Poverty, Vulnerability and Resilience in Rural Ethiopia:
Forward-looking Empirical Analyses for More Effective Policy Interventions

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This is to certify that the thesis prepared by Birhan Sisay, entitled: *Poverty, Vulnerability and Resilience in Rural Ethiopia: Forward-looking Empirical Analyses for More Effective Policy Interventions* and submitted in fulfillment of the requirements for the Degree of Doctor of Philosophy (Development Studies) complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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Abstract

Poverty, Vulnerability and Resilience in Rural Ethiopia: Forward-looking Empirical Analyses for More Effective Policy Interventions

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This dissertation investigates the state and determinants of poverty, vulnerability and resilience in rural Ethiopia during 2012-2016 using the Ethiopian Socioeconomic Survey data. For analysis, the study employed fixed effect model, feasible generalized least square model, factor analysis, structural equation modelling and multivariate probit model to assess the determinants of poverty, vulnerability, resilience capacity dimensions, resilience capacity and coping strategies respectively. The result indicated that poverty and vulnerability are dynamic and prevalent. The observed poverty rate in 2012, 2014 and 2016 are 30%, 36% and 43% respectively. The vulnerability rate also follows in an increasing pattern with 50%, 59%, and 62.4% in 2012, 2014 and 2016 respectively. While education of members, income diversification and distance to market centers are the determinants of both poverty and vulnerability; age, sex and education of head, working household members, social capital, distance to main roads and midland agro ecological location are factors symptomatic to vulnerability only. The study also indicated a difference in resilience capacity & its dimensions over time (2014 was higher than 2012 & 2016). Adaptive capacity and assets are very important dimensions of resilience capacity. Moreover, the study revealed savings; livestock sales; and spiritual help as major coping strategies as well as the type of shocks households faced, literacy, oxen ownership and regional locations as determining factors for households' choice a particular coping strategy. The implication of the result is that anti-poverty intervention based on observed and expected poverty measurements are important. Anti-poverty policies should be strengthened as a key development agenda of the country more than as it did before. Specifically, policies for the poor and vulnerable households are needed. Moreover, policies aiming at poverty reduction should also consider factors that increase their resilience capacity. This include programs on diversifying household's livelihood strategies and improving their education, assets and access to essential social services. Above all, resilience oriented development programs with a focus on not only relief transfers in the short-run but also building assets and adaptive capacity of households in the long-run are needed.

Keywords: poverty, vulnerability, resilience, shock, coping strategy, household, region, Ethiopia.

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This thesis is dedicated to the rural farming households in Ethiopia.

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List of Abbreviations

ABS	Access to Basic Services
AC	Adaptive Capacity
ASS	Assets
CDF	Cumulative Distribution Function
CSA	Central Statistical Authority
DFID	Department For International Development
DROP	Disaster Resilience Of Place
EMDAT	Emergency Event Database
ERHS	Ethiopian Rural Household Survey
ESS	Ethiopian Socioeconomic Survey
ETB	Ethiopian Birr
FA	Factor Analysis
FAO	Food and Agriculture Organization
FGLS	Feasible Generalized Least Square
FGT	Foster-Greer-Thorbecke
GDP	Growth Domestic Product
HICE	Household Income and Consumption Expenditure
kcal	kilo calories
km^2	square kilometer
m.a.s.l	meter above sea level
m.b.s.l	meter below sea level
MDG	Millennium Development Goals

MoFED	Ministry of Finance and Economic Development
MPI	Multidimensional Poverty Index
MVP	Multivariate Probit Model
RCI	Resilience Capacity Index
RIMA	Resilience Index Measurement and Analysis
SDG	Sustainable Development Goals
SEM	Structural Equation Model
SNNP	Southern Nations Nationalities and People
SSN	Social Safety Nets
TLU	Tropical Livestock Unit
UNDP	United Nations Development Programme
USAID	United States of America International Development
USD	United States Dollar
VEP	Vulnerability as Expected Poverty
VER	Vulnerability as uninsured Exposure to Risk
VEU	Vulnerability as low Expected Utility

Glossary

Belg	Secondary rainy season (February to May)
Bererha	Desert
Khat	A perennial crop and its leaves are chewed for a stimulating effect
Dega	Highland agro-ecological zone (2,300 to 3,200 meters above sea level)
Enset	False banana" (*Ensete ventricosum*), a perennial tuber grown especially in southern Ethiopian highlands as a staple food crop,
Gabi	Type of local cloth commonly wore during festivals in rural Ethiopia
Kebele	The smallest administrative unit in the local government system
Kolla	Lowland agro-ecological zone (less than 1,500 meters above sea level)
Kur	Extremely highland and cold area (above 3,700 meters above sea level)
Machid	A local ploughing tool used for cutting crops and grass in rural Ethiopia
Meher	The primary rainy season and therefore the primary crop season
Mofer	A local ploughing tool used for agricultural land ploughing with oxen
Teff	A cereal crop related to millet (*Eragrostis tef*)
Woina-Dega	Mid elevation agro-ecological zone (1,500 to 2,300 meters above sea level)
Woreda	Administrative level under the zone level
Wurch	Frost, or extremely highland area (3,200 to 3,700 meters above sea level)

Chapter 1. Introduction

1.1. Overview

Despite the progress in poverty reduction since the 1980s (Rodríguez-Pose et al., 2015), about a billion people were living below 1 United States Dollar (USD) per day at the turn of the new millennium (Pogge, 2004). In 2000, world leaders set the Millennium Development Goals (MDG) prioritizing poverty reduction, specifically to halve the number of poor people with an income below a USD per day by 2015 (United Nations, 2000). The United Nations (2015a) reports the success of poverty reduction admitting more than 800 million people still living in extreme poverty in 2015. In this regard, the UNDP (2014) also estimated about 2.7 billion people living less than 2.5 USD per day. This considerably high number of poor people indicate that the poverty problem is far from being solved.

The incidence of poverty in Sub-Sahara Africa (46.9%) and South Asia (25%) in 2011 indicates the little progress in reducing poverty and the regions' lag behind in achieving most of the MDG targets (Lowdera et al., 2017). Moreover, the MDG's period poverty reduction has been uneven across regions and countries (United Nations, 2015a). Such high incidence of poverty coupled with this unevenness imply the risk of households falling into poverty. This indicates that there is still lack of in depth understanding on the causes of poverty in this part of the world (Sahn, 2015).

Most of the causes of poverty are generally seen as macro-level sources of vulnerabilities with persistent exposure of households to shocks and their inability to counter these shocks and risks (Baulch, 2011). Specifically, the sources of risk for poverty trap are often associated with the high level of volatility in commodity prices, slow outputs growth and danger of weather related shocks that exacerbate the

repercussions for poverty in this poorest region of Africa and developing countries (Baulch, 2011; Klasen and Waibel, 2013). Such generalizations of being the same for the causes across countries lead similar types of interventions (e.g. enhancing economic growth) to address poverty and vulnerability (Vandemoortele, 2011). Acknowledging some similarities, some scholars however, argue the variations of the causes of poverty across countries and contexts and there is no single set of anti-poverty reduction interventions for all countries of the world (Carr, 2008; Azeem et al., 2016).

Recognizing the success as well as the unfinished business of the MDG, world leaders adopt the Sustainable Development Goals (SDG) to be implemented in 15 years (2015-2030) (United Nations, 2015b). The SDG also put poverty reduction as its forefront among others goals that need serious attention stating "end poverty in all its forms everywhere by 2030" (United Nations, 2015b, p. 17). This very ambitious SDG goal and its specific targets that explicitly focus of reducing households' vulnerabilities to various shocks and building their resilience by the specified time period provide pivotal opportunity for the research community to bridge the research gaps on the nature and causes of poverty in specific contexts. Particularly, such pivotal attention by world leaders would contribute for countries that lag achieving the MDGs in South Asia and Sub-Sahara Africa where policies and programs developed and implemented not based on evidence, rather on an ad hoc basis (Babu, 2015; Azeem et al., 2016).

Ethiopia is one of the poorest and most populous country in Sub-Sahara Africa, where the scourge of poverty continues to haunt the lives of millions. Understanding the state of poverty is of high policy relevance to Ethiopia. This study deals the state and drivers of household poverty in rural Ethiopia during 2012-2016 based on a panel data set.

1.2. Context and Problem Statement

Ethiopia, a Sub-Saharan African country has been poverty ridden and structurally food deficit over the last many decades. Poverty and food insecurity become the defining features of rural farming households since the famous famine period in the mid-1980's (Devereux and Sussex, 2000). Ethiopia is one of the poorest countries in the world that has not achieved the MDG targets related to poverty reduction (Dercon and Porter, 2011; Roelen and Camfield, 2014). In Ethiopia, as many as 25 percent of the population (i.e 26 million people) live on less than USD 1.90 per day in 2015 (World Bank, 2015) and by 2030, as many as 13 million people (10 % of the population) are forecasted to still be living on less than USD 1.90 per day (USAID, 2017). Especially in rural Ethiopia, the problem of poverty and food insecurity are still worrisom and pose great challenge. All the indications are that the country will not be able to drastically reduce poverty nor will the relief interventions be brought to an end any time soon (Dercon and Porter, 2011; Gray and Mueller, 2012; Rahmato, 2013; Hill and Porter, 2017).

The main underlying causes that shapes the nature of poverty are a combination of multiple and intertwined short-term transitory shocks and long-term structural factors. The later may include high dependency on low input-low output rain-fed agriculture system subject to unreliable rainfall pattern with likely drought and other extreme weather events (Devereux and Sussex, 2000; CRED, 2011; Dercon and Porter, 2011); rapid population growth with declining land holdings (Rahmato, 2013); high rate of land degradation (Negatu, 2008); underdeveloped market and technological innovations (Dercon and Christiaensen, 2011); and lack of alternative income sources outside of agriculture (Devereux and Sussex, 2000; Gray and Mueller, 2012).

Combined with such complex structural factors, a wide range of transitory shocks and risks, such as drought, seasonal flooding, localized inter-communal conflict, above-

average food prices, and disease outbreaks are the primary cause for the former (Dercon et al., 2005; Awel, 2007; Debebe et al., 2013; Mohamed, 2017). These shocks and risks combined with other structural factors exacerbate the problem of poverty and food insecurity with declining risk coping ability of the majority of the rural households who are still predominantly reliant on unreliable rainfall dependent agriculture (Porter, 2012; Robinson et al., 2013).

Therefore, in the absence of well-functioning credit and insurance markets, a distressing reality in Ethiopia to these adverse shocks and risks renders households to be poor and vulnerable. Such exposure can affect not only households who were poor to start with and who might face utter destitution as a result of adverse shocks, but also non-poor households who can fall back into poverty, and thus also need to be considered in an analysis of household poverty. Such comprehensive understanding need to account the spatial and temporal nature of poverty, i.e., a dynamic analysis of poverty. The dynamic anlysis of poverty can be made in an *ex-post* or/and *ex-ante* way. Anchoring the poverty status of a household is not fixed but changes over time (Jalan and Ravallion, 2000), poverty analyses incorporates dynamics-as is the case with estimations of transient and chronic poverty in an *ex-post* way. The *ex-ante* is often represented by the concept of vulnerability to poverty which has emerged over the past two decades as an important measure of individual well-being to move in and out of poverty in the near future (Chaudhuri et al., 2002; Klasen and Povel, 2013). The key difference between the *ex-post* poverty dynamics (poverty dynamics hereafter) and *ex-ante* poverty dyanmics (vulnerability to poverty hereafter), is that the latter is a forward looking as opposed to the backward looking (Klasen and Povel, 2013). Similarly, analysis of households' capacity to deal with shocks, i.e. the issue of resilience is an emerging topic for better understanding of household wellbeing (Alinovi et al., 2008; FAO, 2010).

This study is therefore, primairly motivated to embrace such complex issues that consider and shape the nature of poverty and to contribute in filling the following specific apparent research gaps that exist in the contemporary poverty literature elsewhere and in Ethiopia. Firstly, despite a number of empirical studies on poverty (MoFED, 2012; Moges, 2013; Birhan, 2016) and vulnerability (Dercon et al., 2005; Gray and Mueller, 2012; Porter, 2012; Tsehay et al., 2012; Hill and Porter, 2017; Birhan and Tesfahun, 2017) in Ethiopia, these studies have limitations in terms of data and methods used as well as implications to policy. Quality poverty and vulnerability research need tailor made household survey data–have a panel dimension, be extremely detailed about shocks and be large enough in sample size (Hoddinott and Quisumbing, 2003; Hardeweg et al., 2013). However, most of the empirical studies use available data set- either cross-sectional data (Birhan and Tesfahun 2017) or small size panel data designed to represent a particular area or agro-ecological zones of the country. For instance, studies from the Ethiopian Rural Household Survey (Dercon et al., 2005; Gray and Mueller, 2012; Porter, 2012; Tsehay et al., 2012). To make the best use of the available data, the methods of these studies make some stringent assumptions, for instance, in case of cross-sectional data for vulnerability estimations. Hence, the available data and methods used clearly lead differences in the quality of the resulting poverty and vulnerability estimates. In terms of policy implications, most of these studies are narrow in scope to fully understand the state and causes of poverty in Ethiopia. In a country where the scourge of poverty continues to haunt the lives of millions, contemporary in-depth poverty research that indicates the recent conditions prevailing in for the whole nation or regions, or the majority of the population groups that are of particular interest is of high policy relevance to Ethiopia. For these limitations, this study used a recent, panel, nationally and regionally representative in

sample size, high quality data set; the Ethiopian Socioeconomic Survey data unlike the above studies in Ethiopia.

Secondly, as an emerging issue in the context of shock-induced recurrent food emergencies, resilience has become key research as well as policy agenda (Alinovi et al., 2008; FAO, 2013; 2016). With the rapidly growing concern on resilience to negative wellbeing outcomes, better insights are needed to measure and understand the capacity[1] of households to deal with shocks while maintaining their wellbeing (Alinovi et al., 2010; Martin-Breen and Anderies, 2011; Romano et al., 2014). Dominantly in food insecurity literature, the issue of resilience emerged admitting the conceptual differences with vulnerability concept and the weakness associated with vulnerability approaches. Empirical studies on vulnerability to poverty and food insecurity in Ethiopia and elsewhere proved that the rate of vulnerability is higher than the actual rate (Tsehay et al., 2012; Bogale, 2012; Hill and Porter, 2017; Birhan and Tesfahun, 2017). However, it is argued that policies that aim at reducing such problems through policy interventions have not been as effective as expected and have not substantially improved household's capacity to withstand shocks (Alinovi et al. 2008; Romano et al., 2014). Although dynamic and forward looking, statistical methods of vulnerability analysis have both conceptual and empirical limitations (FAO, 2013; Guyu and Muluneh, 2015). While the conceptual limitations arise from the complexity (multidimensionality) of the concepts of poverty and food insecurity and the unpredictability of the many shocks that cause such problems, the empirical gaps on the other hand arise due to lack of longitudinal data from which predictions would be

[1] While resilience itself is the capacity that ensures adverse stressors and shocks do not have long-lasting adverse development consequences, resilience capacity is a set of conditions, attributes, or skills that enable households to achieve resilience in the face of shocks (FAO, 2016).

possible. An alternative to vulnerability analysis, resilience to food insecurity which is adapted from food system analysis can better address these gaps. Unlike vulnerability analysis that attempts to forecast future probability of poverty or food insecurity, resilience based approach aims at analyzing the factors that may improve the capacity of households to react shocks. And issue of resilience has been increasingly recognized as a potentially useful concept to help practitioners, policy-makers and researchers better understand the links between shocks, response and longer-term development outcomes like poverty and food insecurity (Béné et al., 2014; Constas et al., 2014; d'Errico et al., 2016). However, there few empirical studies in Ethiopia (Tesso et al., 2012; Guyu and Muluneh, 2015; Temesgen et al., 2016) and in developing countries (Alinovi et al., 2010; FAO, 2016). Hence, this study seeks to advance the research and policy agenda of resilience by measuring resilience as a multidimensional latent construct to complement vulnerability assessments in the context of poverty.

Thirdly, previous poverty studies overlooks understanding the role of household shock coping mechanisms which also determines vulnerability trajectories towards a positive wellbeing outcome (Dercon et al., 2005; Hoddinott, 2006; Porter, 2012). In this regard, contemporary developments on the subject recognize multiple components such as risks, shocks, insurance and coping mechanisms to better understand the complex nature of poverty & vulnerability (Rashid et al., 2006; Heltberg and Lund, 2009; Tongruksawattana et al., 2010; Bonfrer and Gustafsson-Wright, 2016; Krishna et al., 2018). Hence, this study aims to advance the policy and research agenda by focusing explicitly on the factors that determine the decisions to apply various shock coping strategies.

Fourthly, most of the above previous studies in Ethiopia are based on a small size panel data that were designed to answer specific questions and which at best represent a

particular area or agro-ecological zone of the country (Dercon et al., 2005; Gray and Mueller, 2012; Porter, 2012; Tsehay et al., 2012; Bogale, 2012; Hill and Porter, 2017). Such studies have limitations to characterize and compare the conditions prevailing in for the whole nation or regions, or the whole population groups that are of particular interest. Hence, this study aims to contribute in the disparities of the dynamics and contexts of poverty, vulnerability, resilience and shocks-coping strategies across major regional states, which calls for alternative and adaptable strategies and interventions.

Therefore, this study is motivated to advance the policy and research agenda of poverty, vulnerability, resilience and shock-coping strategies. That is, to contribute for policy and research in the endeavor of poverty reduction or alleviation in Ethiopia using a unique panel data.

1.3. Research Objectives

The overall objective of this research is to analyze households' vulnerability and resilience to poverty in rural Ethiopia. This objective is achieved by addressing the following four specific research objectives:

1) To investigate the determinants of household poverty.
2) To assess the determinants of households' vulnerability to poverty.
3) To measure household resilience capacity and its dimensions.
4) To assess the determinants of coping strategies application against major shocks experienced by households.

1.4. Source of Data and Methodology

The data used in this study comes from the Ethiopian Socioeconomic Survey (ESS) of rural Ethiopia, a unique and recent dataset. This survey was carried out jointly by the Ethiopian Central Statistical Authority (CSA) and the World Bank since 2011. The

survey covers major cities, rural and urban areas of Ethiopia and is representative of the four major regional administration levels. The major regions are Amhara, Oromia, Southern Nations Nationalities & People (SNNP) and Tigray that constitute 86% of the entire population (CSA, 2008). The ESS data has many unique features unlike other surveys in Ethiopia. Some of these include; it is designed to collect panel data (three survey rounds implemented since 2011 and the follow up will continue), it is designed to represent the rural, small towns and urban areas as well as the major administrative regions of the country, it is large in sample size of over 3500 households, it has many indicators of households' socioeconomic wellbeing (CSA and World Bank, 2013; 2015). A detailed description of the data and the relevant methodology is provided in each of the empirical chapters.

1.5. Thesis Organization

The thesis proceeds as follows; after this introduction, chapter two provides a review of the literature on the main issues that are discussed in this study; poverty, vulnerability, resilience, and shock coping strategies. Chapter three presents a brief description to the rural Ethiopia and its administrative regions followed by the investigation of rural household poverty dynamics in chapter four. The same chapter also outline the poverty dynamics profile of the major regions, after which the measurement and determinants of household vulnerability are dealt with (Chapter five).

Chapter six provides an exposition of household resilience capacity in rural Ethiopia. This chapter particularly considers the multidimensionality and dynamic nature of household resilience capacity in the context of poverty and vulnerability. Chapter seven provides an exposition of the determinants of different coping strategies, that rural households use in the face of different shocks. The final chapter (Chapter eight)

summarizes the main findings of the thesis, provides its contribution to knowledge and policy implications and finally suggests directions for future research.

Chapter 2. Review of Related Literature

2.1. Introduction

In most developing countries, the majority of households who live in risky environments are dependent of rain fed agriculture for their livelihoods. Household's welfare is significantly reduced as a direct result of different shocks and lack (unfortunate) risk management strategies to protect consumption from such shock events. There is a vast set of literature written to address the relationship between shocks and household well-being, especially among poor households.

This chapter reviews the theoretical as well as empirical literature on the topics that are covered in this study: poverty and its dynamics, vulnerability to poverty, resilience and shock-coping. Section 2.2 describes the concept of poverty and its measurements. Section 2.3; try to address the concept of vulnerability and resilience in the context of poverty and food insecurity and their measurements. A section that review the major approaches of vulnerability to poverty and resilience is followed in section 2.4. Section 2.5 also reviews the issue of shock and its coping strategies in the context of poverty, vulnerability and resilience. Section 2.6 reviews the empirical literatures on poverty dynamics, vulnerability to poverty, resilience and shocks in general and in Ethiopia in particular. The final section of this chapter outlines the conceptual framework of this study.

2.2. Poverty: Concept and Measurement

2.2.1. Concept of Poverty

The topic of poverty is a multidimensional concept with several definitions and measures in its analysis. Despite the lack of consensus in the definition and concept of poverty, the term 'poverty' is the one that has vastly used and studied. In spite of this

fact, the welfarist and non-welfarist approaches are the two most widely used in the conceptualization and assessment of well-being for poverty analysis (Duclos and Araar, 2007; Ravallion, 2016). The welfarist approach is rooted in utility classical microeconomics theory, that state individuals are rational and maximize their utility and happiness. The working definition of poverty for this approach is the lack of command over commodities, measured by low income or/and consumption which are imperfect proxies for utilities (Atkinson, 1991; Jalan and Ravallion, 1999). Moreover, such conceptualization of poverty also criticized in terms of addressing the basic needs and capabilities of individuals, which are also pivotal dimensions of well-being. Sen (1979) criticized the welfarist approach definition of poverty by stating, "the poor cannot be distinguished for this purpose from the rich-neither in terms of utility, nor in terms of income or other non-utility information" (Sen, 1979, p. 554).

