010). Resilient Adaptation to Climate Change in African Agriculture. In *Publications of the German Development Institute*. German Development Institute.

StataCorp. (2019). *Stata: Structural Equation Modeling Reference Manual* (S. LLC (ed.); Release 16). A Stata Press Publication.

Steinert, J. I., Zenker, J., Filipiak, U., Movsisyan, A., Cluver, L. D., and Shenderovich, Y.

(2018). Do Saving Promotion Interventions Increase Household Savings, Consumption, and Investments in Sub-Saharan Africa? A Systematic Review and Meta-Analysis. *World Development*, *104*, 238–256. https://doi.org/10.1016/j.worlddev.2017.11.018

Steinert, J. I., Cluver, L. D., Melendez-Torres, G. H., and Vollmer, S. (2016). One Size Fits All ? The Validity of a Composite Poverty Index Across Urban and Rural Households in South Africa. *Social Indicators Research*. Netherlands: Springer. https://doi.org/10.1007/s11205-016-1540-x

Stifel, D., and Woldehanna, T. (2017). Estimating Utility-Consistent Poverty in Ethiopia, 2000–11. In C. A. and F. Tarp (Ed.), *Measuring Poverty and Wellbeing in Developing Countries* (United Nat). Oxford University Press (OUP).

Swanepoel, C. (2005). *Poverty and Poverty Dynamics in Ethiopia* (No. 3; Stellenbosch Economic Working Papers).

TANGO International. (2018). Methodological Guide: A Guide for Calculating Resilience Capacity. In *Produced by TANGO International as part of the Resilience Evaluation,Analysis and Learning (REAL)* (Issue October).

Tefera, N., Demeke, M., and Kayitakire, F. (2017). *Building Sustainable Resilience for Food Security and Livelihood Dynamics : The Case of Rural Farming Households in Ethiopia*. https://doi.org/10.2760/973096

Thiede, B. (2016). Resilience and Development among Ultra-poor Households in Rural Ethiopia. *Resilience*, *4*(1), 1–13. https://doi.org/10.1080/21693293.2015.1094166

Thiede, B. C. (2014). Rainfall Shocks and Within-Community Wealth Inequality: Evidence from Rural Ethiopia. *World Development*, *64*, 181–193. https://doi.org/10.1016/j.worlddev.2014.05.028

Tigre, G. (2018). Multidimensional Poverty and Its Dynamics in Ethiopia. In Almas Heshmati and Haeyeon Yoon (Ed.), *Economic Growth and Development in Ethiopia* (Perspectiv, pp. 161–195). Springer Nature Singapore plc Ltd. https://doi.org/10.1007/978-981-10-8126-2_8

Tonini, F., Lasinio, G. J., and Hochmair, H. H. (2012). Mapping Return Levels of Absolute NDVI Variations for the Assessment of Drought Risk in Ethiopia. *International Journal of Applied Earth Observation and Geoinformation*, *18*(1), 564–572. https://doi.org/10.1016/j.jag.2012.03.018

Tran, Q., Alkire, S., and Klasen, S. (2014). Disparities Between Monetary and Multidimensional Measurements of Poverty. In *IARIW 33rd General Conference*. Rotterdam, the Netherlands.

Tsehay, A. S., and Bauer, S. (2012). Poverty and Vulnerability Dynamics: Empirical Evidence from Smallholders in Northern Highlands of Ethiopia. *Quarterly Journal of International Agriculture*, *51*(4), 301–332. https://doi.org/10.22004/ag.econ.155481

Tsui, K. Y. (2002). Multidimensional Poverty Indices. *Social Choice and Welfare*, *19*(2002), 69–93.

Ukegbu, P., and Ogu, V. O. (2017). Assessment of Dietary Diversity Score, Nutritional Status and Socio-demographic Characteristics of Under-5 Children in Some Rural Areas of Imo State, Nigeria. *Malaysian Journal of Nutrition*, *23*(3), 425–435. http://nutriweb.org.my/publications/mjn0023_3/11Ukegbu644(edSP)K2.pdf

UNDP. (2020). Charting Pathways out of Multidimensional Poverty: Achieving the SDGs. In the United Nations Development Programme and Oxford Poverty and Human

Development Initiative (Issue July). https://ophi.org.uk/multidimensional-poverty-index/.