To overcome these limitation, the classical work of Townsend (1979) and Sen (1984) challenged the unidimensional conceptualization of poverty, suggesting that poverty is a multidimensional phenomenon. The non-welfarist approach has two branches, basic needs and capabilities (Sen, 1984). The basic needs approach concentrated on the attainment of basic fundamental needs such as an adequate level of literacy, health and physical security, while the capability approach is concerned with evaluating individuals advantage in terms of achieving the various valuable functionings[2] as a part of a living. Thus, being in poverty can be seen as individual who has low levels of capability or, as (Sen, 1997) put it "the failure of basic capabilities to reach certain minimal acceptable levels" (Sen, 1997, p. 101). In this approach, if the individual has

[2]Functionings are the states and activities constitutive of a person's being. Examples can vary from elementary things, such as being healthy, having a good job, and being safe, to more complex states, such as being happy, having self-respect, and being calm (Sen, 1997).

more freedom of choice, he/she will be considered as poor (i.e. his choice is not to achieve these functionings, though he has the ability to achieve it). It is now widely accepted that a singular focus on income or consumption is not sufficient to indicate households' deprivation on several non-monetary aspects of wellbeing. Further theoretical development and empirical testability of this approach can be found in (Carter, 2003).

However, by acknowledging the alternative theoretical and economic explanation, many authors illustrate the implications beyond a practical understanding of any known measure of poverty such as the proportion of households living below the minimum acceptable level. Therefore, this approach remains difficult into practice; how do you measure freedom, liberty and rights of people? Indeed, several questions remain unanswered, such as; which functioning's the most important to measure? How do you compare uni-dimensional welfare measures with multidimensional ones?

In conclusion, despite the criticisms of the sole use of welfarist use of income or consumption as an indicator of well-being remain important if one wants to study poverty. Therefore, this study applies the welfarist approach definition of poverty due to the reasons above on the non-welfarist approach and the nature of ESS data in providing information for the tangible dimensions of well-being in general and poverty in particular. Thus, one is considered as poor if his/her consumption level is below the minimum threshold level acknowledged command over (market-purchased) resources to maintain his/her life.

2.2.2. Income and Consumption based Poverty Measure

The measurement of well-being and poverty plays a central role identify the poor and non-poor, design optimal poverty targeting schemes as well as assessing the equity of

poverty alleviation policies (Duclos and Araar, 2007). The measurement of poverty needs two inclusive tasks i.e. identification of the poor and aggregation of the data available on the poor (Gillis et al., 2001). The identification of the poor is called the perception of poverty, while the aggregation of the features of the poor is known as a measurement of poverty. As soon as a welfarist approach is agreed as a single aspect of well-being, consumption or income metric indicators often adjusted for differences in needs, prices, household sizes and demographic structures as well as postulating a poverty line, an exogenously specified minimum level to sustain a subsistence standard of living; identification of the poor from the non-poor can be made.

The key issues in the measurement of poverty are income or consumption as a proper indicator of well-being, the comparison of well-being of individuals who live in the households of differing in sizes and composition (equivalence of scales), price deflation and the choice of an exogenous variable to be used as minimum requirement (poverty line). The common indicators of wellbeing and poverty have been income and consumption. The application of each indicator varies from study to study, due to pragmatism in the face of limited financial resources vis-à-vis required data and time (Deaton, 1997). In favor of income, Baudot (2000) argue that income defined to include other resources is a vehicle for the satisfaction of material needs; and lack of control over resources is inseparably linked to poverty.

Fields (1980) favor consumption as a better indicator of well-being and poverty as compared to income by mentioning three reasons. The first is that it directly measures the flow of utility-producing inputs. The second is that it approximates permanent economic position better than current income since income only measures the potential to acquire those inputs. Since consumption manifests actual and not potential flow, income is only a proxy measure of poverty because it only approximates consumption.

The third reason is that price differences of the same item drive a wedge between distributions of income and consumption. This wedge makes consumption a better measure of poverty than income because consumption already factors in price decisions. Conversion of income into a measure requires making assumptions on the prices of goods and services to ascertain how much an income can command (Fields, 1980).

Similarly, Ringen (2006) mention five reasons why income is not a good proxy of consumption and by extension wellbeing or poverty. "First, income is useful only in markets where income has some power to command goods and services. Second, the same income does not buy everyone the same consumption. Third, the market is not the same for all because education, knowledge, and information influence how income interacts with the market. Fourth, when estimated from household surveys, income is an inaccurate measure of economic resources since it excludes wealth. Fifth, low income is not the sole determinant of current consumption although low consumption is strongly influenced by low income" (Ringen, 2006, p. 160).

There are also other reasons in support of consumption. One of them is that consumption is smoother than both income and expenditure. Conceptually, consumption is a better measure of poverty than income, while practically, though, income is a preferred measure in developed countries while consumption supported by expenditure carries the day in developing countries where all are measured with errors. Sen (1997) argues that income is second best to consumption because it measures wellbeing indirectly; however, consumption does not have universal approval either. In general, in most many developing countries, consumption as an indicator of standard of living have been commonly applied as compared to income due to its advantage of smoothing variation across space and time as well as its easy observability and

measurability (Duclos and Araar, 2007). In Ethiopia as elsewhere, consumption is used as an indicator well-being or poverty (MoFED, 2012).

The second important issue in the measurement and comparison across time and space of well-being and poverty is accounting the variations of prices across space and time. Failure to account for such variability can distort comparisons of poverty across time and space. Spatial disaggregation is especially very crucial if when consumption preferences and price changes vary across regions. For the comparisons of real money metric measurements of well-being for households at various periods, one needs an appropriate index of inflation so that the purchasing powers of nominal amounts received at various periods are equalized.

The most generally implemented methodology is simply to deflate incomes or expenditures by an inflation index that is universal to all households, that is, ignoring the fact that different inflation rates may be relevant to households of different types (Deaton and Zaidi, 2002). A matter that has received an even bigger consideration in the study of low-income countries is the selection of price deflators for geographical regions within a country or across countries, reflecting often substantial differences in prices between urban and rural areas (Deaton, 1997). In Ethiopia, household consumption has to be adjusted for differences in prices across regions and at different points in time to take care of the differences in the cost of basic needs between areas and over time.

The third important issue that needs to be considered in the measurement of poverty is household heterogeneity. At a conceptual level, poverty is often seen as a condition specific to individuals. All members of a household may not be equally poor, however. For instance, a grandparent or a child might face deprivation within a household that

has adequate resources. To capture this phenomenon, researchers would ideally collect data on individuals, and poverty measurement would take place at the individual level. The unit of analysis, however, is rarely the level of the individual. Doing so greatly raises logistical hurdles and survey costs. Even if all members of a household could be identified and surveyed, it is often too difficult to allocate particular flows of income, e.g., the value of a harvest for a farming family, to one member or another, just as it is hard to determine who consumes which part of a common pot of rice or pot of soup. In the end, the benefits of individual specificity may seldom judge to outweigh the extra costs of data collection.

The main theoretical foundation of such a model is that each individual within the household has their own individual preferences. The part of microeconomics analysis of household behavior always takes a single household utility function, even for households with many different members, which is maximized subject to a budget line. This is the so called 'unitary' approach, treating each household as a single decision making agent, with a single budget constraint and maximizing a single utility function, in which each household member's consumption enters as an argument. Unitary models consider the household as a black box, so that the distribution of wellbeing within the household cannot be reconstructed (Deaton, 1997).

Dating back to at least Becker (1965), 'collective household' models are those in which the household is characterized as a collection of individuals, each of whom has a well-defined objective function, and who interacts to generate household level decisions such as consumption expenditures (Becker, 1965). The typical collective approach

proposes that the outcomes of decision-making within the household are Pareto efficient[3].

In case of poverty measurement, researchers collect data on households as collective units (where households often defined in surveys as those who share meals together or live under the same roof). The most commonly applied approach in poverty analysis at household level is thus, the direct approach of converting household consumption to individual consumption by dividing total expenditure by the number of people in the household (Deaton and Zaidi, 2002).

Then expenditure per capita is the measure of welfare assigned to each member of the household. This approach, however, is not satisfactory, these per capita computations weigh all household members identically; despite individuals have different needs. For example, a young child does not have the same food need as an adult. Also, there are economies of scale in consumption (especially for non-food items). It costs less to house a couple than to house two single individuals. Creating weights that reflect adult equivalents helps address the first problem, and adjusting for economies of scale helps respond to the second. In order to address this problem, the other most common approach is establishing a system of weights called equivalence scales may be used. The adult equivalent scale must therefore be different for different age groups and the gender of adult members and taking account per adult equivalent scale is a cornerstone in poverty analysis (Deaton and Zaidi, 2002).

Strategies for the estimation of equivalence scales are all contingent on the choice of comparable indicators of well-being. All such indicators are, however, intrinsically

[3]Pareto efficiency is a state of allocation of resources in which it is impossible to make any one individual better off without making at least one individual worse off.

arbitrary. The most widely applied method in most developing countries is using (Deaton and Zaidi, 2002) recommended equation[4]. In Ethiopia, the scale applied is adopted from the MoFED.

Fourthly, whatever poverty measure adopted, there is a need to set a standard that identifies two groups in the sample; the poor and the non-poor. Poverty measures like income and consumption require three separate steps to identify the two groups; i.e. estimating the wellbeing status of each subject (household or individual), determining a point on that measure that separates the poor from non-poor, and determining the number or proportion of the poor out of the population. A poverty line is the point on the measure where the two groups are separated and it is therefore an operational definition of poverty. Moreover, it is important to derive poverty lines that provide consistency in welfare measurement in space and time: two people with the same real consumption should be considered either poor or non-poor.

There are many ways of determining the poverty line inspired by the concept of poverty from the theory in use. Methodologies for the estimation of poverty lines have been most developed in the context of the fulfillment of basic physiological needs. Although such methodologies have often been set in a welfarist framework, they also matter the basic needs, functioning or capability approaches since these approaches are also concerned with basic physiological achievements. The commonly used in the literature include absolute, relative and subjective poverty lines. According to (Duclos and Araar, 2007; Ravallion, 2016), taking account three major issues is pivotal in the estimation

[4]Adult Equivalent $= (A + \alpha K)^{\theta}$; where A is the number of adults, K is the number of children, α is the cost of children relative to adults and θ is an estimate of the household economies of scale. Deaton and Zaidi (2002) recommend α =0.25, implying that children cost a quarter of adults on average, and θ =0.9, a low level of economies of scale given that most expenditures in developing economies are on private goods rather than public goods (for example, the high proportion of food expenditure).

and use of poverty lines. These are defining the space in which well-being is to be measured, determining our interest whether absolute or relative poverty as well as choosing whether it is by someone's 'capacity to function' or 'actual functioning' that households/ individuals are poor;

An absolute poverty line can be interpreted as fixed in any one of the spaces in which the analyst wishes to assess well-being. Conversely, a relative poverty line would depend on the distribution of well-being (including the utilities, living standards, functioning's or capabilities) found in a society and would therefore vary across societies (Duclos and Araar, 2007). Poverty analysis in developing countries widely uses absolute poverty line. International organizations widely use crude absolute poverty measurement USD 1 or USD 2 a day per person poverty lines to compare developing countries (Duclos and Araar, 2007). Moreover, for country poverty reports, the absolute poverty measures dominate. Three methods are commonly applied in the literature to derive/estimate absolute poverty line; direct caloric intake, food energy intake and cost of basic needs (Deaton, 1997; Jalan and Ravallion, 1999). The choice of method can greatly affect poverty measures and who is considered poor.

In the direct caloric intake method, the poverty line is defined as the minimum calorie requirement for survival. Individuals who consume below a predetermined minimum calorie intake are deemed to be poor. For this method, the analyst need to know the quantity of every food item consumed by households and its calorie content. Then, calculate the total calorie content of the food actually consumed and derive an equivalent daily caloric intake per capita for each household. However, this approach does not account for the cost of obtaining these calories and ignores non-food needs.

The food-energy intake method defines the poverty line by finding the consumption level at which a person's typical food energy intake is just sufficient to meet a predetermined food-energy requirement. If applied to different regions within the same country, the underlying food consumption pattern of the population group consuming only the necessary nutrient amounts will vary. This method can thus yield differentials in poverty lines in excess of the cost-of-living differential facing the poor (Bidani and Ravallion, 1994). The cost of basic needs method is the most satisfactory approach in building up a poverty line. First, the food poverty line is defined by choosing a bundle of food typically consumed by the poor. The quantity of the bundle of food is determined in such a way as to supply the predetermined level of minimum caloric requirement (say 2200 kilocalories (kcal) in case of Ethiopia). This bundle is valued at local prices (or it is valued at national prices if the desire is to get a consistent poverty line across regions and groups). Then a specific allowance for the nonfood goods consistent with the spending pattern of the poor is added to the food poverty line. To account for the nonfood expenditure, the food poverty line is divided by the food share of the poorest quartile or quintile.

Given information on a welfare measure such as per capita consumption, and a poverty line, then the only remaining problem is deciding on an appropriate summary measure of aggregate poverty. There are a number of aggregate measures of poverty that can be computed. And there is now a large literature on the measures of poverty (Foster et al., 1984, Jalan and Ravallion, 2000). The commonly applied measures of poverty are the static and dynamic measurement of poverty in terms time. There are many static measures of poverty, the common once; poverty headcount, poverty gap and squared poverty gap.

The headcount index measures the proportion of the population that is poor. It is popular because it is easy to understand and measure. But it does not indicate how poor the poor are. The poverty gap index measures the extent to which individuals fall below the poverty line (the poverty gaps) as a proportion of the poverty line. The sum of these poverty gaps gives the minimum cost of eliminating poverty, if transfers were perfectly targeted. The measure does not reflect changes in inequality among the poor. The squared poverty gap index (also known as the poverty severity index) averages the squares of the poverty gaps relative to the poverty line. It is one of the Foster-Greer-Thorbecke (FGT) class of poverty measures that allow one to vary the amount of weight that one puts on the income (or expenditure) level of the poorest members in society. The FGT poverty measures are additively decomposable. It is also possible to separate changes in the FGT measures into a component resulting from rising average incomes, and a component resulting from changes in the distribution of income (Foster et al., 1984).

With regard to dynamic measurement of poverty, Over the last two decades the measurement of poverty dynamics has been growing rooted from spell and components approaches (Jalan and Ravallion, 2000; Baulch and Hoddinott, 2000; Duclos et al., 2010; Baulch, 2011). The spells approach focuses on counting the poverty spells observed for households. This approach estimates period-by-period incidences of poor households or individuals, and in particular, the time spent in poverty (Baulch and Hoddinott, 2000). The recent research on the spells approach to chronic poverty measures proposes that more weight be given to the duration of uninterrupted poverty spells or by taking into consideration the occurrence of poverty spells at the beginning or at the end of the period (Duclos et al., 2010).

Jalan and Ravallion (2000) proposed the components approach. The authors decomposed poverty at household level into chronic and transitory based on mean level of consumption. When a household mean level of consumption is below the poverty line, then the household suffers from chronic poverty. And transient poverty is the result of difference between total poverty and chronic poverty. "Transient poverty is the component of time means consumption poverty at household level that is directly attributable to variability in consumption: this can be thought of as a measure of vulnerability to falling consumption. In the case of chronic poverty, the non-transient component then depends solely on mean consumption over time (Jalan and Ravallion, 2000 p. 1).

Duclos et al. (2010) using the equally distributed equivalent poverty gaps, and developed a statistical correction for the biases that take place when the number of panel waves available is small have enlarged the components approach of chronic and transient poverty measurement. Jalan and Ravallion's (2000) and Duclos et al.'s (2010) approaches are distinct, both conceptually and methodologically. Firstly, Jalan and Ravallion's (2000) measure of chronic poverty was connected to an average of welfare; however, Duclos et al.'s (2010) approach is linked to an average of ill-fare. Secondly, the two approaches are distinct through their connection of out-of-poverty spells to chronic poverty.

In general, the components approach usually produces more chronically poor than the spells approach, while, the spells approach mainly applies to an analysis of the transient poor (Hulme and Shepherd, 2003). Thus, as these approaches give different scalars on the correlates and causes of poverty, decomposing households in such a way is more significant for policy designs.

2.2.3. Multidimensional Poverty Measure

Despite the acceptance on the multidimensionality of poverty, there is still dispute on how multidimensionality should be reflected in measures of poverty (Ravallion, 2011). In multidimensional measurement of poverty, one must face two distinct problems; identifying the poor among the population and constructing an index of poverty using the available information on the poor (Sen, 1979). In 2010, the UNDP and Oxford Poverty and Human Development Report Office developed the Multidimensional Poverty Index (MPI) (UNDP, 2010).

The index's creators report that they selected the three dimensions (health, education, and standard of living) and each of their corresponding indicators because they reflect problems often mentioned by the poor, and they are well established philosophically as human rights or basic needs; naturally, reliable data also had to be available for enough countries when selecting specific indicators for the index. With respect to health, two indicators—whether any child has died in the family and whether any adult or child in the family is malnourished—are weighted equally (so each counts one-sixth toward the maximum possible deprivation in the MPI). Regarding education also, two indicators—whether not even one household member has completed five years of schooling and whether any school-age child is out of school for grades one through eight—are given equal weight (so again, each counts one-sixth toward the MPI). Finally, in terms of standard of living, equal weight is placed on six deprivations (each counting one-eighteenth toward the maximum possible): lack of electricity, insufficiently safe drinking water, inadequate sanitation, inadequate flooring, unimproved cooking fuel, and lack of more than one of five assets—telephone, radio, television, bicycle, and motorbike or similar vehicle (Alkire and Foster, 2007; UNDP, 2010).

The index belongs to the family of measures developed by (Alkire and Foster, 2007; 2011). The methodology requires determining the unit of analysis (i.e. household), identifying the set of indicators in which they are deprived at the same time and summarizing their poverty profile in a weighted deprivation score. They are identified as multidimensionally poor if their deprivation score exceeds a cross-dimensional poverty cutoff. The number of poor people and their deprivation score (i.e. the 'intensity' of poverty or percentage of simultaneous deprivations they experience) become part of the final poverty measure. More details about the methodology can be found in Alkire and Foster (2011) and in Alkire et al. (2011).

2.3. Concepts of Vulnerability and Resilience in the Context of Poverty

2.3.1. Concept of Vulnerability

In order to understand the effects of economic growth and other policy interventions on poverty rates, it is important to focus also on dynamics, i.e., on movements in and out of poverty. According to this dynamic view, poverty is seen not just as a form of deprivation but also as a form of vulnerability. The early strands of literature assumes vulnerability as the ability and extent to which consumption is protected against fluctuation due to shocks and measured by observed changes in consumption over time (Townsend, 1995; Dercon and Krishnan, 2000; Alwang et al., 2001; Ligon and Schechter, 2003; Günther and Harttgen, 2009). However, there are practical problems with these studies to infer policy implications (Azam et al., 2012).

One of the practical problems is that they all require representative lengthy panel data. Reliable and representative panel data are all still scarce in developing countries and vulnerability analysis mostly relies on more readily available cross-sectional household surveys. The other notable drawbacks of the ability to smooth consumption approach

are inability to set a benchmark and measurement around a given consumption path. Future consumption is measured using an internal rather than an exogenously determined socially accepted threshold. Such a definition is not particularly useful for practical purposes and most strands of literature agree that vulnerability is a concept useful only if it is defined as to a measurable loss (the metric) below a minimum level (the benchmark). Without use of benchmark, the term vulnerability becomes too imprecise for practical use (Alwang et al., 2001). Variation around a given consumption path may not be a good indicator of vulnerability that households face with uncertain future income (Christiaensen, 2005).

Another strand of literature that attempt to overcome the deficiencies of the traditional point in time of poverty measurement by decomposing poverty into those who are chronically poor (structural poverty) and those who are transient poor (temporary) (Jalan and Ravallion, 2000; Hulme and Shepherd, 2003; Duclos and Araar, 2007). While the distinction between chronic and transient poverty and the underlying dynamics of movements in and out of poverty have significant policy implications, there are important conceptual and empirical differences between identifying vulnerability and poverty. The chronic-transient poverty approach reflects the *ex-post* poverty dynamics while vulnerability literature focuses on *ex-ante* measurement of poverty, i.e., distribution of future welfare measures. There has been increasing recognition that exploring vulnerability is very important for understanding *ex-ante* poverty dynamics and policy intervention.

The third strand of literature on vulnerability that attempt to define and measure vulnerability as expected poverty is rather a recent phenomenon. In this case, vulnerability is a dynamic *ex-ante* assessment of poverty taking into account the

variation in well-being over time due to some unexpected negative events (shocks) affecting the productive asset base, income, or consumption of a household. In general, the concept of dynamic welfare measurement and vulnerability introduces uncertainty about future levels of welfare. In the presence of risk and uncertainty, it is possible to differentiate between the observed welfare status and the expected welfare status of a household. The expected welfare status is dependent on household's resource endowments and other household specific factors, while the realized welfare status is mostly subject to some (positive or negative) stochastic events. Moreover, vulnerability is mainly concerned with the negative side of income variation, i.e. with downside risk.

Vulnerability estimates are always based on two parameters of the stochastic distribution of welfare: the mean and variance of a pre-defined welfare indicator (consumption or income). These parameters are then employed in different ways to estimate the magnitude of the 'threat' of poverty, measured ex ante, before the veil of uncertainty is lifted (Calvo and Dercon, 2005). In this sense, vulnerability measures the resilience against a shock or "the likelihood that a shock will result in a decline in well-being" (Gillis et al., 2001, p. 139), independent of the person's current poverty or welfare status (Christiaensen, 2005). More importantly Heitzmann et al., define vulnerability to poverty as "the forward-looking state of expected outcomes, which are in themselves determined by the correlation, frequency and timing of realized risks and the risk responses. Households are vulnerable if a shock is likely to push them below (or deeper below) a predefined welfare threshold (e.g., poverty)" (Heitzmann et al., 2002, p. 6). In a probabilistic interpretation, vulnerability to poverty would then be the likelihood that a household's income falls or stays below the poverty line (Kurosaki, 2006).

The overall view of vulnerability is the *ex-ante* measurement of a household's probability to be below a certain welfare threshold in the future (Hoddinott and Quisumbing, 2003). The level of vulnerability is typically assumed to depend on the exposure to risks and households' ability to cope with these risks. Such an emphasis on vulnerability being an effect of poverty focuses attention on the mutually reinforcing nature and multidimensionality of poverty and vulnerability. Thus, the concept that vulnerability is both a cause and symptom of poverty reinforces the need for a more nuanced understanding of vulnerability than just being vulnerable to poverty.

2.3.2. Concept of Resilience

Resilience has been conceptualized and applied in a variety of ways since the influential work of Holling (1973) in ecology. When talking about resilience, it is important to clarify precisely what one is referring to: resilience of what/whom and to what (Béné et al., 2012) In terms of what or whom, the resilience concept has been developed mainly to deal with complex systems and to focus on the relationships and interdependence between system components. Therefore, while "resilience of what" is about the systems (individual, household, community, country) of resilience to be detected, "resilience to what" refers to the need to identify the type of shocks and stresses faced by the system and its components. Defining what or whom is resilient to what is essential to the analysis of the capacities of the selected system to deal with a given shock or stress (Béné et al., 2012; Fan et al., 2014).

The current literature in defining the concept broadly categorized into ecological, engineering and socio-ecological resilience (Quinlan et al., 2015). The ecological literature defines resilience as the persistence of relationships within a system and the measure of the ability of these systems to absorb changes of state variables, driving

variables, and parameters. Resilience is the property of a system that denotes the persistence or probability of extinction whereas stability is the ability of the system to return to an equilibrium state after a temporary disturbance, which measures the degree of fluctuations around a specific state or result (Holling, 1973). Ecological resilience thus assumes that a system has multiple alternate equilibria and focuses on the capacity of a system to maintain, including through reorganization, it's essential structure and function when confronted with shocks. This capacity for self-organization has not always been clearly defined, but it is a key aspect of complex adaptive systems that enables them to regenerate and transform (Holling, 1996). And since then, this conceptualization of resilience has been applied in a variety of disciplines including social sciences (Martin-Breen and Anderies, 2011).

Socio-ecological resilience extends the definition of resilience from ecology that include; the amount of disturbance that a system can absorb and still remain within a domain of attraction, the capacity of a system to learn and adapt and the degree to which the system is capable of self-organizing (Carpenter et al., 2001). Engineering resilience is understood as a system's speed of return to equilibrium following a shock, indicating that a system can only have a single stability regime (Holling, 1996). With its focus on stability and efficiency, engineering resilience has quite different implications for the management of ecosystems than that of ecological resilience. The differences among these categories of resilience have consequences for assessing and measuring resilience, just as they do for understanding and managing complexity and change (Quinlan et al., 2015).

The term has gained much popularity among humanitarian and development actors after the 2008 food, fuel and financial crises left people searching for new approaches to

tackling poverty and a variety of resilience definitions are available due to the diversity of applications in many disciplines in a wide range of contexts (McAslan. A, 2010; FAO, 2013). Building on existing definitions and its experience of supporting agriculture based livelihoods, FAO has proposed a definition of resilience that highlights the relevance of this concept to the food and agriculture sector: "Resilience is the ability to prevent disasters and crises, and to anticipate, absorb, accommodate or recover from them in a timely, efficient and sustainable manner. This includes protecting, restoring and improving food and agricultural systems under threats that impact food and nutrition security, agriculture, and/or food safety/public health"(FAO, 2013, p. 2). In many of these definitions, resilience is referred to and measured at individual, household or country level as well as share three common elements, namely the capacity to bounce back after a shock; the capacity to adapt to a changing environment; and the transformative capacity of an enabling institutional environment

2.3.3. Conceptual Relationship between Vulnerability and Resilience

The cross-disciplinary conceptual divide that exists with regard to vulnerability and resilience manifests in an academic debate over the nature of their mutual links. In the literature, two alternative hypotheses are proposed: either resilience is a subset of vulnerability; or both vulnerability and resilience are two distinct concepts with some overlapping components (Gallopín, 2006; Hoddinott, 2014; Ahsan and Takeuchi, 2015).

The scholars supporting the narrowly defined paradigm suggest that vulnerability is the flip side of resilience, i.e. 'high levels of vulnerability imply low resilience and vice versa'(Van Aalst et al., 2008; Galderisi et al., 2010; Martin-Breen and Anderies, 2011). This doctrine that suggests highly vulnerable households (the poor and marginalized) are also less resilient would imply that the immediate impacts as well as the longer-

term impacts of shocks will be born disproportionately by the poorer segment of a society. If the opposite is true, however, i.e. high vulnerability does not necessarily lead to low resilience, then this would imply that the poor and marginalized may bear the larger share of the immediate impacts of a natural disaster but may equally be able to avoid its longer term consequences (Ahsan and Takeuchi, 2015).

The advocates of the broadly defined vulnerability paradigm dismiss the flip-side hypothesis, arguing that although a resilient system is less vulnerable than a non-resilient one, the relation is not necessarily symmetrical. They offer two alternative hypotheses; either resilience is a subset of vulnerability or resilience and vulnerability are fundamentally different concepts which nonetheless have some components in common (Gallopín, 2006; Sapountzaki, 2012).

The fundamental question to answer from the outset concerns the distinctiveness of resilience. Does resilience offer a new perspective or does resilience simply offer a different vocabulary to describe vulnerability? To help clarify the distinction between vulnerability and resilience, two definitions may be considered. The concept of vulnerability is the likelihood that at a given time in the future, households will have a level of welfare below some norm or benchmark (Hoddinott and Quisumbing, 2003), whereas resilience is defined as the capacity that ensures adverse stressors and shocks do not have long-lasting adverse development consequences (Alinovi et al., 2009). One obvious distinction between the two definitions is that vulnerability refers to a negative likelihood function while resilience refers to a positive likelihood function. A second distinction is that vulnerability draws attention to sensitivity to disturbances whereas resilience is concerned with the collection of responses that reduce the consequences of such disturbances.

The concept of resilience is useful because it provides an overarching organizational scheme within which vulnerability, shocks, and heterogeneity of recovery pathways may be measured. Thus, resilience is not simply the inverse of vulnerability[5]. It describes a set of conditions that prevents people from managing adverse events, resilience is comprised of a set of responses that may counter the structural and stochastic factors that allow a household or other unit to be vulnerable when exposed to some set of shocks. In this sense, vulnerability refers to the set of characteristics that increases the probability of descent when exposed to risks. Expanding on the initial definition provided above, resilience capacity includes the array of characteristics, actions, and strategies taken to prevent and/or counter the effect of such risks. Whereas vulnerability has the effect of enabling the causal connections between shocks and negative outcomes, resilience has the effect of disabling or transforming those causal connections.

The relationship between vulnerability and resilience has been the topic of extended debate in the field. More importantly, this debate clouds our understanding of the distributional consequences of shocks across different groups living within a household. That is, the value added proposition of the resilience concept is that it draws attention to the inferential and programmatic benefits associated with including resilience as an additional explanatory variable, one that may improve our ability to more accurately estimate the effects that shocks have on a particular outcome (Gallopín, 2006; Nelson et al., 2007; Hoddinott, 2014). A simplified formulation highlights the

[5] If resilience is conceptualized as the inverse of vulnerability, the task of measuring resilience would entail little more than providing directions to guide the reinterpretation of data gathered from existing vulnerability measures.

relationship among resilience, vulnerability, and shocks in connection with, for example, wellbeing is a function of vulnerability, resilience capacity, shocks.

To promote resilience as a pro-poor concept, it is also important to define resilience as a capacity that prevents households from falling below a normatively defined level for a given developmental outcome (e.g., food security, poverty level). Resilience is a capacity that should be indexed to a given development outcome with a normative threshold and its measure should therefore be developed in relation to the instrumental value that such capacity has for a particular outcome. The outcome of interest should include a normative boundary that defines a threshold condition below which the well-being of a household is unacceptable.

Characteristically, vulnerability approach places agents (for example, households) who are exposed shocks and their role as a quite passive, while resilience approach puts agents and their ability to react in a creative ways at the center of debate (Romano et al., 2014). As a phenomenon to be measured, vulnerability draws attention to sensitivity to disturbances whereas resilience is concerned with the various ways a given entity prepares for and responds to shocks that threaten their well-being. As noted above, resilience is now regularly introduced as a new concept for development (Bene et al., 2012). It is, however, important to acknowledge that an interest in understanding the dynamics that explain how households deal with adversity in developing countries is not new.

Resilience measures should build on the knowledge gained from studies of vulnerability and the contents of existing vulnerability measures and coping measures should be used as key points of reference for constructing resilience measures. A question that must first be settled as a key part of the resilience measurement effort is

as follows: does resilience offer a new perspective on how to describe and model how a household respond to and recover from shocks in a manner that affects poverty, food security and nutrition?

To further explain the link between vulnerability and resilience the analyst can assume that initial vulnerability can be represented by some composite variable comprised of assets, protections, and expectations. The analyst might assume, for the sake of illustration, that resilience can be represented by some composite variable comprised of the capacity to absorb, adapt to or transform in response to some risk exposure event (shock) or recurrent condition (stressors). In this scheme, wellbeing is seen as the dynamic interaction of conditions (vulnerability levels), events (shocks and stressors), and capacities (resilience). In some designated period following a shock, any given unit (e.g., household) may end up in one of three states with respect to poverty, food and nutrition security: worsened poverty, recovery of initial poverty and improved wellbeing (to be non-poor).

With a focus on capacities as noted above, resilience provides a perspective that may help us understand why households with similar profiles (e.g., asset profiles, livelihood profiles) may respond differently to the same set of shocks. It is possible that groups of households who have the same level of measurable vulnerability will exhibit different levels of resilience which will in turn affect the poverty, food and nutrition security of households. In this sense vulnerability and resilience are functionally related to one another. By treating resilience capacity as mediator of shocks may shed light on observed heterogeneity of post-shock pathways for households who share vulnerability profiles. The ability to measure resilience should facilitate efforts to explain heterogeneous response to shocks observed in households with different and similar levels of vulnerability. Measures of resilience should assess the way in which resilience

capacities mediate the consequences of shocks. Generally, the nexus between vulnerability and resilience plays an important role in determining the nature of that correspondence.

2.4. Measuring Vulnerability and Resilience in the Context of Poverty

2.4.1. Measuring Vulnerability to Poverty

The growing literature has produced a vast approaches aiming to identify and quantify vulnerability levels. However, the diversity in approaches and concepts in fact tend to obscure several commonalities in vulnerability measures that allow for meaningful insightful and robust comparisons of vulnerability across space and time without excessive scope in interpretation (Pritchett et al., 2000; Chaudhuri et al., 2002; Christiaensen, 2005; Scaramozzino and others, 2006). At present, vulnerability as expected poverty (VEP), vulnerability as low levels of expected utility (VEU) and vulnerability as uninsured exposure to risks (VER) are the most popular approaches of vulnerability measures.

The VEP is one of the popular measure based on household consumptions probability for falling below the benchmark (poverty line) in the future in relation to household characteristics related to poverty, shocks, and risks. The main advantage of this measure is its usefulness when panel data is not available and want to use cross-sectional data as a second best option in vulnerability to poverty measurement (Jha et al., 2009). The VEU measure understand vulnerability as the utility lost due to risk, as the difference between the expected household consumption and the certainty-equivalent consumption, or consumption that would have occurred in a situation of certainty (Ligon and Schechter, 2003; Gallardo, 2017). This measure has the benefit of disaggregating vulnerability due to poverty and vulnerability due to uninsured risk.

Although considered a stronger measure of vulnerability than VEP, VEU is difficult to calculate and reliant upon difficult-to-acquire panel data. It has been used less extensive compared to VEP because it measures vulnerability in terms of utility units, with a less straightforward interpretation of the results.

The VER approach, even if based on inter-temporal variability of consumption as VEP and VEU, is very different in terms of perspective. Vulnerability as uninsured exposure to risk is backward looking, while the formers methods are forward-looking. VER is in fact an *ex-post* assessment of the extent to which a negative income shock caused a welfare loss in terms of consumption. VER is not a predictive tool, but instead measures actual changes in welfare due to a given risk. It is easy to calculate and can attribute welfare loss to either idiosyncratic or covariate risks. This analysis focus on VEP that has a forward-looking perspective and is easier to interpret as its value can be expressed in monetary terms.

By expanding of the traditional poverty measures, (Pritchett et al., 2000) quantify an *ex-ante* vulnerability to poverty and measure the risk for a household of falling into poverty in the future. The general definition that they state is then clarified in terms of risk and time, falling into poverty at least once in the next few years. Therefore, the vulnerability of the household for specified periods is the probability of observing, in the time span considered, at least one episode of poverty, i.e. the complementary probability of observing no episodes of poverty.

Vulnerability is a risk measured in terms of probability that depends on the time horizon and the poverty line. The authors observe that everybody face a certain degree of poverty risk, also the richest individuals, therefore, to have a more reliable aggregate measure of poverty risk, called headcount vulnerable to poverty rate, they introduce the

function, that takes value 1 if the probability computed is higher than the chosen threshold level, 0.5, and zero otherwise. Christensen and Subbarao (2005), also used vulnerability as expected poverty approach using pseudo panel data from Kenyan rural households.

Vulnerability expressed in terms of probability has been used extensively, despite the huge data demand to translate its true meaning empirically. Vulnerability in fact some assumptions have necessarily to be made to compute probabilities information about the distribution of the welfare measure, either consumption or income, is needed not only at the aggregate level but also at the household (or individual) level (Pritchett et al., 2000). As the majority of the restrictions are imposed by the empirical analysis, part of the literature on vulnerability as expected poverty has focused on overcoming the limitations of the data by improving the estimates of income or consumption variability. As it is difficult to find a broadly recognized procedure for vulnerability, Hoddinott and Quisumbing (2003) summarized all the attempts used in the literature, highlighting the drawbacks of each approach. About the expected poverty version, they criticize mainly the fact that downside and upside risks are weighted the same way.

After the first empirical focus, the literature has developed towards a more formal attempt to test if some desirable properties were satisfied by the measures proposed, this is what is called axiomatic approach. In their definition, (Calvo and Dercon, 2005) consider as vulnerability the magnitude of the threat of poverty and the sense of insecurity, they clarify how their view of vulnerability is not simply low expected welfare, as often turns out from previous studies, but is related to dangers or threats, as opposed to uncertainties in general. The authors formally require that their measure of vulnerability satisfies the following properties. The measure used for vulnerability does

not consider differently two possible states of the world, if they do not differ in terms of probabilities and outcomes known as symmetry.

The changes in outcomes of good states of the world do not affect individuals' vulnerability to poverty call it focus. This axiom clarifies that the threat of future poverty will not be mitigated by simultaneous (*ex-ante*) possibilities of being well-off. Probability dependent effect on outcomes axiom expressed as if the outcome in one state of the world improves, the consequent effect on vulnerability does not depend on the outcomes or probabilities of other states of the world but on the likelihood of that particular state of the world. The probability transfer axiom explains vulnerability as linear in probabilities and, as long as outcomes are below the poverty line, its increase is monotonically related to decreases in outcomes. As the issue of risk leads to higher vulnerability, they call it risk sensitivity axiom. The scale invariance axiom requires that the index does not depend on the unit of measurement because what matters is only the relative distance from the poverty line.

2.4.2. Measuring Resilience Capacity

The closest reference for a quantitative measurement of resilience that builds on economic work is vulnerability analysis. The common econometric models that estimate vulnerability are VEP, VEU and VER. While the measures of VEP and VEU estimate vulnerability as the likelihood that realized consumption will fall below a normative threshold, the VER does not estimate probabilities; instead, it assesses whether observed shocks generate welfare losses. VER measures are *ex-post* assessments of how far a negative shock causes a household to deviate from its expected level of welfare. Among the vulnerability approaches, the VER provides a suitable basic analytical framework to assess resilience, especially when using available data

sources such as the living standards measurement survey data and related household data sets (FAO, 2013, 2016).

Empirically, available resilience assessment differ, depending on their orientation toward the outcome (end result) or process-driven (leading to the desired outcomes) approach (Ahsan and Takeuchi, 2015). The former approach deals with resilience in terms of end results, while the latter approach treats resilience as a sequence of dynamic reformations to regain the original state. There are many frameworks in explaining resilience in the literature.

The resilience assessment by DFID (2011) proposes four possible reactions (i.e., outcomes) to a shock. The first best case is 'bounce back better,' which indicates that a household demonstrates a stronger capability to deal with future perturbations than it did in the past. The second best case is 'bounce back,' indicating a household's capability of reinstating the pre-disaster status. The third best case, 'recover, but worse than before,' refers to less capacity, compared with the pre-disaster condition; and finally, 'collapse' indicates the worst case where a household suffers substantial deterioration in its capacity to cope with future perturbations (DFID, 2011).

Likewise, (FAO, 2013, 2016) portraits resilience as outcome through a number of socioeconomic variables namely access basic services, adaptive capacity, assets, and social safety-nets. By assigning weights to these factors, a composite weighted index is obtained which provides a 'resilience capacity for a specific households and the model called Resilience Index Measurement and Analysis (RIMA). Following this, FAO compares the resilience capacities among different household and socio-economic characteristics.

The process-driven approach abridges the dynamism of resilience in terms of its operational definition. The most notable approach in this regard denoting resilience is the disaster resilience of place (DROP) model suggested by (Cutter et al., 2008). This model considers and contrasts the attributes of a system in different time periods (i.e., pre- vs. post-disaster). The pre-disaster attributes, treated as intrinsic vulnerability, are assumed to be the static benchmarks of a household which are governed by three types of determinant that are social, structural, and environmental. The structural determinants focus a household's sensitivity, whereas the environmental determinants imply its exposure. The social determinants estimate the degree of sensitivity and response capacity. The post-disaster attributes explore the dynamic benchmarks of resilience through factors such as hazard maps, evacuation routes, and early warnings (altogether constitute adaptive capacity).

The other notable model that portraits resilience by measuring a household's capacity on the basis of risk recognition, resistance, redundancy, and rapidity is the '4 Rs' model suggested by Forgette et al. (2014). Risk recognition postulates the degree to which a household can detect the risk likelihood of a disaster. Resistance is the robustness of the structural, environmental, and socioeconomic attributes of a system to withstand perturbations. Redundancy is the extent to which structural, environmental, and socioeconomic statuses permit substitutes or resources for the replacement of critical commodities (e.g., food, logistic supply, and credit), and rapidity is the span of time utilized by individuals and groups in a community to reach internal and external support (e.g., the time to reach relief supports).

In line with '4 Rs' model, the MOVE framework which is also a process-oriented approach focuses the nexuses among vulnerability, risk, and social responses by

(Birkmann et al., 2013). Considering resilience as societal response capacity to perturbation and stress by utilizing the common-pool resources, the definitional spectrum of the MOVE framework includes pre-disaster risk reduction, coping capacity during disaster, and post-disaster response measures by the at-risk community with a focus of learning from the past experience(s) and accordingly applying those lessons to handle future hazard events (Birkmann et al., 2013).

The resilience assessment discussed above establish a paradigm where pre- and post-shock situations lie between two extremes (Ahsan and Takeuchi, 2015). While the DROP model, RIMA model, and the 4'Rs' model take respective positions somewhere 'in-between' of the two poles, the MOVE model only deals with pre-disaster features and post-disaster response (not recovery). Thus, no model addresses the full paradigm of all the existing scientifically accepted approaches on disaster resilience (Ahsan and Takeuchi, 2015). Therefore, this study opt for the FAO RIMA model, introduced first by (Alinovi et al., 2008) and further developed by (FAO, 2013, 2016) since it accommodates a wider spectrum of resilience dynamics.

In FAO's RIMA model, resilience explains why one household returns to a desired level of food security while a similar household does not. Therefore, the model explains the interaction between shocks and their effects on households, with resilience accounting for the difference in outcomes between two similar households exposed to the same shock. According to this model, the outcome for a given household is a function of three complementary issues, namely; the probability of being reached by a natural crisis due to the geographical location of the household; the probability of suffering from a shock due to a particular set of household characteristics which determine a household's livelihood; and the resilience of the household (ibid).

Thus, resilience analysis aims to identify the different responses adopted by a household and capture the 'dynamic' components of the adopted strategies. That is, the approach investigates not only how disturbances and change might influence the structure of a system, but also how its functionality in meeting these needs might change. Therefore, resilience analysis should not be seen as an alternative to vulnerability analysis, but as a complement (Alinovi et al., 2008, 2010; FAO, 2013). The resilience measurement in this case has to capture all possible pathways to well-being in the face of shocks. When a shock occurs resilience mechanisms are activated to ensure the household well-being. That means household well-being is a function of a set of time-variant and time-invariant characteristics, a number of dimensions contributing to household resilience capacity. As resilience is made up of diverse dimensions and the resilience of a given household at a given point in time depends primarily on the options available to that household to make a living (e.g. access to basic services, assets, income-generating activities, social safety nets). These options, therefore, determine the household's ability to handle a given risk. Therefore, understanding the components comprising resilience is critical to identifying where the greatest areas of vulnerability exist.