UNDP. (2018). Ethiopia's Progress Towards Eradicating Poverty. In *Implementation of the Third United Nations Decade for the Eradication of Poverty (2018 – 2027)*.

Upton, J. B., Cissé, J. D., and Barrett, C. B. (2016). Food Security as Resilience: Reconciling Definition and Measurement. *Agricultural Economics*, *47*, 135–147. https://doi.org/10.1111/agec.12305

Usman, M. A., and Callo-Concha, D. (2021). Does Market Access Improve Dietary Diversity and Food Security? Evidence from Southwestern Ethiopian Smallholder Coffee Producers. *Agricultural and Food Economics*, *9*(1), 0–21. https://doi.org/10.1186/s40100-021-00190-8

Venton, C. C. (2018). *Economics of Resilience to Drought Ethiopian Analysis* (Issue January). A Report of the USAID Centre for Resilience.

Wagle, U. (2008). *Multidimensional Poverty Measurement: Concepts and Applications* (J. Silber (ed.); Economic S). Springer Science+Business Media, LLC. https://doi.org/10.1007/978-0-387-75875-6 e-ISBN

Walker, B. H., Anderies, J. M., Kinzig, A. P., and Ryan, P. (2006). Exploring Resilience in Social-Ecological Systems through Comparative Studies and Theory Development: Introduction to the Special Issue. *Ecology and Society*, *11*(1). https://doi.org/10.5751/ES-01573-110112

Weldeegzie, S. G. (2017). Growing-up Unfortunate: War and Human Capital in Ethiopia. *World Development*, *96*, 474–489. https://doi.org/10.1016/j.worlddev.2017.03.030

WFP and CSA. (2019). Comprehensive Food Secruity and Vulnerability Analysis (CFSVA). In *Saving Lives Changing LIves*.

WFP VAM. (2008). *Food Consumption Analysis: Calculation and Use of the Food Consumption Score in Food Security Analysis Technical Guidance Sheet* (Vol. 148).

WHO. (2021). The State of Global Nutrition. In *Global Nutrition Report* (Issue June). Development Initiatives Poverty Research Ltd. Suggested. https://globalnutritionreport.org/reports/2021-global-nutrition-report/

Williams, R. (2016). Understanding and Interpreting Generalized Ordered Logit Models. *Journal of Mathematical Sociology*, *40*(1), 7–20. https://doi.org/10.1080/0022250X.2015.1112384

Woodson, L., Frankenberger, T., Smith, L., Langworthy, M., and Presnall, C. (2016). *The Effects of Social Capital on Resilience Capacity: Evidence from Ethiopia, Kenya, Uganda, Niger and Burkina Faso. Report Prepared by the Technical Consortium, a Project of the CGIAR. Technical Report Series No 2: Strengthening the Evidence Base for Res* (Issue 2).

Wooldridge, J. M. (2013). Introductory Econometrics: A practical Approach. In J. S. Worls and Michael (Eds.), *Introductory Econometrics: A Practical Approach* (Fifth Edit). South Western Cengage Learning. https://doi.org/10.4324/9780203157688

Wooldridge, J. M. (2012). *Econometric Analysis of Cross Section and Panel Data* (Secon Edit). The Massachusetts Institute of Technology Press.

World Bank. (2020a). *Ethiopia Poverty Assessement: Harnessing Continued Growth for Accelerated Poverty Reduction*. www.worldbank.org

World Bank. (2020b). Reversals of Fortune. In *Poverty and Shared Prosperity 2020: Vol. 3678 LNBI*. https://doi.org/10.2307/j.ctv14npk3p.9

World Bank. (2018). *Poverty and Shared Prosperity2018: Piecing Together Poverty Puzzle*. Washington, DC: World Bank. License: Creative Commons Attribution CC BY 3.0 IGO

World Bank. (2015). *Ethiopia Poverty Assessement 2014: Poverty Global Practice Africa Region*. Washington, DC. http://localhost:4000//entities/publication/c4161170-c4a7-5049-a2bb-bb7e418200d1"

Wossen, T., and Berger, T. (2015). Climate Variability, Food Security and Poverty: Agent-based Assessment of Policy Options for Farm Households in Northern Ghana. *Environmental Science and Policy*, *47*, 95–107. https://doi.org/10.1016/j.envsci.2014.11.009

Wulff, J. N. (2015). Interpreting Results From the Multinomial Logit Model: Demonstrated by Foreign Market Entry. *Organizational Research Methods*, *18*(2), 300–325. https://doi.org/10.1177/1094428114560024

Yao, Y. (2019). Does Higher Education Expansion Enhance Productivity? *Journal of Macroeconomics*, *59*(December 2018), 169–194. https://doi.org/10.1016/j.jmacro.2018.11.009

Yengoh, G. T., Dent, D., Olsson, L., and Tengberg, A. E. (2015). *Use of the Normalized Index (NDVI) to Assess Diff erence Vegetation Current Status, Future Trends, and Practical Considerations* (Springer B). Springer International Publishing.