The most credited and recent description of core components of resilience seems to be that in (Adger, 2006; Béné et al., 2012). With an emphasis on the practical application that a resilience measurement tool is supposed to accomplish, this study operationalizes a model that specifies the relationships between the unobserved resilience dimensions and the corresponding indicators a priori on the basis of theoretical and empirical knowledge from the existing resilience studies. To do so, the FAO'S analytical framework of Resilience Index Measurement and Analysis (RIMA-I) model (FAO, 2013) and RIMA-II (FAO, 2016) with some innovation but consistent with the original framework proposed the four dimensions of resilience capacity: access to basic

services, adaptive capacity, assets, and social safety nets and our study follows in line with those dimensions too.

2.5. Shocks and Coping Strategies

Shock can be broadly defined as an unexpected event for households, which can lead to a substantial loss of consumption, income or wealth (Gillis et al., 2001). Risk; a probability of shock divides the inter-temporal income of households into permanent and temporary income (Deaton, 1997). Risk whether covariant or singular, is central to the processes that create and perpetuate poverty, as well as sideline equally important structural and idiosyncratic bases to chronic poverty (Baulch, 2011). If there is a developed credit market and simultaneously households have good saving behavior, their consumption would be smoothed over time and proportioned to their permanent income. However, in developing countries, credit markets are still poorly developed and poor households do not have the behavior and extra quality of savings to smooth their consumption when shocks occurred. The impacts of shocks depend on their nature, frequency and severity as well as households' ability to cope with the shocks (Heltberg and Lund, 2009).

The issue of shock, realization of risk and poverty has been of increasing concern from time to time in an advisory domain. From the policy perspective, when resources to fight poverty are limited, the priority is how to use them effectively, while the priority with shocks are how much shocks can exacerbate poverty and how should governments intervene effectively (Gillis et al., 2001). Moreover, the issue shock and its coping has been examined increasingly on the static poverty and dynamic nature of poverty.

The literature can be categorized into two in such case. The first group tries to investigate the direct impacts of shocks on poverty and poverty dynamics through either

calculating risk-adjusted poverty or identifying shocks as their determinants (Dercon, 2002). The second category explores the impacts of shocks on poverty and poverty dynamics through a response to shocks (Dercon et al., 2005; Tongruksawattana et al., 2010; Wagstaff and Lindelow, 2014). Although this category does not evaluate the direct impacts of shock-coping mechanisms on poverty, it focuses on examining how households respond to shocks/risks and how risks are shared, especially for poor households. These strategies are grouped into *ex-ante* and *ex-post*, depending on whether they are put in place before or after the occurrence of a shock, respectively (Ellis, 2000).

(Ellis, 2000) defines *ex-ante* risk management as consisting of "forward planning to spread risk across a diverse set of activities, in the context of subjective evaluations about the degree of risk attached to each source of risk" (Ellis, 2000, p. 62). These strategies are proactive in nature and undertaken before the occurrence of a shock, to prevent the risk from happening, or if prevention is not possible, to mitigate the impacts of such shocks (Dercon, 2002; Heitzmann et al., 2002). The common *ex-ante* prevention strategies include sound macro-economic policies, public health and education investments *(*(Heitzmann et al., 2002) while the common *ex-ante* risk mitigation strategies include income diversification (Dercon, 2002) livelihood diversification (Dercon, 2002; Hoddinott and Quisumbing, 2003).

Ex-post coping strategies are defined as "the methods used by households to survive when confronted with unanticipated livelihood failure" in either a gradual or a sudden sense (Ellis, 2000, p. 62). These strategies can smooth households' consumption and deal with the impacts of shocks that have not been managed *ex-ante.* Thus, the key on the discussions of resilience and vulnerability in the context of poverty is to understand

the role of risk/shock is important. What poor people are concerned about is not so much that their levels of income, consumption, or capabilities are low, but that they are likely to experience highly stressful declines in these levels, to the point of premature death (Hulme and Shepherd, 2003).

2.6. Related Empirical Literature Reviews

2.6.1. Poverty Dynamics and Vulnerability to Poverty

Ordinarily, one would wish to steer away from studying such a depressing subject as poverty and its related issues (Ravallion, 2016). However, due to mounting poverty incidences and crave to discover more on its causes and how it can be caused, many researchers remained engrossed to the static and dynamic nature of poverty. While analyzing households' poverty level is relatively straight forward, household vulnerability requires information on the possible states of the world in the future and the probability distribution of their occurrences. Information on different states of the world becomes more complicated as the analyst move further away from the present. Clearly, these depend on the quality and nature of data that are available and accordingly most of the empirical literatures are crafted on the strengths of available data.

There are many empirical literature on the ability and extent to which consumption is protected against fluctuation due to shocks and measured by observed changes in consumption over time (Townsend, 1995; Jalan and Ravallion, 2000). These empirical literatures provide pivotal information on households' ability to partially smooth consumption as well as the role of informal mechanisms in protecting households' consumption; given the considerable markets failures hindering formal credit and

insurance market development. However, there are practical problems with these studies to infer policy implications (Azam et al., 2012; Arouri et al., 2015).

One of the practical problems is that they all require representative lengthy panel data. Reliable and representative panel data are all still scarce in developing countries and vulnerability analysis mostly relies on more readily available cross-sectional household surveys. The other notable drawbacks of the ability to smooth consumption approach are inability to set a benchmark and measurement around a given consumption path. Variation around a given consumption path may not be a good indicator of vulnerability that households face with uncertain future income (Christiaensen, 2005).

The most notable empirical literature that decompose poverty into chronically poor (structural poverty) and those who are transient poor (temporary) (Jalan and Ravallion, 2000; Hulme and Shepherd, 2003; Duclos and Araar, 2007). Jalan and Ravallion (2000), expressed transient poverty as the poverty that can be attributed to inter-temporal variability in consumption, and distinguished transient from chronic poverty using data from rural china. Using robust semi-parametric method, they found that household average wealth holding is an important determinant for both transient and chronic poverty. However, household demographics, education levels, and health status of household members-while important for chronic poverty were not significant determinants of transient poverty. Numerous studies explored poverty dynamics in Ethiopia fall into this category of *ex-post* poverty dynamic analysis.

With regard to vulnerability as expected poverty based on panel data, (Pritchett et al., 2000; Chaudhuri et al., 2002; Shiferaw et al., 2014; Fang et al., 2016) made the initial contributions by developing a methodology which estimates vulnerability as probabilities that are computed the expected value of poverty score in the future,

conditional on the bundle of covariates. This poverty score takes the form of the FGT (1984), measures, specifically the head count index. While panel data of sufficient length would provide a better source for vulnerability estimates-the availability of repeated observations add a crucial dimension (variability) to the measurement of household welfare, in practice these are scarce in developing countries.

In Ethiopia, most of the earlier studies are static and descriptive in nature, while some others focus on poverty dynamics and inequalities among the poor. Recently, there are few studies on vulnerability to poverty. When analyst focus strictly on poverty dynamics and vulnerability to poverty studies in Ethiopia, the absence of panel data collected for the same representative households for the entire population over multiple periods has constrained such analysis. Several of these studies are based on the Ethiopian Rural Household Survey (ERHS) data from 1994-2009 (Dercon and Porter, 2011). A brief review of some these empirical literatures would not be out of context in this sense. Dercon et al. (2005) also analyze the impacts of shocks on per capita consumption in rural Ethiopia and find that only experiencing drought and illness reduced per capita consumption significantly. However, the result seems inconsistent with Dercon and Krishnan (2000) where both idiosyncratic significantly affected consumption and covariate shocks like crop failure or rainfall shortage.

Brück and Kebede (2013), using a three waves of ERHS data (1994, 2004 and 2009) assessed the drivers of poverty dynamics in rural Ethiopia. Smaller household size with educated members has a lesser tendency to move into poverty. Moreover, drought and crop pest shocks are the main contributing factors for households' movement into poverty. On the contrary, access to formal and informal credit is important for reducing poverty. Using a six-year period data, Little et al. (2006) analyzed the impact of drought

on poverty dynamics in South Wollo area of northern Ethiopia. The study revealed that the greater the dependence on rain-fed agriculture based incomes and the less diversification there is, the greater risk of poverty. Limits on land ownerships and property transaction, lack of physical and social infrastructure, investment opportunities and serious natural constraints on herd accumulation retarded poverty exit.

Using four waves of ERHS panel data (1994, 1999, 2004, and 2010) Abrham and Bauer (2012) decomposed poverty into chronic and transient components, revealing the dominance of chronic poverty as compared to transient ones. While household size became critical in the movement into chronic and transient poverty, livestock assets and involvement in off-farm activities are the key factors to reduce the movement of households falling into chronic and transient poverty in rural Ethiopia. Moreover, the authors made vulnerability analysis to complement *ex-post* poverty studies. Household age, membership in saving, crop diversification and engagement in off-farm activities are the main cause of vulnerability to poverty. Literacy of head, household size, access to credit and livestock assets as the key factors to play in reducing vulnerability to poverty in rural Ethiopia.

In general, most of these studies on poverty dynamics and vulnerability to poverty in Ethiopia could not depict the true picture due to their limitations in terms of representing the study units as well as incorporating the many facets of poverty dynamics. This study therefore, attempted to overcome such data limitations and the related methodology to infer the true picture of poverty dynamics (in an *ex-post* and *ex-ante* form) in rural Ethiopia.

2.6.2. Household Resilience Capacity

Since 2008, many researchers and institutions have tried to measure resilience and assess the impacts of their resilience programs at the household or community levels in the context of food security. Employing two stage factor analysis techniques, Alinovi et al. (2008) studied the resilience of Palestinian households to food security. The authors used six dimensions of resilience capacity, namely, asset, income and food access, access to basic service, social safety nets, adaptive capacity and stability. The study revealed that the dimensions of the resilient model showed a significant difference in terms of location that richest and more stable area (East Jerusalem) are most resilient and its resilience is depending on income and food access capacity, while in Gaza Strip mostly dependent on social safety nets.

In 2010, with a few modifications from the Alinovi et al. (2008), Alinovi et al. (2010) made household resilience analysis in Kenya. In this case, the authors added additional dimensions of resilience capacity and variables to consider the nature of the country and local contexts. The study categorized households into pastoralist, agro-pastoralist, large holder farmers, smallholder farmers using household's livelihood strategies as criteria. The result indicated the importance and significant variations of overall resilience capacity and the dimensions of resilience capacity across livelihood groups. While access to credit is much more relevant to pastoralists and large-holders than other groups, access to water is more relevant to both farmer groups and agro-pastoralists. Moreover, access to electricity and telephone networks and social safety nets for urban dwellers as it was more relevant to entrepreneurs and wage-employees.

Using the same methodology of Alinovi et al. (2008) and Alinovi et al. (2010), Romano et al. (2014) tried to measure the resilience of rural households to food security for

Hurricane Mitch 1999 affected rural households based on panel data from national household surveys of both 1998 and 2001. By dropping some of the dimensions of resilience capacity and variables used by Alinovi et al. (2008) and Alinovi et al. (2010) and included some additional variables, the study produced a single agricultural resilience index. The study revealed the significant variations among livelihood groups in resilience that agricultural wage workers and small land owners were poorly resilient than others.

In Ethiopia, there are some recent empirical studies on household resilience, specifically focused on food and livelihood security. Mulat and Nigussie (2013) studied resilience for food security and livelihood dynamics based on the ERHS panel data using principal component analysis and dynamic probit random effect model. The result showed that cultivated land, ownership of livestock, use of improved technologies and household membership in traditional saving groups are positively and significantly correlated with dynamics of building sustainable resilience for food security.

Based on two years of four rounds (two rounds in the hunger season and two rounds in the post-harvest season) of a household survey from two districts in Tigray national regional state, Maxwell et al. (2013) tried to measure resilience in northern Ethiopia using livelihoods change over time approach. In addition to measuring the current as well as over time change of livelihood status, the study analyzed underlying factors of change for each of the four resilience pathways for how households respond to shocks (i.e., bounce back better, bounce back, recover but worse than before, collapse). The study revealed that all the food security indicators depict improving access to food, decreasing levels of coping and increased dietary diversity over the four rounds of the survey; however, the determinants of food security status vary by outcome indicator

and round. Among factors of food security, the aggregate impact of shocks is a significant factor across all rounds of the survey and for most of the socio-economic and geographic subgroups.

Using the 2004 ERHS data and employing structural equation modelling, Negussie and Francois (2014) analyzed household resilience in rural Ethiopia. The study found that building resilience significantly influences household per capita consumption, absorptive and transformative capacities and vice versa. Absorptive capacity of the households positively and significantly correlated with household per capita income (crop, livestock, on-farm and off- farm wage income), ownership of livestock, land cultivated and participation in social capital, while the transformative capacities was positively and significantly correlated with use of modern technologies such as irrigation, fertilizer, advice/services from extension agent as well as access to information services. There are also few similar recent studies in Ethiopia (Tesso et al., 2012; Guyu and Muluneh, 2015; Temesgen et al., 2016; Thiede, 2016; Knippenberg and Hoddinott, 2016).

The resilience studies are still very limited in the literature and much focus on the issue of food security. Therefore, this study strives to contribute for the limited literature by testing the concept using a unique national data and advanced quantitative methodology (structural equation modelling).

2.6.3. Shocks and Coping Strategies

There are plenty definitions of shocks in the literature. Shock can be broadly defined as an unexpected event for households, which can lead to a substantial loss of consumption, income or wealth (Gillis et al., 2001). Risk; a probability of shock divides the inter-temporal income of households into permanent and temporary income

(Deaton, 1997). Risk whether covariant or singular, is central to the processes that create and perpetuate poverty, as well as sideline equally important structural and idiosyncratic bases to chronic poverty (Baulch, 2011). These risks can translate into a range of different 'shocks', defined as adverse events that are costly to individuals and households in terms of lost income, reduced consumption or the sale of assets (Dercon et al., 2005).

The literature on risk and shocks in developing countries has established that shocks from many sources occur frequently and translated into income loss, which can put financial constraints on households and leading to among others loss of assets that may decrease future earning probabilities and savings (Tongruksawattana et al., 2010; Heltberg et al., 2014). The effect of shocks is more severe for the poor who are less *ex-ante* insured than wealthier households against shocks (Jalan and Ravallion, 1999). Over the last decade, the literature on shocks made a distinction based on their scope between idiosyncratic (individual household specific) shocks such as illness and death of a household members; and covariate (that impact large group the population) such as drought, market price fluctuation and flooding (Dercon, 2002; Christiaensen, 2005; Günther and Harttgen, 2009). Moreover, shocks can be classified into a number of broad categories based on their origins like climatic, economic, health, crime and agricultural production shocks (Dercon et al., 2005; Makoka, 2008). Rural households in developing countries face a variety of multiple shocks (Dercon, 2002; Hoddinott and Quisumbing, 2003; Tongruksawattana et al., 2010). Similarly, rural households in Ethiopia endure multiple of shocks (Asfaw and Braun, 2004; Dercon et al., 2005; Porter, 2012; Debebe et al., 2013; Krishna et al., 2018).

In response to risks and shocks, rural households living in risky environments devise strategies to deal with the risks both before the shocks occur (*ex-ante* risk management)

and after the shocks have manifested themselves (*ex-post* coping strategies) which is focus of this study. Most of empirical evidences indicated that, as rural households face a variety of multiple shocks, they use a variety of *ex-post* coping strategies to maintain their level of consumption. The choice coping strategies of rural households depends on the type of shocks as well as other household and community characteristics (Dercon, 2002; Hoddinott, 2006).

One of the most common coping strategy used by households to relieve the impact of shocks is self-insurance (Christiaensen, 2005; Dercon et al., 2005; Heltberg and Lund, 2009). The other commonly used strategy employed by households in response to shocks in the empirical literature is informal insurance in the form of informal group-based risk sharing mechanisms (Hoddinott, 2006). These informal arrangements that develop between members of a group or community to support each other in times of shocks. Other studies on the issue confirmed that disposition of savings and assets, income diversification and informal credit help households to cope with income shortfalls as a consequence of shocks (Hoddinott, 2006; Heltberg and Lund, 2009; Mersha and van Laerhoven, 2018) and (Berloffa et al., 2009) also found that while households with higher level of assets tend to use savings or take up additional loans to cope with income loss, poor households are more likely to work in off-farm activities.

The following paragraphs solely focus on the empirical studies conducted on the impact of shocks and coping strategies in rural Ethiopia. Using two years panel data, (Asfaw and Braun, 2004) examines the impact of illness shocks on consumption and the capacity of inter and intra risk sharing arrangements in insuring consumption against illness. The authors' found the incapability of the household him/herself and the risk sharing arrangements against the impact of health shock on purchased and non-food household consumption items and recommended policy makers either to upgrade the

existing risk sharing arrangements or introduce a new form of community health insurance schemes for households resided in rural Ethiopia.

The study by Dercon et al. (2005) using a multi-shock data also confirmed that droughts and illness shocks occurring in the five years prior to the survey reduce total per capita consumption by 20% and 9% respectively. Implicitly, a larger proportion of households respond to drought by reducing current food consumption while for illness a reduction in food consumption may not be a viable response and the adverse effects may be postponed due to the reliance on asset sales and borrowing. Explicitly, however, the study didn't consider the importance of households' *ex-post* coping responses to these shocks in bearing such outcomes before concluding that the consequences of droughts are worse than illnesses or that health shocks do not affect food consumption.

Porter (2012) using six rounds of ERHS data (1994, 1995, 1997, 1999 and 2004) investigated the impact of adverse shocks on household welfare as measured by consumption per adult of a basic basket of food and essential other expenses. The study revealed despite all shocks included have a significant and sizeable effect on income of households, rainfall shock in the form of extreme low rainfall relative to local norms contribute significantly for poverty persistence. Moreover, she confirmed the consistency with other studies on the literature that have shown the ability of households to smooth their consumption against idiosyncratic shocks, but not covariates in case of Ethiopian rural households.

The latest empirical evidence in rural Ethiopia by Debebe et al. (2013) found that, natural shocks dominate in term of frequency and have affected almost half of all households. In terms of coping strategies across shock types, economic and natural shocks were more likely to trigger using saving and a reduction in food consumption.

The links between the coping response and the shocks found in their study are consistent with the results in Asfaw and Braun (2004) and Dercon et al. (2005) but suggest a different interpretation. Moreover, for health shocks, the sale of assets and the indebtedness generated by such shocks there is a clear need for health insurance schemes which work towards mitigating the financial consequences of health shocks.

Despite such empirical studies in Ethiopia and elsewhere, household shock coping activities are part of the welfare literature rather than independently exploring the issue. However, there is a need to further explore shock types and households' coping strategies on strong empirical backgrounds. At present, a better understanding this is limited and this study makes use of a large scale household level data to analyze households' behavior regarding decisions to make coping actions and the choice of coping strategies.

2.7. Conceptual Framework of the Study

The analysis of poverty dynamics, vulnerability and resilience capacity requires a framework that incorporates on how households take on production and consumption. The level of analysis in this study is therefore, at household level. Due to mounting poverty incidences and crave to know more on its causes, many researchers remained engrossed to the static and dynamic nature of poverty. However, it seems a reached consensus on the very importance of dynamic poverty nature than its counterpart, static poverty. The dynamic poverty analysis over time use both *ex-post* and *ex-ante* welfare measurement to know the status of households in entering or moving out of poverty.

The conceptual framework depicted in figure 2.1 visualizes the static and dynamic nature of poverty in general as well as the specific interests of this study in particular in relation to the different household, community and shock characteristics. A typical

rural household in Ethiopia engage in agricultural activities such as crop production, livestock rearing as well as earn a living from non-agricultural activities like off-farm, non-farm activities. Hence, the rural household is subject to a decision-making between the amount to produce and consume. Here, the amount to consume depend on the amount produced and earned. The basis of understanding starts with how much the rural household consumed using the poverty line as a minimum threshold. And depending on the multi-layered decision making for all activities, households' consumption would improve or deteriorate across time and space because of shocks and risks.

The episode of shocks households experience would adversely affect their current or/and future consumptions. Understanding such movements of into and out of poverty, signify the structural and temporal nature of poverty to design policies and programs for the chronically and transitorily poor households. Such king of measuring poverty is known as *ex-post* poverty dynamics measurement in the conventional poverty literature (Jalan and Ravallion, 2000; Baulch, 2011). More importantly, an understanding of poverty dynamics based on *ex-ante* measurement of welfare is a reasonable predictor of observed future poverty called vulnerability to poverty (Chaudhuri et al., 2002). The conceptual framework proposed here depict the relevance of vulnerability to poverty in a recursive, dynamic and forward looking way with other key aspects of poverty in rural Ethiopia.

The related issue studied is overall household resilience capacity and the dimensions of resilience capacity. As resilience is not merely the inverse of vulnerability, work on resilience and vulnerability do share common features. Both emphasize that households are strongly affected by the settings they find, assets and their livelihood strategies and that these strategies are both affected by and respond to shocks as well as both give

prominence to the asset households of households (FAO, 2013; Fan et al., 2014; Hoddinott, 2014).

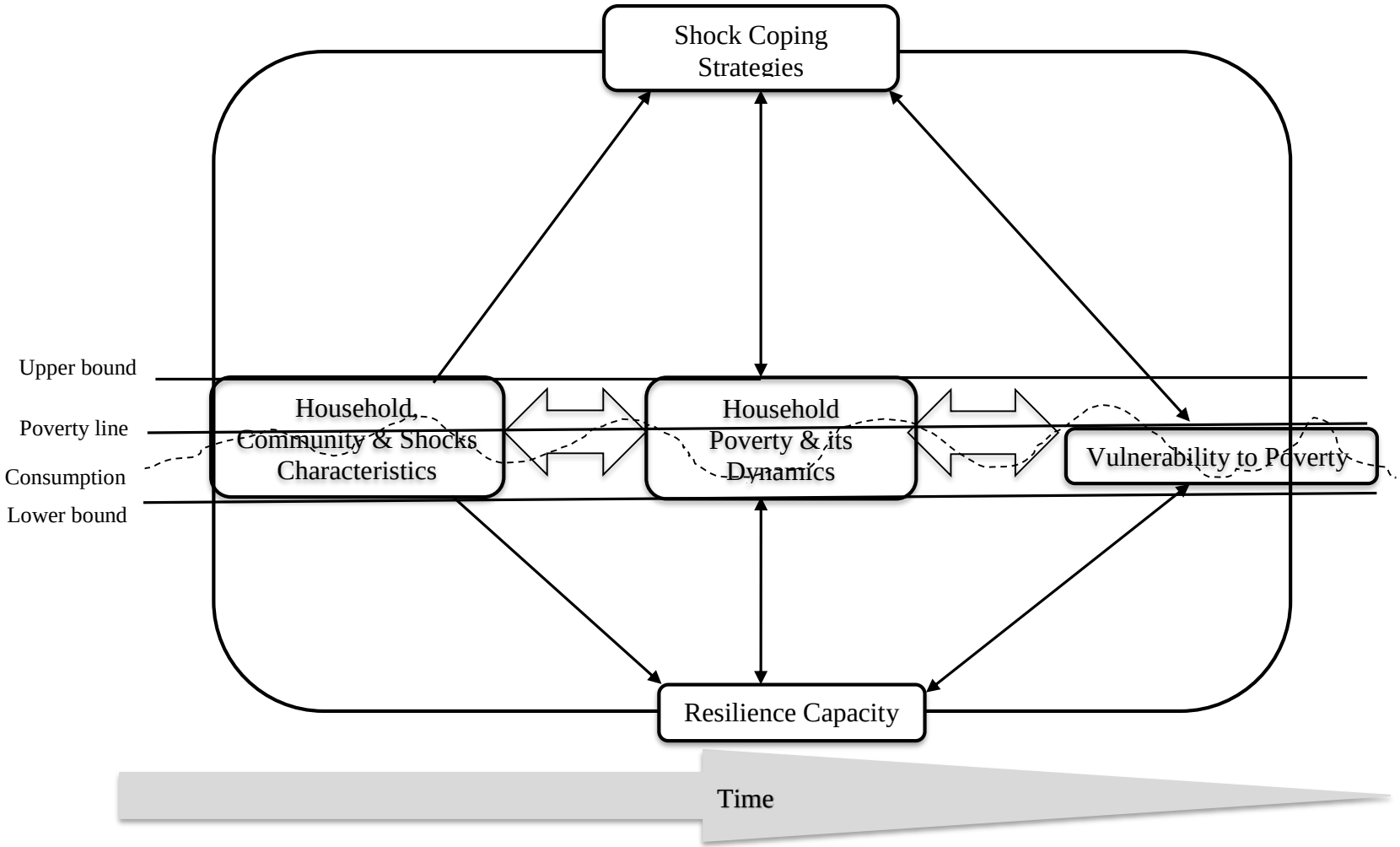

Figure 2.1. Conceptual framework of the study

Source: Adapted from Jalan and Ravallion (2000), 2017.

Despite such commonalities, many scholars underscore their focus differences on the issue of shocks. Hoddinott (2014) explicitly explain their differences stating “Will shocks push into poverty?” as a critical question of vulnerability research and “Do shocks or stresses have long-term adverse consequences?” as a key question of resilience. Hence, household resilience here is better viewed as one objective among others to reduce poverty, improved standard of livings and reduce vulnerability rather than the objective of development efforts. Moreover, the issue of coping strategies against shocks has relationships with poverty in general and vulnerability and resilience in particular as depicted in figure 2.1

Chapter 3. Study Area Description: Overview of Rural Ethiopia

3.1. Introduction

Despite the government of Ethiopia claims massive poverty reduction (MoFED, 2012) and rapid economic growth (USAID, 2017) the country remains one of the most poverty stricken nations in the world (Moges, 2013). All the poverty reduction programs being undertaken in Ethiopia are based on static poverty measures. When conducting an analysis of poverty, a cross-sectional data set may indicate the poverty situation at one point in time. However, a deep understanding of poverty and its dynamics including vulnerability to poverty and resilience requires panel data with comprehensive information on household and community characteristics as well as risks and shocks.

The aim of this chapter is to present an overview of rural Ethiopia that include its physical, socio-economic, administrative regions such that poverty, vulnerability and resilience analyses are put in their proper perspectives by taking into account the environment in which the households find themselves. The chapter proceeds as follows; a description of rural Ethiopia's biophysical, socioeconomic and major administrative regions in section 3.2, 3.3 and 3.4 respectively.

3.2. Biophysical Description

Ethiopia is located in the Horn of Africa between 3^0N and 15^0N North latitude and 33^0E and 48^0E east longitude. It is a land locked country bordered by six east African countries; Djibouti (east), Eritrea (north), Kenya (south), Somalia (south-east), South Sudan (west) and Sudan (north-west). Ethiopia has a total area of 1, 104,300 km^2, about 9.44 percent (104,300 Km2) of which is water.

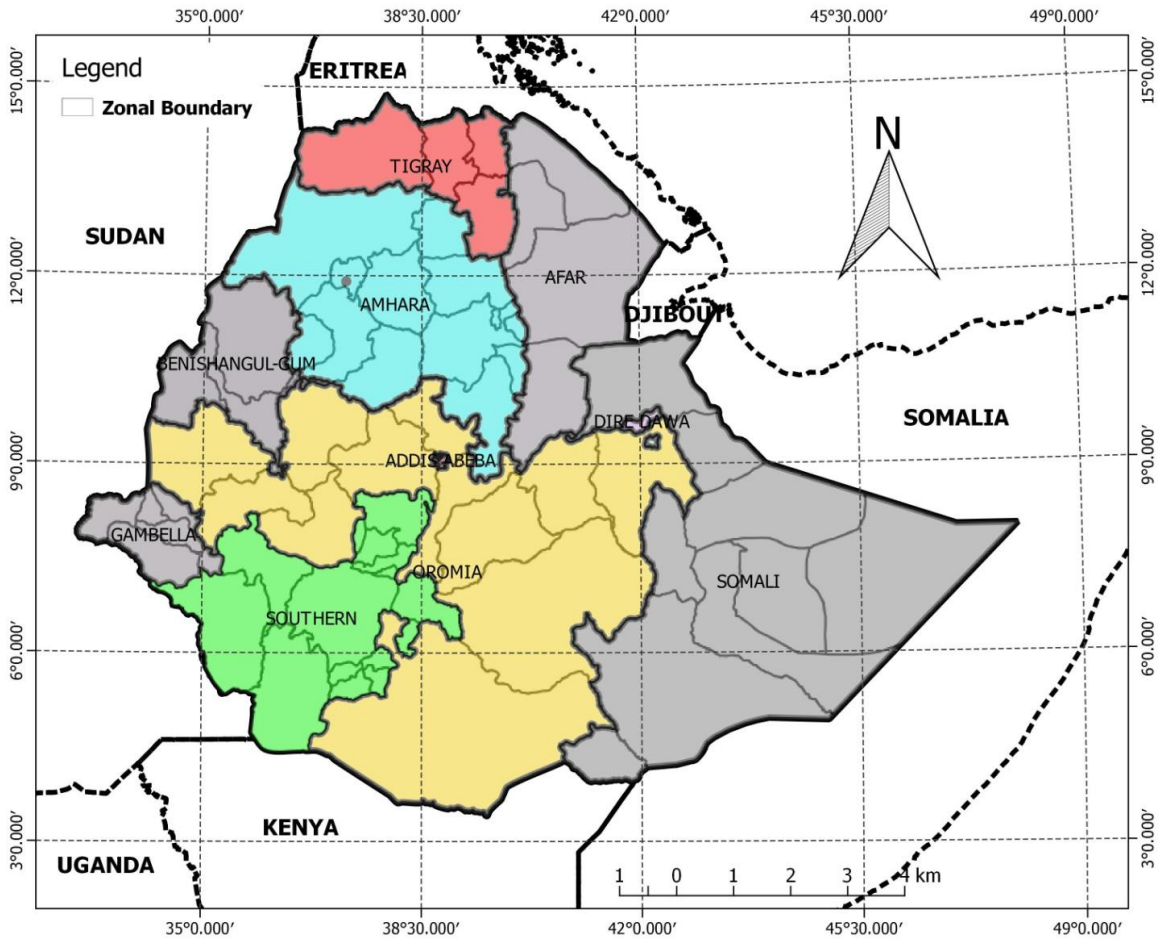

Figure 3.1. Location map of the study area.

The Ethiopian landmass consists of a large, high elevated plateau bisected by the Rift Valley into the northwestern and the southeastern highlands, each with associated lowlands The contrast in relief is remarkable as land elevation ranges between 155 m.b.s.l sea level of Asal lake in the Afar depression (the lowest point in Africa) to the peak of mount Ras Dejen at 4,620 m.a.s.l in the Simen Mountains. For these reasons and given its geographic position close to the equator and the Indian Ocean, the country is subjected to large spatial variations in temperature and precipitation (Paolo, 2015).

The climate of Ethiopia is mainly controlled by the seasonal migration of the inter-tropical convergence zone and associated atmospheric circulations and the complex physiography

and the marked contrast in elevation among large different areas of the country (Paolo, 2015). The transition between lowlands and highlands is commonly very sharp, resulting in a variety of climates, from very arid to very humid typical of equatorial mountains, with further differentiation at local scale. Moreover, precipitation varies with latitude, decreasing from south to north, whereas the meteorological framework is deeply affected also by elevation and physiography, especially as regards temperature distribution and anemometric characteristics (Paolo, 2015).

There is a wide range temperature variability that be as low as -7^0C (Degree Celsius) in the Bale Mountains and as much as 50^0C in the Danakil Desert. In terms of rainfall, the higher rainfalls are recorded in the western highlands, with 2,101 millimeters a year at Gore, and the lower in the Afar depression with 145 millimeters a year. The summer, monsoon rains account for more than 50 % and as much as 85% of the annual rainfall, whereas the spring rains are more variable in amount and predictability. High rainfall intensities in 24 hours may occur every month but are more common in the middle of the two main rainy seasons. The highest average and absolute rainfall intensities are recorded at Gambela (89.4 and 181.4 millimeter per 24 hours, respectively), whereas the lowest values are measured at Elidar and Gewane in the Afar triangle. Rainfalls are very severe over large part of Ethiopia; the higher values of rainfall erosivity in the central and part of the northern highlands and, subordinately, in the central portion of the Somali plateau margin (Paolo, 2015).

The long time series data over past three decade show the change in both the maximum and minimum temperature with an average increase of 1.1^0C. By contrast, annual precipitation is characterized by a decreasing trend with an average decline of about 125

millimeters in 49 years, with the small spring rains decreasing at a rate 1.5 time higher than the monsoon summer rains.

Ethiopia has three agro-ecological zones using average altitude, temperature and rainfall as classification criteria. These are *kolla*/tropical zone (below 1830 meter, 27^0C and 510 milliliter rainfall); *woina-dega*/sub-tropical zone (1830-2440 meter, 22^0 C and 510-1530 milliliter rainfall) and d*ega*/cool zone (above 2400 meter, 16^0C and 1530-2000 millimeter rainfall) (Hurni, 1998). Moreover, to characterize the different environments of Ethiopia, landscapes are classified where predominant physical conditions guide relatively homogenous agricultural land use options using elevation as basis of classification. These: bereha (less than 500 meters above sea level), *kolla* (between 500 and 1,500 meters), *woina-dega* (between 1,500 and 2,300 meters), *dega* (2,300-3,200 meters), *wurch* (3,200-3,700 meters) and *kur* (above 3,700 meters). Therefore, altitude is the primary determinant of agricultural land-use options in Ethiopia due to its influence on temperature.

The practice of agriculture across most of the country is dependent on rainfall availability and the major growing seasons in Ethiopia are associated with annual rainfall patterns. The long rains occur roughly from June to September (*kiremt*); the short rains occur from March to May (*belg*). Most areas in the country experience both the *kiremt* and *belg* rains with the exception of some areas in the northwest (Hurni, 1998).

3.3. Socioeconomic Description

Since the 1960's, Ethiopia's population has grown at an average of 2.5% annually, increasing from 22 million people in 1960 to just over 102 million in 2016. Ethiopia's population first doubled to over 44 million by 1987, and then doubled again, reaching over

89 million people in 2011 (USAID, 2017). Ethiopia's population is forecast to grow to around be approximately 145 million by 2030. Between 2015 and 2016 alone, Ethiopia added an estimated 2.7 million people to its population, by 2030 they could be adding 3.1 million people per year.

Ethiopia's current population growth rate of 2.7% per annum is expected to decline to 2.6 % by 2021, and will be 2.3 % by 2030, changes driven largely by gradual reductions in fertility. This is in comparison to an average growth rate of 2.9% across other African low income countries in 2016, which is forecast to decline to 2.5% in 2030 (USAID, 2017). Ethiopia's rapid population growth is putting increasing presser on land resources, expanding environmental degradation, and raising vulnerability to food shortages. With more than 40 percent of the population below the age of 15 years and a fertility rate of over 5 children per woman (even higher in rural areas).

While the overall development context has improved, the story of Ethiopian development has still been mixed given its previous low levels of development, turbulent history and impact of repeat cycles of drought and famine. Let us look at the progress of Ethiopia on the health, education, and economy as key human development indicators specifically. When we look at the progress in health sector, the government and aid organizations have made a concerted effort to extend health infrastructure and services to improve the health of Ethiopians over the past 25 years (USAID, 2017). Life expectancy has increased by just under 40 percent and infant mortality has decreased by over 60 percent. The country has also decreased infant mortality from 120 deaths per thousand births in 1990 to 46 in 2015.

Currently, Ethiopia's infant mortality rate is 22 percent lower than that of sub-Saharan Africa and 18 percent lower than that of African low-income countries. Furthermore, Ethiopia has made huge progress in reducing maternal mortality rate[6]. Since 1990, the maternal mortality rate in Ethiopia has fallen from 1250 (per 100,000 live births) to 353, which represents a 70 percent decrease over the past 25 years. Ethiopia's maternal mortality rate in 2015 is 35 percent lower than sub-Saharan Africa and 25 percent lower than other low-income African countries. In terms life expectancy significant progress have been recorded from 46 years in 1990 to 63 years in 2015. It is clear that Ethiopia has made significant progress in ensuring that infants (and mothers) survive childbirth and increasing life expectancy of those newborn children. Despite these health outcomes, Ethiopia still lags behind in many health indicators and faces significant health and mortality challenges. Globally, Ethiopia ranks 150th (out of 186 countries) in infant mortality and 154th in life expectancy. Lack of access to improved water and sanitation facilities and a dearth of calories for much of the population means that Ethiopia has some of the highest rates of child malnutrition (21st) and stunting (9th) in the world. Furthermore, Ethiopia still has one of the highest burdens of disease in sub-Saharan Africa–Ethiopians experience an estimated 395 years of life lost[7] per 1000 people. While the communicable disease death rate has declined significantly (and is now one of the lowest in sub-Saharan Africa), the sheer size of Ethiopia's population and the nature of the communicable disease burden (nearly 70 percent of year of life lost in Ethiopia are due to communicable disease) means

[6] Maternal mortality rate is fined as the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes.

[7] Years of life lost is defined as number of healthy years lost due to premature death.

that communicable disease detection and treatment will continue to play a major role in the Ethiopian health system for the foreseeable future.

In terms of progress in education, Ethiopia has also made significant strides in education since the early 1990s (USAID, 2017). Primary enrollment rates (net) have climbed from near 19 % in 1994 to 84 % by 2016. In 2000, close to 12 % of age appropriate children were enrolled in secondary education, by 2016 that number grew to 17%. Government expenditure has climbed from approximately 2.3% of GDP in early 1990s to near 4.5% in 2016. Despite the laudable progress of increasing access, particularly at the primary school level, Ethiopia's education system continues to face persistent challenges with respect to access and completion, equity, and quality. Ethiopia missed the millennium development goal target of universal primary education by 2015.

In terms of economy, Ethiopia has the sixth-largest economy in Sub-Saharan Africa and has sustained rapid and stable economic growth over the past decade (World Bank, 2015). GDP growth averaged 10.4 percent between 2005 and 2015, which propelled Ethiopia from 2nd poorest country in the world to the 11th poorest. And by this period, the size of the Ethiopian economy has nearly tripled in size (from USD 17.15 billion to USD 45.8 billion). GDP per capita doubled (from USD 730 to USD 1,500) and the portion of the population living under USD 1.90 per day has decreased by 25 percent. The economy is dependent on rain fed agriculture that employees more than 80% of the labor force with 41% of GDP and 70% of total export earnings contributions (Devereux, 2000; MoFED, 2012).

The agriculture sector has historically been the foundation of the Ethiopian economy, despite being largely based on rain fed, subsistence farming. Almost 80% of Ethiopia's

population is still employed in the agricultural sector, but services have surpassed agriculture as the principal source of GDP. According to the (World Bank, 2015), the number of people employed in the agricultural sector increased by nearly 11 million people between 1999 and 2013, growing from 19.9 million to 30.8 million during that time period. Over this period the agricultural sector absorbed more than 70 percent of the total increase in employment. While the agricultural sector did account for the majority of increased employment in an absolute sense, the size of the agricultural labor force relative to other sectors has declined slightly, from about 80 percent in 1999 to 77 percent in 2013. Overall, the smallholder agricultural production increase helped to reduce poverty (over 70 percent of the labor force is employed in agriculture) and shifts to commercial farming for exports helped bolster Ethiopia's trade balance.

As the Ethiopia's economy grow the contribution of the service to both value added and labor productivity has increased significantly. While the growth in employment between 1999 and 2013 was overwhelmingly absorbed by the agricultural sector (73 percent), the majority (50 percent) of growth in value added has come from services. Despite increasing its productivity from 1999-2013, the agricultural sector is the least productive sector of the Ethiopian economy as measured by wages (this is consistent across countries and time). In other words, while the growth of output has shifted considerably away from agriculture toward services over the last fifteen years, the change in employment has been more muted.

For instance, in 2016 the agriculture sector accounted for roughly 41% of total value added to Ethiopia's economy in 2016, slightly below the contribution from services (45 percent), which again is the most productive and fastest growing sector of Ethiopia's economy. Nonetheless, because agriculture represent the bulk of both employment and exports along

with being a major contributor to general economic growth agriculture is and will continue to be a crucial segment of the Ethiopian economy for the foreseeable future. In the future however, it is unlikely that Ethiopia will be able to duplicate the type of rapid sustained growth as it has seen over the past 10 years.

3.4. Administrative Regions

Administratively, Ethiopia introduced decentralization as the strategic tool for empowering citizens and devolving power to lower levels, following the 1995 Constitution. This decentralization divided the country into regions, zones, districts and *kebeles*[8]. (CSA, 2008). The country has established nine regions (Afar, Amhara, Benishangul-Gumuz, Gambella, Harari, Oromia, SNNP, Somali, and Tigray) and two city administrations (Addis Ababa and Dire Dawa). The city administrations of Addis Ababa and Dire Dawa have different structures but are considered the equivalent of regions. Since 2006, the zones in most regions have become arms of the regional government. The districts are considered the key local government units in each region, with significant responsibility for providing basic services. The local government landscape follows similar patterns across regions

Despite nine regional states, four of the regions namely Amhara, Oromia, SNNP and Tigray together account about 87 percent of the Ethiopia's entire population of which 86.4 are rural (CSA, 2008). Oromia and Amhara are the two largest regions with 37.6 and 26.6 percent share of the entire population respectively. SNNP (20.8%) is the third largest and Tigray (6.6%) is fifth largest region of the country.

[8] The smallest administrative unit in Ethiopia can be compared to peasant associations.

As the data set is representative at regional, rural, and urban level, this study made an analysis at national and regional level (for the major regions) on rural basis. To make a more comprehensive analysis with comparisons, this study considered the remaining five small regions that account 8.4% of the Ethiopian population as one category called it 'Others'[9] regions. Thus, this study has five regional categories namely Amhara, Oromia, SNNP, Tigray and Others to get a clear picture of the country's rural poverty situation. In addition to administrative divide, the regions of the country vary across different characteristics like bio-physical, socio-economic and other related issues.

From climatic condition perspective, the study regions are characterized by rugged topography, temperate to subtropical climates with seasonal rainfall, and a dependence on smallholder agriculture as the primary livelihood strategy. Agro-ecologically, most of these regions fall in three agro-ecological zones. The *dega* zone covers 50%, 25% and 12% of Oromia, Amhara and Tigray regions respectively. About 44% of Amhara, 42% of Oromia and 49% of Tigray region also found in *woina-dega* agro-ecological zone of the country.

There is also a great deal of variation in terms of rainfall and temperature across regional states. In Oromia, the mean annual rainfall of the region varies from 200 mm to 2.400mm while annual mean temperature mostly lies between 7.5-27.5^{0}C. While Amhara region is the highest recipient of rainfall (about 40% of the country's total), its mean annual temperature variation lies between 15-21^{0}C.