Zereyesus, Y. A., Embaye, W. T., Tsiboe, F., and Amanor-boadu, V. (2017). Implications of Non-Farm Work to Vulnerability to Food Poverty-Recent Evidence From Northern Ghana. *World Development*, *91*(November 2016), 113–124. https://doi.org/10.1016/j.worlddev.2016.10.015

Zewdie, M. C., Van Passel, S., Cools, J., Tenessa, D. B., Ayele, Z. A., Tsegaye, E. A., Minale, A. S., and Nyssen, J. (2019). Direct and Indirect Effect of Irrigation Water Availability on Crop Revenue in Northwest Ethiopia: A Structural Equation Model. *Agricultural Water Management*, *220*(July 2018), 27–35. https://doi.org/10.1016/j.agwat.2019.04.013

Zhang, X., and Zhang, B. (2019). The Responses of Natural Vegetation Dynamics to Drought During the Growing Season across China. *Journal of Hydrology*, *574*(January), 706–714. https://doi.org/10.1016/j.jhydrol.2019.04.084

Appendices

Appendix 2

Table 2.11: Variables used in PCA

Table 2.11a: Access to basic services

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	1.15193	.142034	0.3840	0.3840
Comp2	1.0099	.171735	0.3366	0.7206
Comp3	.838165	.	0.2794	1.0000

Variable	Comp1	Comp2	Comp3	Unexplained
Clean water	0.4799	0.7221	0.4982	0
Improved toilet	-0.7182	-0.0027	0.6959	0
Electricity	0.5039	-0.6917	0.5173	0

Table 2.11b: Assets

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	1.01562	.0153737	0.3385	0.3385
Comp2	1.00025	.0161233	0.3334	0.6720
Comp3	.984127	.	0.3280	1.0000

Variable	Comp1	Comp2	Comp3	Unexplained
Land	0.7099	-0.0084	0.7043	0
Tlu	-0.3575	0.8572	0.3706	0
Numbers of rooms	0.6069	0.5148	-0.6055	0

Table 2.11c: Adaptive capacity

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	1.04946	.0309276	0.3498	0.3498
Comp2	1.01853	.0865236	0.3395	0.6893
Comp3	.932008	.	0.3107	1.0000

Variable	Comp1	Comp2	Comp3	Unexplained
Food ratio	0.7262	-0.2644	0.6346	0
Numbers of income sources	-0.0862	0.8808	0.4657	0
Subsistence households	0.6820	0.3929	-0.6168	0

Table 2.11d: Stability

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	1.07256	0 .06184	0.3575	0.3575
Comp2	1.01072	0.09398	0.3369	0.6944
Comp3	.916728	.	0.3056	1.0000

Variable	Comp1	Comp2	Comp3	Unexplained
Numbers of skilled workers	0.5773	0.5775	-0.5773	0
Availability of food stock	-0.3658	0.8150	0.4495	0
Potential Wetness Index	0.7301	-0.0483	0.6817	0

Table 2.11e: Income and Food access

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	1.27294	.272128	0.4243	0.4243
Comp2	1.00081	.274567	0.3336	0.7579
Comp3	.726246	.	0.2421	1.0000

Variable	Comp1	Comp2	Comp3	Unexplained
Per capita income	0.0650	0.9943	0.0846	0
Non-food consumption expenditure	0.7076	0.0138	-0.7065	0
Food consumption expenditure	0.7037	-0.1058	0.7026	0

Table 2.11f: Social safety net

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	1.0082	.0163924	0.5041	0.5041
Comp2	.991804	.	0.4959	1.0000

Variable	Comp1	Comp2	Unexplained
Remittance	0.7071	0.7071	0
PSNP	0.7071	-0.7071	0