[9] Combining the smaller regions namely Afar, Gambela, Benishangul-Gumuz, Somali, Dire-Dawa, Harari one 'Others' regions category.

Overall, rainfall is highly seasonal, falling mostly during a summer *kiremt* season, the primary agricultural season, but in many areas also during a shorter spring *belg* season. Related to high inter-annual rainfall variation, different shock events caused disastrous consequences since the mid 1980's ((EMDAT, 2010). For instance, drought occurred in 1999, 2002-2003, 2005, 2008 and 2015/2016 caused severe impacts on households and communities in the regions of the country (EMDAT 2010; Reliefweb, 2017). About 2.09 million in other regions, 2 million in Oromia, 600,000 in Amhara, 400,000 in SNNP and 300,000 people in Tigray regions need humanitarian food assistance in 2017 (Reliefweb, 2017).

From income sources point of view, the majority of rural households are primarily dependent on smallholder agriculture in the form of crop and livestock production. About 90% of rural households in Oromia, 85% in Amhara; 83% in Tigray and significant proportions in SNNP engaged in solely in agriculture. The major crops grown include cereals (*teff*, barley, wheat, maize and sorghum) and perennial crop (*enset*, coffee and *khat*). Livestock are also an important form of wealth, commonly cattle (oxen, cows, heifers and bulls), shoats (sheep and goats), mules, donkey, horses and camels. Oromia region accounts 51.2 percent of crop production and 44 percent of the country's total livestock population. Amhara region also constitute 40% of the livestock population of the country.

Following the nationalization of land in the 1970's, land legally belongs to the state but households have use rights that in many areas have been formalized through land registration and certification programs (Deininger et al. 2008). The population pressure on land is significant and the median household cultivated only 1 hectare in 2004. In 2017, the statistics indicated that households in Oromia, Amhara and Tigray own an average land

size (measured in hectare) of 1.84, 1.34 and 1.15 respectively. The lowest average land size is in Others (0.84) and SNNP (0.77) (Central Statistical Authority et al., 2017)..

From a development perspective, the study regions are characterized by severe poverty, food insecurity, malnutrition; low access to education, market and credit services; and other development indicators. In 2017, the highest multidimensional poverty (59%) are in Amhara and Oromia regions while SNNP (57.4%) is the second. The relatively lower poverty incidence is in Tigray (53.7) and Others (50.6%) regions (University of Oxford, 2017). Hence, this study believe the importance of driving rural households' poverty, vulnerability and resilience across these five regions.

Chapter 4. Household Poverty in Rural Ethiopia

4.1. Introduction

Knowledge of a country's poverty incidence is not sufficient for policy makers and development practitioners who are involved in developing poverty reduction strategies. Effective poverty reduction strategies are based not only on poverty rates in a country but also on the distribution of poverty among the different segments of the population. In order to institute policies that are effective to reduce levels of poverty in rural Ethiopia, policy makers need to be aware of how the extent of poverty varies across subgroups of the population as well as the determinants of poverty transitions. The poverty profiles and assessment results presented below are geared towards achieving this objective.

The reminder of the chapter is organized as follows: Section 4.2 presents the data and methodology used. The results are presented and discussed in section 4.3, and section 4.4 summarizes the chapter.

4.2. Data and Methodology

This section describes the data used and research method used in the following four sub-sections. The first part explains the description of our data source, the reason why to rely on panel data and explanatory variables. The second part deals with the aggregation the dependent variable with its poverty line. The third section explains the method of the ex-post dynamic measurement of poverty. The final section deals with fixed effects model used to investigate the determinants of poverty over the period 2012-2016.

4.2.1. Data

The data that form the empirical analysis of this objective is the rural category of the Ethiopian Socioeconomic Survey (ESS), three waves panel data conducted by Ethiopian Central Statistical Authority (CSA) and the World Bank (CSA and World Bank, 2013, 2015; Central Statistical Authority et al., 2017). The first, second and third waves were implemented in 2011–2012, 2013–2014, and 2015–2016 respectively. For simplicity, this study referred the 2011-2012 round as 2012 (wave 1), the 2013-2014 as 2014 (wave 2) and the 2015-2016 as 2016 (wave 3) survey round. The ESS data is part of the World Bank's Living Standards Measurement Study–Integrated Surveys on Agriculture (LSMS-ISA) project. The objectives of the ESS include the development of an innovative model for collecting agricultural data, inter-institutional collaboration, and comprehensive analysis of welfare indicators and socioeconomic characteristics. In terms of survey design, the ESS is designed to collect panel data in rural, small town, and urban areas on a range of household and community level characteristics linked to agricultural activities. Considering the regional administration of the country and rural-urban classification, the ESS sample selection follows a two-stage probability sample selection. While the first stage of sampling entailed selecting primary sampling units, called enumeration areas, the second stage of sampling involved the selection of households from each enumeration area. In order to understand the majority's poverty and vulnerability situation (85% of the population) (CSA, 2008), this study used the rural category of the ESS data only.

Before undertaking any analysis, each wave of ESS data was cleaned and created our panel data. Panel data have the advantage to control for unobserved sources of heterogeneity. It helps for rigorous analysis of poverty dynamics and the drivers and maintainers of chronic

poverty. Without panel data it is impossible to distinguish between a stock of persistently poor people and large flows of people moving in and out of poverty. Panel data also allow the role of initial conditions in both locking households into chronic poverty and creating the foundations for accumulation and growth to be examined. While dynamic poverty is solely dependent on panel data, many researchers exploring vulnerability to poverty have relied upon cross-sectional data, simply due to a dearth of available panel data. Other recent applications have used pseudo-panels from repeated cross-sections (E´chevin, 2013).

Where panel data are available, there is an issue of respondent attrition, which can be problematic when those who leave the sample are differently poor from those who remain in the sample. For instance, households that migrate may do so because they are among the poorest or, since migration may be a means of smoothing total household consumption, those who have migrated may have more stable incomes and, as a result, be less poor than those who have not migrated. If attrition arises due to either of these causes, resulting estimates will be biased in one direction or another.

There are three possible options that could be followed in this regard (Ward, 2016). First, one could simply treat the data as repeated cross-sections. The limitation of this approach, is that it imposes strong distributional assumptions on the error terms, cannot control for unobservable sources of heterogeneity, and assumes that intertemporal variation in consumption is reasonably proxied by cross-sectional variation. The second approach is to use the unbalanced panel to form pseudo-panels. The third approach is to use a balanced sample of households that appear in each survey wave. Reducing the total sample into a balanced panel requires tradeoffs between the number of households observed and the length of time over which each household is observed.

In order to focus on poverty dynamics and vulnerability to poverty, this study tracked the same households across survey waves to ensure that our aggregated figures were not simply capturing the entry or exit of different households from the sample. This study therefore, restricted our sample to those households who participated in the survey in every wave from 2012 through 2016. This study extracted a balanced sample of 3089 households that remained as survey respondents from 2012 through 2016, yielding 9267 total observations.

A range of explanatory variables are included in the model as our ESS survey data is rich in capturing individual, household and community level variables. A key consideration in selecting from the potential determinants of consumption is to choose variables that are arguably exogenous to current consumption. Thus, the explanatory variables are hypothesized to influence the dependent variable based on theoretical expositions and previous empirical studies (Sen, 2003; Baulch and Dat, 2011).

And hence, a combination of household demographic, socioeconomic and community characteristics are chosen for poverty dynamics analysis. Table 4.1 shows the main variables used in the analysis and their means and standard deviations by survey rounds. These include; age of the household head, a binary variable to capture the household's head status as being female headed (=1), heads ability of reading and writing any language as being literate (=1), the education of the household head, the average education level of household members, the number of dependents (household members younger than 15 and older than 65 years), working age household members, a binary variable capturing whether the household has got social assistance from relatives and friends (=1), household oxen ownership, a binary variable that capture whether the household has access to credit services (=1), income diversification index, distance to main road and market centers in

kilometers (km), a binary variable capturing whether the household is located in lowland (=1), midland (=1) and highland (=1) agro ecology, number of shocks experienced, drought (=1), food price rise (=1), illness (=1). To create our measure of income diversification index, this study applied principal component analysis. This index is based on binary indicators of household's involvement and access of various types of indicators, and are normalized relative to period specific means and standard deviations. The indicators used in constructing income diversification index include household's farming activity, employment activities, self-employment activities, received transfers and earned income from rent.

4.2.2. Consumption Aggregation and Poverty Line Construction

The ESS collects detailed information on a wide variety of topics that can be used for household welfare analysis. One common measure of poverty and wellbeing in developing countries is aggregated household consumption expenditures. Consumption, as opposed to household income, is the common measure of household welfare in Ethiopia. The study used household consumption expenditure as our dependent variable based on the ESS consumption data. The components of ESS household consumption include food and non-food consumption-expenditures (Central Statistical Authority and World Bank 2017)[10]. The components of household consumption include food and non-food consumption-expenditures. Food expenditures include expenses for 25 different food items with a recall period of the last seven days. While the non-food expenditures recall period was either the

[10]Detail descriptions of the ESS consumption generating process and aggregates is available from the Central Statistical Authority and World Bank (2017).

last one month or the last 12 months, depending on the item. Before totaling, all individual consumption expenditure values are expressed in annual terms.

The first step towards constructing a comparable welfare indicator among the household is to normalize the total household consumption expenditure on the basis of household composition. Differences in ages and numbers of members imply that household needs are different such that the same total household consumption may be adequate or inadequate. One of the ways to normalize the consumption is to use the household size. A superior method is to consider the varying needs according to age, sex, and activity status of members. Per-adult household consumption was obtained by first dividing the nominal consumption expenditure by nutritional calorie based adult equivalence family size by age and gender. Second, per-adult consumption expenditure has to be updated by deflating all food and nonfood consumption items by spatial price indices (disaggregated at the reporting level relative to national average prices) and temporal price indices. Hence, to adjust for inflation at the national level and make the values comparable across waves, there is a need to inflate the value of wave 1 consumption to wave 2 levels by a factor of 1.21 as reported in the 2015 annual report of the Central Statistical Agency (Central Statistical Authority, 2015). Then, there is also a need to deflate the value of wave 3 consumption to wave 2 level by the same factor.

For poverty analysis, this study set poverty line based on household consumption expenditure. The construction of poverty line in Ethiopia is based on the cost of 2,200 kcal per day per adult food consumption with an allowance for essential nonfood items by the Ministry of Finance and Economic Development since the 1995/1996 poverty analysis report (MoFED, 2012). The calculation is based on the cost of basic needs method using

the Household Consumption Expenditure Survey (HCES). Based on the 2011 HCES, total poverty lines in 2011 for the country is 3781 Ethiopian birr (ETB) at national average prices. As the consumption modules in the HCES are much more extensive than in ESS, the aggregate consumption values may not be entirely comparable as the ESS survey was not originally designed to accurately measure poverty in the country. This problem is solved by calibrating our poverty line so that the poverty headcount in the data matches the national estimate in 2011, 30 percent (MoFED, 2012). This calibration is made by sorting the population by consumption and selecting the consumption level capturing the 30th percentile in the (weighted) sample as the poverty line. This automatically yields a poverty headcount rate of 30 percent. Therefore, this study then set the poverty line to a value that corresponds to the 30th percentile of total consumption in wave 1, which is 3246 ETB per year per adult equivalent in 2014 terms.

4.2.3. Measurement of Poverty

This study measured household poverty in rural Ethiopia using the consumption expenditure method.

For poverty measure, this study uses the class of the consistent and additively decomposable poverty measures by Foster, Greer and Thorbecke (FGT) (Foster et al., 1984). The FGT index is given by:

$$\boldsymbol{P_{\alpha}} = \frac{\mathbf{1}}{\boldsymbol{N}} \sum_{\boldsymbol{i}=\mathbf{1}}^{\boldsymbol{n}} \left[\frac{\boldsymbol{z}-\boldsymbol{y_i}}{\boldsymbol{z}}\right]^{\boldsymbol{\alpha}} \quad (4.1)$$

where $\boldsymbol{z}$ is the poverty line; $\boldsymbol{y_i}$is the poverty indicator; $\boldsymbol{n}$ is the number of poor people in the population; $\boldsymbol{\alpha}$ is the poverty aversion parameter that takes the values of zero, one or two.

4.2.4. Determinants of Poverty

To assess the determinants of household consumption to explain why households are poor and remain poor over time, the study employed fixed effects model due to its advantage in controlling the unobserved heterogeneities among households over random effect model. It is formulated as:

$$\boldsymbol{lnc_{it} = X_{it}\beta + \alpha_i + \delta_t + \varepsilon_{it}} \quad (4.2)$$

where lnc_{it} is household i's log consumption at period t; X_{it} is a vector of observable time-varying household characteristics, β is a vector of parameters describing the state of the economy at period t, α_i is the unobservable household-specific factors that condition consumption, δ_t is the effects of the passage time, and ε_{it} is a time-varying idiosyncratic (i.e., household-specific) disturbance, presumably capturing unobserved shocks that leads to perturbations of observed consumption from expected consumption.

4.3. Results and Discussions

4.3.1. Descriptive Statistics

Table 4.1 presents the explanatory variables and their corresponding descriptive statistics in terms of their mean and standard deviation that are used in the poverty dynamics and vulnerability to poverty analysis. The dependent variable used as a measure of well-being in this study is the real consumption per adult equivalent in 2014 Tigray region prices. Several household characteristics variables are used in the analysis. The descriptive statistics in table 4.1 shows that the time average age of household head is about 45.5 and around 24% of the sample households are female headed households. With regard to the

status of household heads who are literate (i.e. they can read and write a letter), while similar result with a 37% is observed in the 2012 and 2014 survey rounds, slight progress has been observed in the case of the 2016 survey round to 39%.

With regard to the average number of oxen each sample household owns for farming activity, a slight difference between the three survey rounds is observed with 1.04 in 2012, 0.93 in 2014 and 1.14 in the case of the 2016 survey round. In terms of accessing or getting different services like extension, credit, market services, a great deal of differences have been observed among the sample households (Table 4.1). In this study, the main shock variables included are drought, food price increase and illness as proxies for the happenings of natural, economic and health shocks respectively as well as the number of shocks each households' experience in the previous one year of the study.

Table 4.1. Descriptive statistics of major variables

Variables	2012	2014	2016
Annual household total consumption per adult equivalent) in 2014 real price	6490.6 (7689)	5459 (3929)	4858 (3738.6)
Female headed household (=1)	0.24 (0.42)	0.24 (0.45)	0.23 (0.42)
Age of household head (years)	44.64 (15.6)	46.45 (15.35)	48.12 (15.26)
Literacy status of household head (=1)	0.32 (0.47)	0.32 (0.47)	0.33 (0.47)
Education of household head (grade)	1.67 (3.08)	1.72 (3.11)	1.85 (3.23)
Average education of members	1.63 (2.17)	1.75 (2.10)	1.90 (2.03)
Number of dependents	2.5 (1.73)	3.60 (2.48)	3.90 (2.80)
Number of working members	2.36 (1.29)	2.72 (1.50)	2.85 (1.42)
Social capital (=1)	0.13 (0.34)	0.12 (0.33)	0.12 (0.32)
Number of oxen	0.87 (1.07)	0.91 (1.09)	0.98 (1.26)
Income diversification index	0.86 (0.25)	0.213 (0.31)	0.070 (0.16)
Access to credit services (=1)	0.20 (0.40)	0.20 (0.40)	0.16 (0.37)
Distance to main road in km	17.35 (22.97)	17.12 (22.96)	16.63 (22)
Distance to market center in km	68.4 (50.3)	67.07 (51.44)	67.04 (51)
Lowland agro-ecology (=1)	0.26 (0.44)	0.26 (0.44)	0.25 (0.43)
Midland agro-ecology (=1)	0.53 (0.50)	0.55 (0.50)	0.55 (0.50)
Highland agro-ecology (=1)	0.21 (0.41)	0.19 (0.39)	0.20 (0.41)
Number of shocks experienced	1.51 (2.99)	1.12 (2.63)	1.76 (2.93)
Drought shock experience (=1)	0.16 (0.37)	0.10 (0.30)	0.33 (0.47)
Food price rise experience (=1)	0.25 (0.43)	0.15 (0.35)	0.20 (0.40)
Illness of member (=1)	0.14 (0.35)	0.10 (0.31)	0.22 (0.42)
No. Observations	3356	3196	3089

Source: Author's computation using ESS; 2012, 2014 and 2016.

Note: Standard deviations in parentheses.

As depicted in table 4.1, while about 16% in 2012 and 10% in 2014 survey rounds experience drought shock, a staggering increase has been observed in the case of the 2016 round with 33%. A fluctuating trend has been observed in the case of food price rise with 25%, 15% and 20% during the 2012, 2014 and 2016 survey rounds respectively. Moreover, 14%, 10% and 22% of the sample households reported illness shock in the same waves of the survey respectively. As compared to the three survey rounds, rural households in Ethiopia encountered the highest number of shocks with 1.76 on average in the case of the 2016 survey round (i.e. 2016).

4.3.2. The Prevalence and Dynamic of Poverty

Measures of poverty were calculated using real consumption per adult equivalent as the welfare measure. Table 4.2 presents three poverty measures of the FGT class—the poverty headcount, the poverty gap and the squared poverty gap. The poverty headcount represents the proportion of households falling below the poverty line; the poverty gap represents the proportionate shortfall in consumption from the poverty line averaged over all households; and the squared poverty gap is the squared proportionate shortfall in consumption from the poverty line averaged over all households. The squared poverty gap therefore emphasizes the poverty of those furthest below the poverty line. During 2012–2016 headcount poverty increased from 30% to 43%. The poverty gap and the squared poverty gap follow the same trend as the headcount index with an increase in the three waves.

Table 4.2. Poverty measures

Poverty measures	2012	2014	2016
Headcount	0.30	0.36	0.43
Poverty gap	0.08	0.10	0.17
Squared poverty gap	0.03	0.04	0.07

Note: Values are given as proportion of the population

In consistent with other studies (McCulloch and Calandrino, 2003; Duclos and Araar, 2007), this study used cumulative distribution function (CDF) to examine the sensitivity of our results to the choice of the poverty line. Figure 4.1 shows the CDF of per adult equivalent consumption expenditure for each of the three waves. Whenever the CDF of one wave lies completely above another, the incidence of poverty is higher regardless of the choice of poverty line or of poverty measure (a property known as first-order stochastic dominance)[11]. Figure 4.1 also shows that the CDFs of consumption expenditure for 2012, 2014 and 2016 show a similar pattern of poverty increment. The CDF for consumption expenditure in 2012 lies well below those of 2014 and 2016 as well as the CDF for consumption expenditure in 2014 also lies below those 2016. Therefore, the increase in the incidence of poverty from 2012 to 2014 as well as the increase from 2014 to 2016 is robust both to the choice of poverty line and poverty measure and to the choice of price deflator.

[11] CDF also tests the sensitivity of poverty measures to the choice of price deflators (McCulloch and Calandrino, 2003).

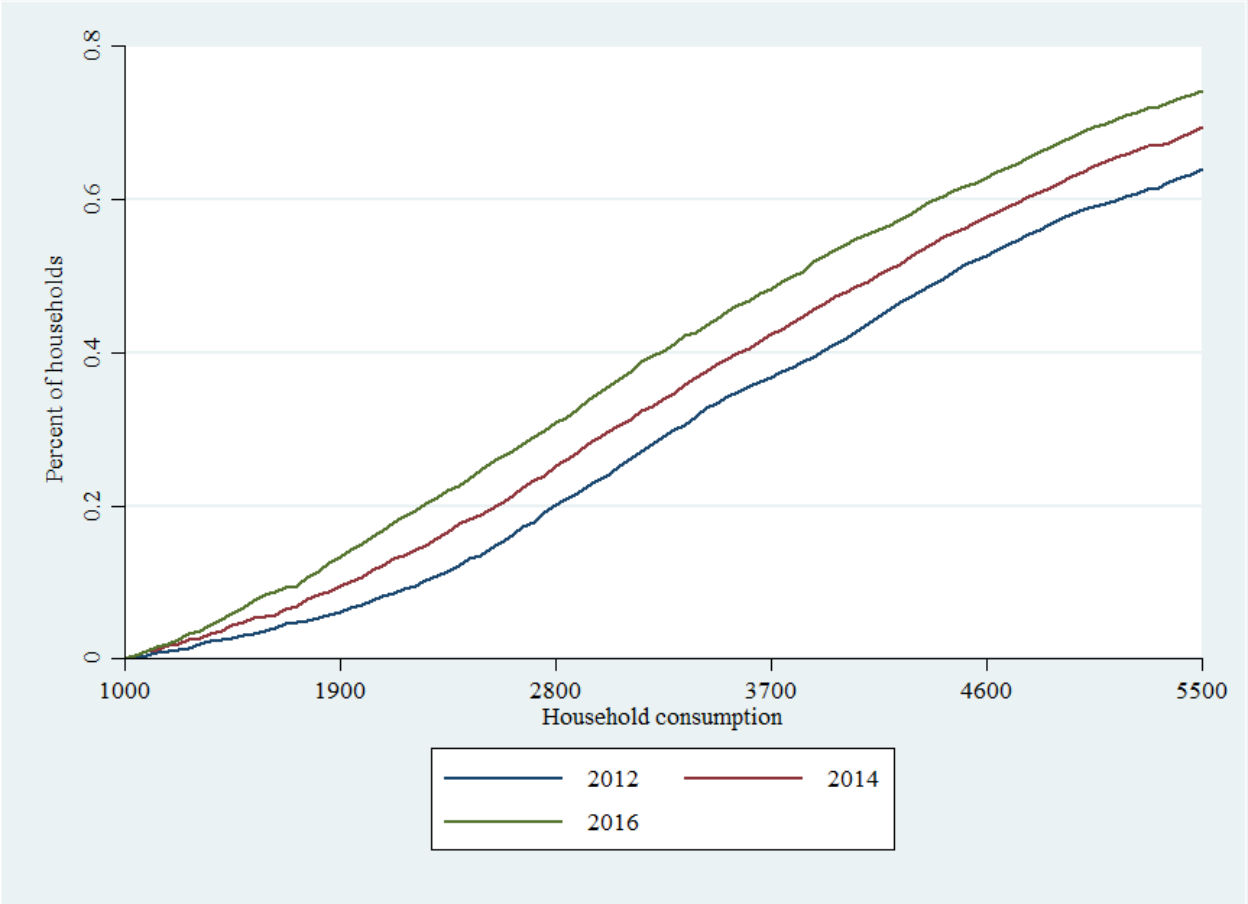

Figure 4.1. Cumulative distribution function of household consumption

Moreover, the three period panel data enable us to show the movement of households in and out of poverty between 2012 and 2016. Table 3 decomposes both poor and non-poor households into two groups, depending on whether their consumption expenditure is below or above the poverty line in the first, second and third year of the survey. The transition matrices in table 3 depicts the number of panel households that were in poverty for two consecutive surveys increased from 12 to 16 percent between 2012–2014 and 2014–2016. The number of households moving out of poverty also increased from 19 percent in 2012–2014 to 20 percent in 2014–2016, while the percentage of households moving into poverty increased from 23 percent to 26 percent over the same period. The consequence of this was a substantial reduction in the number of households who were non- poor in consecutive

years, which declined from 46 percent in 2012-2014 to 38 percent in 2014–2016. Table 3 also shows that over the entire 2012–2016 period, 15 percent of households were poor in both surveys, 17 percent of households moved out of poverty while 27 percent of households moved into poverty, and 41 percent of households were non- poor in both 2012 and 2016. Previous empirical studies indicate that the relatively large numbers of households move into or out of poverty between years, though it is difficult to compare the amount of poverty mobility across countries because of the different time periods and welfare metrics they use (Baulch and Dat, 2011; Dercon and Porter, 2011).