Table 2.12: Treelet transform/correlation to compute RCI

Component	Variance	Proportion	Cumulative	Adj. proportion
TC1	2.1003	0.3500	0.3500	0.3500
TC2	1.0000	0.1667	0.5167	0.1661
TC3	1.0000	0.1667	0.6834	0.1645
TC4	0.9773	0.1629	0.8463	0.1628
TC5	0.9224	0.1537	1.0000	0.1521
TC6	0.0000	0.0000	1.0000	0.000

Table 2.13: Correlation matrix of resilience and multidimensional poverty

	RCI	AST	IFA	ABS	AC	STB	SSN	M_0
RCI	1.0000	0.1558	0.5415	0.4842	0.1558	-0.0606	0.0086	-0.2205
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.4477	0.0000
AST	0.2729	1.0000	0.2359	0.0374	1.0000	0.3406	-0.0839	-0.0784
	0.0000	0.0000	0.0000	0.0009	0.0000	0.0000	0.0000	0.0000
IFA	0.7072	0.1127	1.0000	0.0592	0.2359	0.0439	-0.0253	-0.1609
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0255	0.0000
ABS	0.3994	0.0912	0.0209	1.0000	0.0374	0.0182	-0.0235	-0.1909
	0.0000	0.0000	0.0646	0.0000	0.0009	0.1068	0.0379	0.0000
AC	0.2729	1.0000	0.1127	0.0912	1.0000	0.3406	-0.0839	-0.0784
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STB	-0.0341	0.2045	0.0096	0.1285	0.2045	1.0000	-0.0442	-0.0685
	0.0025	0.0000	0.3955	0.0000	0.0000	0.0000	0.0001	0.0000
SSN	0.0361	-0.0502	0.0230	-0.0312	-0.0502	-0.0476	1.0000	-0.0301
	0.0014	0.0000	0.0416	0.0058	0.0000	0.0000	0.0000	0.0078
M_0	-0.1806	-0.0707	-0.0761	-0.1770	-0.0707	-0.1010	-0.0253	1.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0252	0.0000

Figure 2.4: Cluster tree produced by ttdendro

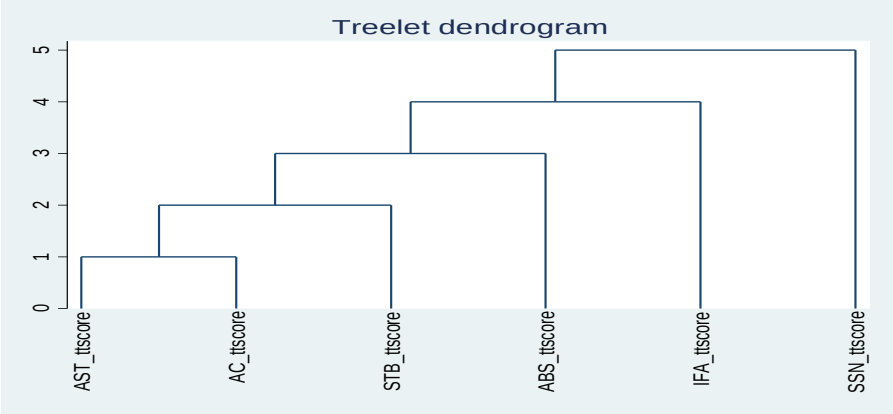
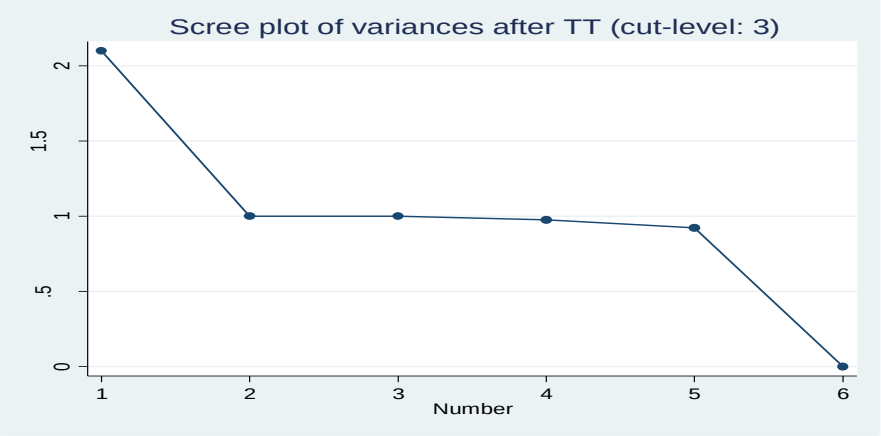