Table 4.3. Poverty transition matrix

		2014		2016	
Poverty status:		Poor	Non-poor	Poor	Non-poor
2012	Poor	0.12	0.19	0.15	0.17
	Non-poor	0.23	0.46	0.27	0.41
2014	Poor			0.16	0.20
	Non-poor			0.26	0.38

Note: Empirical probabilities are computed as sample averages for each of the particular transition categories.

4.3.3. Determinants of household poverty

This section presents the results on the impacts of the explanatory variables on household consumption. Table 4 depicts the results of both fixed and random effects estimation for comparison purposes. The study employed a Hausman test to determine the appropriate model specification, a 113.86 Hausman test statistics indicate a clear rejection of the random effects estimator. Turning to the results, households with educated members are associated with higher level of consumption expenditures. That is educational attainment of the household members show a clear positive impact on consumption per adult equivalent consumption increases by 1.8 per cent with each additional year of schooling.

Table 4.4. Regression results of the determinants of poverty.

Variables	Fixed effects	Random effects
Age of household head	-0.004	-0.002
	(0.003)	(0.002)
Age of household head^2	0.000	0.000
	(0.000)	(0.000)
Female headed household (=1)	-0.013	0.011
	(0.019)	(0.016)
Education of household head	0.010*	0.002
	(0.005)	(0.003)
Average education of members	0.016***	0.010**
	(0.005)	(0.005)
Number of dependents	-0.006**	0.000
	(0.004)	(0.003)
Number of working age members	0.006	0.006
	(0.006)	(0.005)
Social capital (=1)	0.016	0.030
	(0.023)	(0.020)
Income diversification index	0.183***	0.171***
	(0.018)	(0.016)
Access to credit (=yes)	0.025	-0.007
	(0.021)	(0.017)
Number of oxen	-0.020	-0.010
	(0.006)	(0.006)
Distance to main road in km	0.001	0.001**
	(0.000)	(0.000)
Distance to market center in km	-0.001***	-0.002***
	(0.000)	(0.000)
Lowland agro-ecology (=1)	-0.061***	0.014
	(0.026)	(0.020)
Midland agro-ecology (=1)	0.020	0.008
	(0.021)	(0.017)
Time dummies [Base year=2012]		
Y2014	-0.090***	
	(0.027)	
Y2016	-0.203***	
	(0.031)	
Constant	8.569***	8.456***
	(0.079)	(0.064)
F (18, N)	18.97	
Pro > F	0.000	
Total Observations (N)	9,640	9,640

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Again, households having higher number of dependents face declining consumption expenditure in real terms as well as a decreasing trend for households who have better access to services. This result is consistent with what most empirical literatures witness. From the results of the regression, income diversification is found to have a positive impact with 1 per cent level of significance, which indicates the vital role of diversified income sources. Most of the empirical results reported here correspond to the outcomes of the foregoing descriptive statistics.

Overall, the result from the fixed effect model helps to understand two important points. First, it helps to understand the variables that condition or symptomatic to household consumption. Second, as the expected household consumption relative to the poverty line is our measure of vulnerability to poverty, understanding how these variables influence consumption may have some direct implication for how these variables influence vulnerability. Thus, this result can be considered as our hypothesis test in order to compare the determinants of poverty and vulnerability to poverty to the outcomes of the subsequent analysis.

4.4. Summary

This chapter described the prevalence of household poverty as well as investigates the determinants of poverty in rural Ethiopia. The three period panel data also show a great deal of household movement into and out of poverty between 2012 and 2016. Over the entire 2012–2016 period, 12.5 percent of households were poor in both surveys, 18.5 percent of households moved out of poverty while 24 percent of households moved into poverty, and 45 percent of households were non poor in both 2012 and 2016. The result

from the fixed effect model revealed different household and community characteristics variables for such households' movement into and out of poverty between 2012 and 2016.

Chapter 5. Household Vulnerability to Poverty in Rural Ethiopia

5.1. Introduction

Ethiopia, like many countries in Sub-Sahara Africa continue to experience high levels of poverty. The deep rooted poverty in Ethiopia (see Chapter 4) are indications that static and dynamic anti-poverty programs are not sufficient in moving the majority of the rural population out of the trap of poverty. There is now a growing consensus in poverty literature that policies aimed at reducing the levels of poverty should not only be based on static and dynamic *ex-post* measures of poverty but also on *ex-ante* poverty measures in order to account the proportion of the population who are currently non-poor but may be poor in the near future in poverty alleviation and/or reduction programs (Chaudhuri et al., 2002; Klasen and Waibel, 2013). Therefore, such an *ex-ante* poverty measurement is fundamental for policymakers and practitioners in order to design appropriate poverty reduction strategies that address the risk of poverty in a forward-looking way. This is the entry point for vulnerability assessments that shifts the attention from *ex-post* poverty outcomes to *ex-ante* poverty risks by trying to identify the types of households with highest future poverty risks.

Therefore, this chapter aims at estimating household vulnerability to poverty and investigate its determining factors in rural Ethiopia using a unique three period panel data sets. It endeavors to determine how vulnerable households are, and identify the characteristics of these households. The chapter proceeds as follows: section 5.2 outlines the data and method of vulnerability to poverty measurement. Section 5.3 provides results from the econometric regression results. This section further provides a profile of

vulnerability and poverty decompositions by regional states and household characteristics across survey rounds. Section 5.4 offers the summary of the chapter.

5.2. Data and Methodology

5.2.1. Data

The data that form the empirical analysis of this objective is the data used in chapter 4 except the dropping of some explanatory variables. All explanatory variables in section 4.2.1 are used for this objective except number of shocks experienced, drought (=1), food price rise (=1), illness (=1). The dependent variable of this study is real annual household consumption in adult equivalent terms. Its components and aggregation process is as explained in section 4.2.2.

5.2.2. Methodology

The measurement of vulnerability of at best requires a panel data of sufficient length and sample size that includes detail information on the shocks and risks which rural households in particular are facing (Calvo and Dercon, 2005; Klasen and Waibel, 2013). This study uses a unique three waves panel data sets from a nationally and regionally representative data sets. Vulnerability is estimated as expected poverty to determine the probability that a household would find itself consumption poor in the future by taking household consumption per adult equivalent as a proxy measure of poverty. The vulnerability level of a household at time t (time is measured in year in our case) is defined as the probability that the household will find itself consumption poor in the next time;

$$\boldsymbol{V_{it} = Pr\left(c_{i,t+2} \leq z\right)} \quad \textbf{(}5.1\textbf{)}$$

where V_{it} is vulnerability of household i at time t; $c_{i,t+2}$is the consumption level of the ith household at time t+2, and z is the poverty line. That means, the level of vulnerability at

time t is defined in terms of the household's consumption prospects at time t + 2 in this study.

Following Chaudhuri et al. (2002), our consumption function is expressed as:

$$\boldsymbol{lnc_i = X_i\beta + e_i} \qquad (5.2)$$

where lnc_i is per adult equivalent consumption expenditure for the i^{th} household, X_i represents a bundle of observable household characteristics and other determinants of consumption. This study does not include observable idiosyncratic and covariate shocks in generating vulnerability estimates based on the review relevant literature. Incorporating few shocks may lead to may lead to econometric problem of omitted variable bias and the overestimation of the impacts of selected shocks on households' vulnerability to poverty (Günther and Harttgen 2009; Ward 2016; Azeem et al. 2016). β is a vector of coefficients of household characteristics, and e_i is a mean-zero disturbance term that captures idiosyncratic shocks to household consumption. The error term is assumed to be heteroscedastic in order to measure the variance in consumption using a short panel dataset. As ordinary least square method assumes homoscedastic, this study applied three step Feasible Generalized Least Square (FGLS) method is used for our vulnerability measure suggested by Amemiya (1977).

The variance of the disturbance term depends on:

$$\boldsymbol{\sigma^2_{e,i} = X_i\theta} \qquad (5.3)$$

The estimates of β and θ are obtained using a three-step feasible generalized least squares (FGLS). Using the estimates $\hat{\beta}$ and $\hat{\theta}$, the study compute the expected log consumption and the variance of log consumption for each household as follows:

$$\boldsymbol{E[lnc_i/X_i] = X_i\widehat{\beta}} \quad (5.4)$$

$$\boldsymbol{V[lnc_i/X_i] = X_i\widehat{\theta}} \quad (5.5)$$

By assuming $\ln c_i$ as normally distributed and letting Φ (.) denote the cumulative density function of the standard normal distribution, the estimated probability that a household will be poor in the future (in this case, at time t +2) is given by:

$$\boldsymbol{\widehat{V}_{ht} = \widehat{Pr}(lnc_i < lnz/X_i) = \Phi\left(\frac{lnz - X_i\widehat{\beta}}{\sqrt{X_i\widehat{\theta}}}\right)} \quad (5.6)$$

Moreover, a clear minimum threshold above which a household is qualified to be vulnerable is needed for targeting development program and/or for understanding how vulnerable households' respond to the inherent shocks and risk they face. The most commonly applied threshold in the vulnerability literature is a probability of poverty of 0.5, implying households with at least 50% risk of poverty are considered to be vulnerable (Pritchett et al. 2000; Chaudhuri et al. 2002). The use of 0.5 threshold is defended as it defines the point in equation (5) where expected consumption exactly equals the poverty line and a 50/50 risk of falling into poverty seems a reasonable threshold to delineate the vulnerable from those not vulnerable (Klasen and Waibel 2013). In consistent with many of the empirical studies, the study used the following equation as given in del Ninno et al. (2006) and Azeem et al. (2016) to arrive at the estimated vulnerability threshold for future year (s):

$$\boldsymbol{v^* = 1 - \sqrt[n]{1 - v_n}} \quad (5.7)$$

where v^* denote the estimated vulnerability threshold that the actual number used in estimating vulnerability, v_n is the benchmark threshold (for instance 0.5), and n is the future number of years. Given 0.50 as a benchmark threshold, the value of v for the next

one year, two years, and three years are 0.50, 0.29, and 0.20, respectively. In consistent with other studies (Echevin, 2013; Azeem et al., 2016), this study set 0.29 as its vulnerability threshold, i.e., households with at least 29% risk of poverty are considered to be vulnerable.

5.3. Results and Discussion

Here, this study presents the result of the analysis of vulnerability to poverty of households in rural Ethiopia. Then discussed the determinants of household vulnerability to poverty, and decompose the incidence of poverty and vulnerability across major regions and some household characteristics.

5.3.1. Measuring Vulnerability to Poverty

The section presents the determinants of *ex-ante* mean and variance of future consumption that are used in the estimation of household vulnerability to poverty. The results presented in Table 5.2 is the *ex-ante* mean and variance of consumption for the pooled data. The coefficients of the age of head and its square are highly significant with the *ex-ante* mean and variance of consumption, thereby reducing overall vulnerability. This finding corroborate other research in rural Ethiopia (Tsehay et al., 2012) and elsewhere (Azeem et al. 2016).

The coefficients for female headship are negative and significant with *ex-ante* variance, implying that female headed households are associated with household vulnerability, i.e., higher probability of future poverty as compared to male headed households. In terms of education of the household head, the result show that a household head with education positively affects *ex-ante* average consumption (at a 1% significance level) thereby

reducing vulnerability. The results of this variable and households with educated members imply in reducing overall vulnerability. Similar results are found in Ethiopia (Dercon and Porter 2011; Abrham and Bauer 2012; Birhan and Tesfahun 2017) and elsewhere (Makoka 2008).

The statistically significant coefficient of the number of dependents for *ex-ante* variance imply the lower is its vulnerability. This may be due to household's usage of children labor force. In Ethiopia, despite household members aged lower than 15 years and above 65 years are considered as dependents (MoFED, 2012) children aged between 7-15 years contribute for the household by keeping livestock and doing lighter works. Furthermore, income diversification enhances average consumption and decreases the variance of future consumption at a 1% significance level suggesting diversified income sources not only reduce poverty but also the probability of future poverty.

Despite indications of limited or insignificant role for vulnerability to poverty reduction in existing empirical researches (Birhan and Tesfahun, 2017; Hill and Porter, 2017; Tsehay et al., 2012), it can be seen that different community variables that are included in this study to account for unique unobserved characteristics have different effects on the *ex-ante* mean and variance of future household consumption. Access to credit services is statistically significant at 1% for the mean and variance of future consumption with an overall effect of increasing household vulnerability. This result is against our expectation and what most empirical literatures witness.

Table 5.1. Determinants of vulnerability to poverty

VARIABLES	*Ex-ante* average consumption	*Ex-ante* variance of consumption
Age of household head	-0.0030***	-0.0007***
	(0.0003)	(0.0002)
Age of household head^2	0.0000***	0.0000***
	(0.0000)	(0.0000)
Female headed household (=1)	0.0094***	0.0041***
	(0.0021)	(0.0014)
Education of household head	0.0013***	0.0004
	(0.0004)	(0.0003)
Average education of members	0.0096***	0.0045***
	(0.0006)	(0.0004)
Number of dependents	0.0004	-0.0031***
	(0.0004)	(0.0003)
Number of working age members	0.0057***	-0.0040***
	(0.0007)	(0.0004)
Social capital (=1)	0.0276***	0.0011
	(0.0027)	(0.0018)
Income diversification index	0.1615***	0.1464***
	(0.0022)	(0.0015)
Access to credit (=yes)	-0.0053**	-0.0042***
	(0.0023)	(0.0015)
Number of oxen	-0.0092***	0.0011**
	(0.0008)	(0.0005)
Distance to main road in km	0.0008***	-0.0003***
	(0.0000)	(0.0000)
Distance to market center in km	-0.0017***	0.0005***
	(0.0000)	(0.0000)
Lowland agro-ecology (=1)	-0.0169***	-0.0065***
	(0.0022)	(0.0015)
Midland agro-ecology (=1)	-0.0217***	-0.0133***
	(0.0027)	(0.0018)
Constant	8.5035***	0.4363***
	(0.0086)	(0.0057)
Observations	9,640	9,640
R-squared	0.646	0.589

Source: Author's computation using ESS; 2012, 2014 and 2016.
Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

It is important to note that vulnerability is a function of the expected mean and variance of household consumption. The mean of expected consumption is determined by household and community characteristics while the variance of expected consumption is determined

by the occurrence and impacts of covariate and idiosyncratic shocks (Günther and Harttgen 2009). This study therefore, concluded that vulnerability to poverty is both a function of low expected mean of household consumption as well as the high volatility in the expected variance of household consumptions. Moreover, the study estimated the average probabilities that a rural household will fall into poverty by regional states and survey rounds. The result indicated that vulnerability to poverty varies over time and space. Figure 5.1 depicts that at national level and in the five regions namely Amhara, Oromia, SNNP, Tigray and Others, vulnerability is either slightly increasing or remaining flat from one survey round to the next. Moreover, the sample households in SNNP region has the highest average level of vulnerability in the 2014 and 2016 survey rounds.

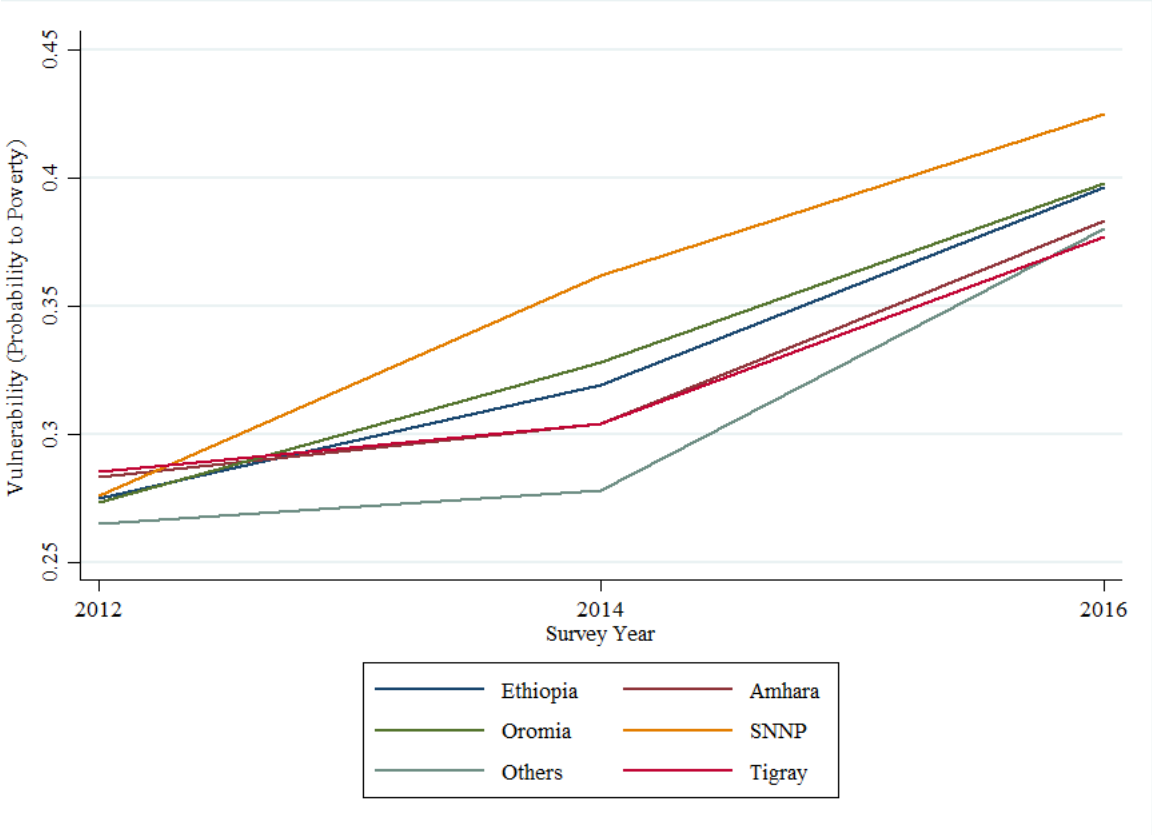

Figure 5.1. Vulnerability to poverty by region and survey round

5.3.2. Vulnerability and Poverty Decompositions

The purpose of categorizing poor and vulnerable households is to investigate the magnitude and causes of *ex-post* poverty and vulnerability to poverty among the heterogeneous groups of households. This is helpful in designing anti-vulnerability policies for diverse groups of households and regions. Following Chaudhuri et al. (2002) and Makoka (2008), this study decomposed each survey round poverty and vulnerability across Ethiopia, its major regions and different household characteristics as depicted in Table 5.3.

When the study compared the incidence of poverty across survey rounds, the observed poverty in 2016 with 43% is higher as compared to the 36% in 2014 and 30% in 2012 at national level. The vulnerability rate also follows somewhat in an increasing pattern with 50%, 59%, and 62.4% in 2012, 2014 and 2016 respectively. The regional distribution of observed poverty profile shows that Amhara and SNNP are the poorest regions in all survey rounds. In Amhara the proportion of poor during the three survey rounds reveal about 42.5% (2012), 44% (2014) and 51.5% (2016), while case in SNNP show 35.5% (2012), 48% (2014) and 59.2% (2016). The least poor regions are Tigray and Oromia regions. It is 63% (2012), 55% (2014), 72.7% (2016) in Amhara and 51.6% (2012), 77.4% (2014), 64.3% (2016) in SNNP. And almost a similar pattern emerges in the remaining regions indicating the incidence of poverty is lower than vulnerability across regions and survey rounds. Overall, the result indicates substantial regional poverty and vulnerability disparities across survey rounds. Further classifications of poverty and vulnerability profiles based on several household characteristics shows that vulnerability to poverty rates is substantially higher than poverty rates across survey rounds.