Figure 2.5: Scree plot of variances of TT component scores



Appendix 4

Table 4.8: Description of variables used for MFII measurement

Dimensions	Variables	Description
Availability	Calorie consumption	The daily kilocalorie intake per adult equivalent per day
	Self-sufficiency ratio	The proportion of crops used for own consumption
Accessibility	Numbers of oxen	Oxen used for plow as a proxy for productive resources
	Distance to market	Distance from the nearest market in Km
	Distance to town	Distance from the nearest population center in Km
	Numbers of plots	Numbers of plots used as a proxy for land fragmentation
Utilization	Numbers of food crops	Food crops cultivated as a proxy for dietary diversity
	Child mortality	Whether a household reported one or more child mortality
	Sanitation	Whether a household uses modern waste disposal
Stability	NDVI	Normalized Difference Vegetation Index
	Access to irrigation	Whether the farmer uses irrigation
	Saving account	Whether the farmer has a saving account
	Land certificate	Whether their farmland is certificated by the government
	Numbers of shock	The sum of covariate and idiosyncratic shocks

Table 4.9: Dimensions and indicators used to estimate resilience

Dimensions	Indicators	References
Access to basic services	Access to clean water Access to improved toilet Access to electricity	Exogenous responses provided by the public play a key role in determining the risk exposure of households.
Assets	Land Tropical livestock unit Number of rooms	Assets are part of household wealth, and their availability serves as an important risk coping mechanism. They enhance the resilience capacity of the household to be free from poverty even in the face of shocks and stresses.
Adaptive capacity	Numbers of income sources Subsistence households Food ratio	Households' capacity to cope with and adapt to certain shocks, so enables households to keep performing their key functions.
Social safety nets	Participation in PSNP Remittances	They comprise formal and informal access to public and private, cash or in-kind transfers to households from different sources that make up a substantial portion of poor households' annual income.

Table 4.10: FA results for resilience pillars

Table 4.10a: FA results for ABS

Variable	Factor1	Factor2	Uniqueness
Clean water	-0.1416	-0.1652	0.9527
Sanitation	0.6167	-0.0334	0.6186
Improved toilet	0.6261	0.0079	0.6080
Electricity	-0.1716	0.1177	0.9567
Expenditure for education	0.0790	0.1569	0.9691

Table 4.10b: FA results for AST

Variable	Factor1	Factor2	Uniqueness
Land in hectare	0.5893	-0.5729	0.3246
Tropical livestock unit	0.7612	0.1082	0.4088
Number of rooms	0.3121	0.8176	0.2340

Table 4.10c: FA results for SSN

Variable	Factor1	Factor2	Uniqueness
Participation in PSNP	0.6769	0.3077	0.4348
Social assistance	0.7478	-0.2709	0.3794
Remittance	-0.0353	0.9151	0.1633

Table 4.10d: FA results for AC

Variable	Factor1	Factor2	Uniqueness
Dependency ratio	0.0544	0.8574	0.2619
Illness of household head	0.4250	0.3721	0.6809
Number of income sources	-0.2673	-0.1549	0.9045
Number of non-farm skilled workers	0.7403	-0.0533	0.4491
Subsistence	-0.6351	0.3255	0.4907

Appendix 5

Table 5.8: The deprivation thresholds of those who are multidimensionally destitute

Dimensions	Indicators	Deprived if	Weight
Education	Years of schooling	No household member has completed at least one year of schooling	0.166
	School attendance	No child is attending school up to the age at which they should finish class	0.166
Nutrition	Child mortality	Any child has died in the household	0.166
	Nutrition	Any child for whom there is nutritional information is malnourished	0.166
Standard of living	Electricity	The household has no electricity	0.055
	Improved sanitation	There is no sanitation facility (open defecation)	0.055
	Safe drinking water	The household does not have access to improved drinking water	0.055
	Flooring	The household has a dirt, sand, or dung floor	0.055
	Cooking fuel	The household cooks with dung, wood, or charcoal	0 .055
	Assets	The household has no assets	0.055