Table 5.2. Poverty and vulnerability decomposition by survey rounds

	2012		2014		2016	
	Poor	Vulnerable	Poor	Vulnerable	Poor	Vulnerable
National	30	50	36	59	43	62.4
Regions						
Amhara	42.5	63	44	55	51.5	72.7
Oromia	17	47	25.2	61	29	51.5
SNNP	35.5	51.6	48	77.4	59.2	64.3
Tigray	28	64.4	28.4	62.6	42.6	60.2
Others	33.5	31	37.2	34.2	46	60.2
Sex of head						
Male	29.4	46.3	35.4	60.2	43.7	62.4
Female	32	62	37	54.4	39.5	62.3
Literacy status of head						
Literate	30.5	31	37	62.4	45.2	62.2
Illiterate	30	59	33.3	57	41.7	62.5
Head's age category in years						
< 30	29.4	50.3	41	56	47	63
30-64	25.5	48.5	33.3	57	44	62.4
> 64	37.4	56	41.4	70.5	36	61.5
Agro ecological location						
Lowland	30	44.6	41.6	54.8	59	69
Midland	32	52.3	36.3	61.5	42.4	63.5
Highland	21	44.4	25.6	49.7	31	49.3

Source: Author's computation using ESS; 2012, 2014 and 2016.

Similar to other findings (Chaudhuri et al. 2002; Birhan and Tesfahun 2017), this study revealed two important points. First, in keeping with our findings, the estimated incidence of vulnerability is at least as high and in most cases higher than the observed incidence of poverty in each survey round. Second, a similar pattern also emerged when poverty and vulnerability profiled across regional levels and different household characteristics in Ethiopia. Regions with high poverty rates also have high vulnerability to poverty rates. In all regional states, vulnerability headcount is much higher than poverty headcount. Moreover, vulnerability is more than a predictor of poverty. The vulnerability rate in 2012 is higher than the poverty rate in 2014 as well as vulnerability rate in 2014 is higher than the poverty rate in 2016.

The study also checked the robustness of our results to the chosen vulnerability threshold (keeping the poverty line of 3246 Ethiopian Birr constant) and to the chosen poverty line (keeping the vulnerability threshold of 0.29 constant) as depicted in figure 5.2 and 5.3. Figure 5.2 depicts the estimated aggregate distribution of vulnerability for the three waves, which plots the incidence of vulnerability at vulnerability thresholds ranging from 0 to 1, for the whole sample as well as by observed poverty status. As the vulnerability threshold increases, the incidence of vulnerability declines. Thus, at a threshold of zero, everyone is vulnerable while no one is vulnerable at the threshold of one. As expected, for any given threshold, the incidence of vulnerability is higher for the poor than for the whole population, which in turn is higher than the incidence of vulnerability amongst the non-poor. More importantly, figure 5.2 suggests that for a wide range of thresholds, poverty and vulnerability are somewhat different from each other in the case of 2014 and 2016 than 2012.

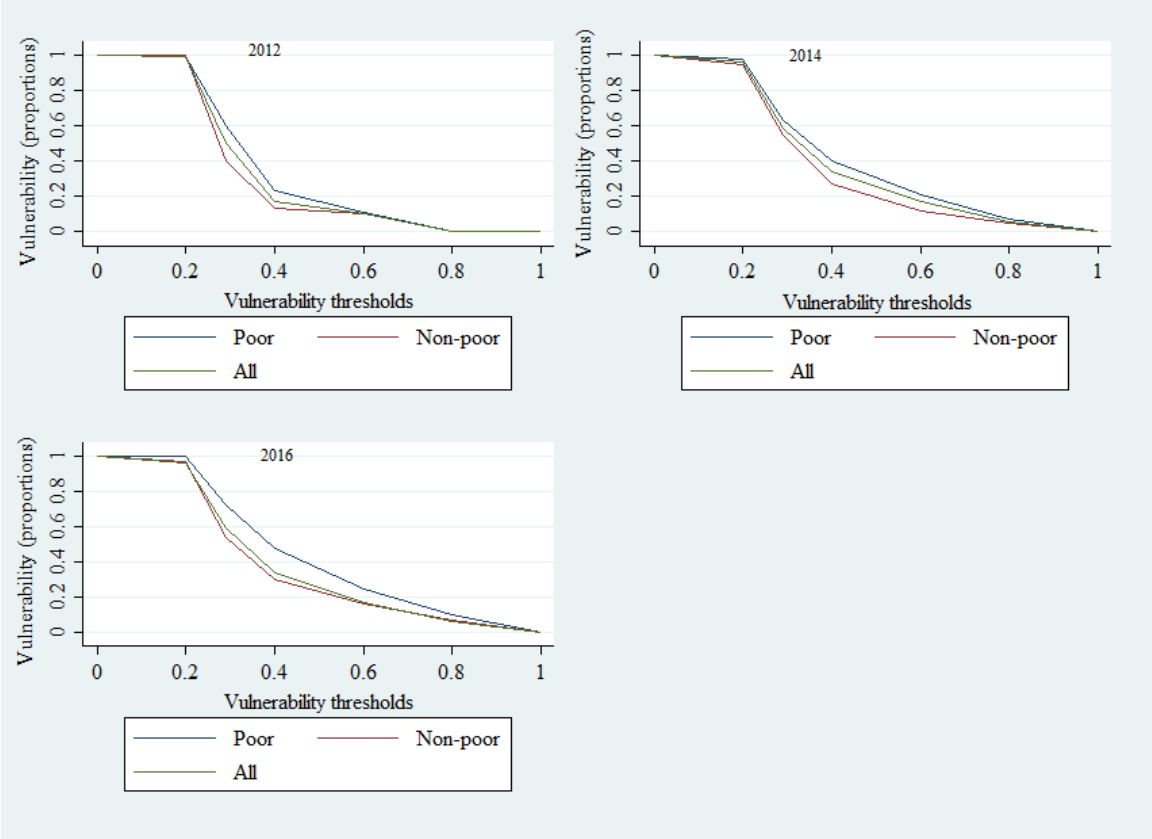

Figure 5.2. Robustness of vulnerability estimates for several vulnerability thresholds

Figure 5.3 also indicates the robustness of vulnerability estimates over several poverty lines. This study used four poverty lines ranging from 10% below to 10% above our poverty line, for the whole sample and by poverty status for the stated poverty lines-along the horizontal axis for 2012, 2014 and 2016. As poverty line increases, vulnerability rate between the whole sample and poverty status is narrow in the case of 2012 than 2014 and 2016. In general, the overall vulnerability rate increases with lower vulnerability thresholds and higher poverty lines and decreases with higher vulnerability thresholds and lower poverty lines.

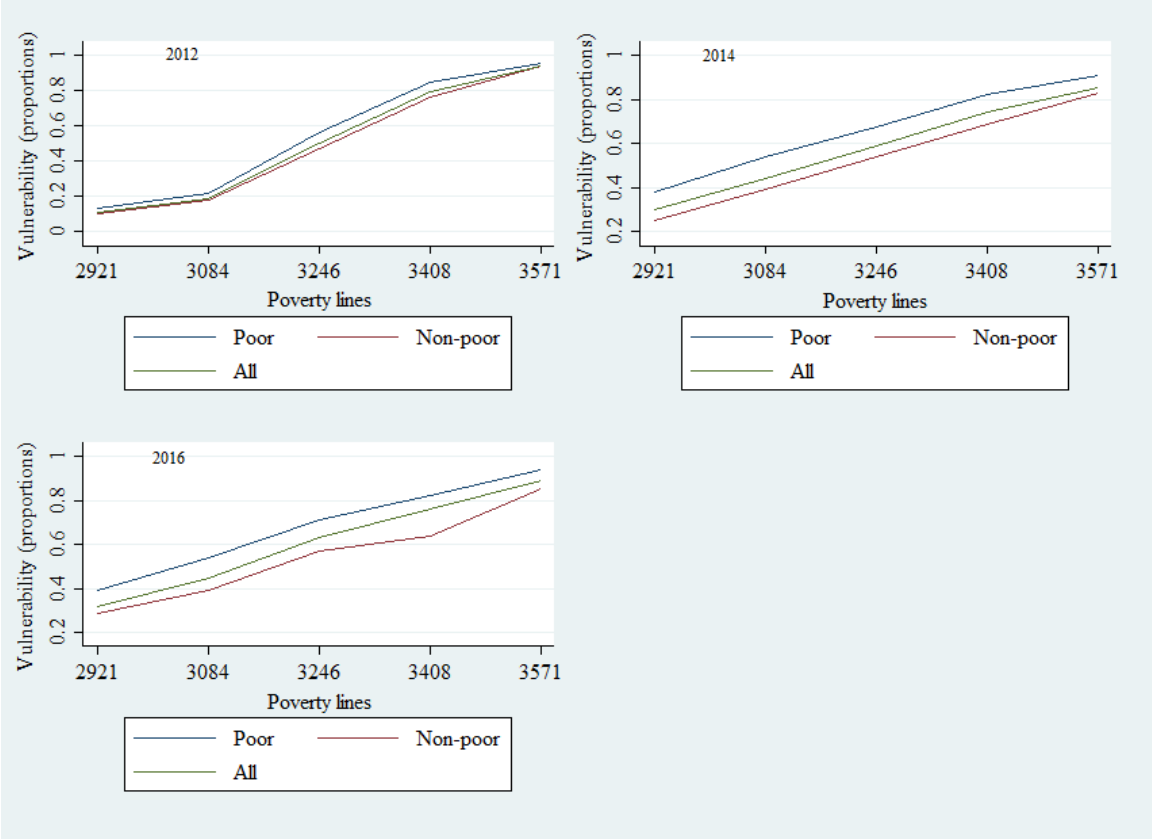

Figure 5.3. Robustness of vulnerability estimates for several poverty lines

5.4. Summary

This chapter analyzed vulnerability to poverty in rural Ethiopia using three period ESS panel data sets. Vulnerability is quantified as the probability that household consumption will fall below the poverty line using three step FGLS model. Our results during the study periods suggest that, while poverty and vulnerability are closely corresponding and overlap to some extent, they are distinct concepts. In other words, not all the poor are vulnerable, while a significant proportion of the non-poor are vulnerable. This study found the following major results: 1) poverty and vulnerability are still prevalent in rural Ethiopia during the study period from 2012 to 2016; 2) regional disparity of poverty and vulnerability is substantial across the period.

Chapter 6. Household Resilience Capacity in Rural Ethiopia

6.1. Introduction

Like many households in developing countries, rural households in Ethiopia are exposed to numerous risks and shocks. Most of these risks and shocks have irreversible adverse consequences on people's lives, affecting their well-being and possibly driving them deeper into poverty. And a growing body of evidence has pointed that shocks have a debilitating impact on households current and future wellbeing in developing countries (Jalan and Ravallion, 1999; Dercon et al., 2005; Heltberg et al., 2014).

In Ethiopia, poverty continues to prevail especially in rural areas where households face high risk of falling into poverty in the future due various risks and shocks attributed to their dependence on rain-fed agriculture and other structural factors (Dercon et al., 2005; Carter et al., 2007; Porter, 2012; Hill and Porter, 2017). The result of this study to some extent complements the high and increasing vulnerability of rural households to poverty as shown in chapter 5 of this dissertation.

There is a growing consensus on vulnerability literature, the vulnerability of households depends not only on their exposure to those shocks, but also on their resilience capacity (FAO, 2013). And currently household resilience holds particular appeal to the idea of people being able to endure shocks and bounce back. Recently resilience has emerged as a concept that could help academics and practitioners to better understand the links between shocks, responses and development outcomes (Constas et al., 2014). "Resilience offers a lens with which to explore stressors and shocks and to understand livelihood dynamics" (Marschke and Berkes, 2006, p. 2).

As such resilience thinking is now becoming a central component in the planning and implementation of interventions in many sectors like humanitarian interventions (DFID, 2011), disaster risk reduction (Klein et al., 2003), climate change adaptation (Boyd et al., 2008), social protection and food security and nutrition (Constas et al., 2014). Therefore, understanding households' resilience capacity would help decision makers to design a forward looking policy against ill-being outcomes (for example poverty in this case).

Resilience has been recognized to be multi-scale, context and shock specific, and highly dynamic characteristics that make it hard to measure through simple proxies (Alinovi et al., 2008; Béné et al., 2012; FAO, 2013). In addition, improving our understanding of the factors that affect household's resilience requires more than just the development and field testing of robust and measurable indices of resilience. As with the rapidly growing literature on resilience to food insecurity and poverty, better insights are needed into the social, institutional and economic mechanisms that make people vulnerable and the contextual factors that influence individual and collective capacity to respond to shocks and stressors (Alinovi et al., 2008; Martin-Breen and Anderies, 2011; Romano et al., 2014). This in turn requires a better understanding of knowledge, perceptions and motivations of households in order to identify factors that influence behavior and decisions (Constas et al., 2014; Quinlan et al., 2015).

Therefore, resilience should be understood in such a context, and as a multidimensional concept that incorporate several dimensions (FAO, 2013, 2016). That means, there is a possibility of adopting the resilience concept developed within the environmental context to the poverty reduction domain, and apply a methodology for measuring household resilience capacity as a solid basis for vulnerability analysis. It is against this background

that this study sets out to determine quantitatively the magnitudes and patterns of households' resilience capacity and its dimensions in rural Ethiopia.

The reminder of this chapter is organized as follows: Sections 6.2 and 6.3 unfold the data used and the empirical regression models used for analysis respectively. Section 6.4 addresses the results and discussions; descriptive statistics of observed variables of dimensions of resilience capacity, the factor loadings and correlation of observed variables of the dimensions of resilience capacity using factor analysis, measure household resilience capacity using a multivariate structural equation modeling and household resilience profiles across different characteristics. Section 6.5 offers the summary of the chapter.

6.2. Data

The data that form the empirical analysis of this objective is the rural category of the ESS. Taking the advantage of the available ESS panel data, the study made resilience capacity analysis for each survey rounds and compare overall household resilience capacity and its dimensions. Unlike our focus on poverty dynamics and vulnerability to poverty, this study aims to compare the household resilience capacity and its dimensions across survey waves. In doing so, this study analyzes the data of 3323, 3196 and 3089 rural households during the first, second and third survey rounds respectively.

On the basis of theoretical and empirical knowledge from the existing resilience studies (e.g. Alinovi et al., 2009; 2010; FAO, 2013; 2016), a range of resilience variables were included in the model as our ESS survey data is rich in capturing individual, household and community level variables. In consistent with the recent study of FAO (2016), this study has four dimensions of resilience capacity− access to basic services (ABS), adaptive

capacity (AC), Assets (ASS) and social safety nets (SSN). Table 6.1 presents the observed variables of each dimensions of resilience capacity that are used in resilience analysis with their expected effects on these dimensions and hence, overall resilience.

Recognizing the vital role of ABS dimension for household resilience capacity (Dercon et al., 2004; Frankenberger et al., 2013), the study take five available variables that are associated with accessing basic services: households access to credit, health, extension services and household' residence distance to the district town. Except the variable town, all of the ABS variables have categorical scales. While the study hypothesizes access to credit, health and extension services to associate positively with ABS, household's residence distance from the district town to correspond negatively with ABS.

There is an argument of ecological and economic systems as non-linear and adaptive (Levin et al., 1998) and the need to account adaptive capacity as a resilience capacity dimension (Smith and Frankenberger, 2017). As FAO (2016), adaptive capacity represents household ability to adapt to the changing environment in which it operates. Therefore, four observed variables are used namely the diversification of households' income sources[12], diversification of livestock reared by the household[13], diversification of crops grown in the households' agricultural land[14] and the literacy status of the household head.

[12] Income diversification index is created through factor analysis. A list of variables assumes value 1 or 0 is used, depending on whether or not a household has been involved in farming activity; employment activities; self-employment activities; received transfers and earned income from rent.

[13] Livestock diversifications is also created through factor analysis. A list of variables assumes value 1 or 0 is used, depending on whether or not a household has been involved in rearing cattle, shoats, donkey/mule/horse and camels.

[14] Crop diversifications is created through factor analysis. A list of variables assumes value 1 or 0 is used, depending on whether or not a household has been involved in planting barely, beans, *chat*, coffee, *enset*, maize, sorghum, *teff*, and wheat in their agricultural field in the past cropping season.

All of these variables have continuous scales except the literacy of the household head ‘liter; as a categorical variable.

Assets are important dimensions of resilience capacity since they can be used by households to increase income and buffer themselves against shock impacts (Zimmerman and Carter, 2003; Barrett and Carter, 2005; Hoddinott, 2006). As a result, assets should be part of the resilience capacity dimension. The ASS dimension of resilience capacity used three observed indicators, per capita size of agricultural land measured in hectare and the number of livestock the household owns measure in tropical livestock unit (TLU)[15] to represent productive assets as well as the wealth index[16] in the case of the non-productive assets. All the three variables are in continuous scale. In accordance with the literature (Alinovi et al., 2010; FAO, 2016) and the context of rural Ethiopia, the study anticipates that the size and activities of wealth, land and livestock are positively related to the ASS and hence overall resilience capacity.

Access to transfers, whether cash or in-kind, represents a major source of poverty alleviation in many developing countries and make up a substantial portion of poor households’ annual income, providing important cash to generate additional income (FAO, 2013). In this study two indicators, namely formal and informal transfer of money to the household in the past twelve months represent the SSN dimension of resilience capacity.

[15] TLU standardizes different types of livestock into a single unit of measurement. The conversion factor adopted is: 1 camel; 0.7 cattle; 0.55 donkeys /mules/horses; 0.1 shoats.

[16] wealth index is also created through factor analysis. A list of variables assumes value 1 or 0 is used, depending on whether or not a household has specific non-productive assets, such as a *gabi* bed clock phone radio *mofer machid* plough axe.

These observed variables comprise all transfers received by the household in Ethiopian birr (ETB) in the past twelve months in per capita.

Table 6.1. Explanatory variables and expected effects on resilience

Resilience Capacity Dimensions	Variable description	Expected effect on resilience
ABS	Access to credit services (=1)	+
	Access to health services (=1)	+
	Access to market services (=1)	+
	Access to extension services (=1)	+
	Distance to nearest district town in kilometers	-
AC	Income diversification index	+
	Livestock diversification index	+
	Crop diversification index	+
	Ability to read and write (=1)	+
ASS	Wealth index	+
	Size of agricultural land measured in hectare	+
	Livestock number in TLU per capita	+
SSN	Cash transfers per capita from formal source	+
	cash transfers per capita from informal sources	+

Source: Author's illustrations using ESS; 2012, 2014 and 2016.
Note: + = positive relationship; - = negative relationship

6.3. Analytical Model

In this study, household resilience capacity is an index constructed as a latent variable in accordance with prior applications in the field and latest literature reviews (Alinovi et al., 2009; FAO, 2013, 2016). The overall household resilience capacity and its dimensions are estimated through multivariate statistical techniques in a two-step procedure by using factor analysis (FA) and structural equation modeling (SEM).

In the first step, the dimensions of resilience capacity are estimated through FA from observed variables. The procedure allows for the reduction of the set of variables used as proxy indicators for the latent variable, as a single variable, the dimension of interest. FA

is used to estimate a construct that is not directly observed, i.e., dimensions of resilience capacity (Bollen, 2002).

As Bollen (2002), the basic idea of a latent variable approach is that "there are one or more latent variables that create the association between unobserved variables" (Bollen, 2002, p. 609). A formal expression of this idea is as follows:

$$\boldsymbol{\gamma_i = \lambda_0 + \lambda_1 \varepsilon_{i1} + \lambda_2 \varepsilon_{i2} + \cdots + \lambda_k \varepsilon_{ik} + u_i} \quad (6.1)$$

Where;

γ_i = observed indicator for the i^{th} case

λ_0 = intercept term

$\varepsilon_{i1} \ldots \varepsilon_{ik}$ = factor loading for the 1^{st} through k case

u_i= unique variable or error term

In the second step, SEM is employed to predict a latent outcome, namely household resilience capacity index (RCI) based on the four dimensions estimated above. That means, the dimensions of resilience capacity are combined to arrive at the overall composite resilience index. The combined scores of RCI can be expressed in the equation as follows:

$$\boldsymbol{RCI_{i,t} = f\left(ABS_{i,t} AC_{i,t} ASS_{i,t} SSN_{i,t}\right) + \varepsilon_{i,t}} \quad (6.2)$$

Resilience index of i^{th} household depends on the level of ABS, AC. ASS and SSN at time t, plus the error term.

SEM method requires a greater computational effort than FA, as it allows for model calibration until the satisfactory level of goodness-of-fitting is achieved (Acock and others, 2013). Overall, applying SEM has the advantage of identifying the direct and indirect effects, the possibility to have multiple indicators explaining the latent variable and the measurement error inclusion in the model (Acock and others, 2013).

6.4. Results and Discussions

Here, this study presents the results of households' overall resilience capacity and its dimensions in the context of rural Ethiopia. It first presents the descriptive statistics of the observed variables as well as the importance of each resilience capacity dimension from FA estimation. Then it discussed the state of households' overall resilience capacity from SEM followed by a resilience capacity profile by regional states and household characteristics across survey rounds.

6.4.1. Descriptive Statistics

Table 6.2 presents the descriptive statistics (mean and standard deviations) of the observed variables of dimensions of resilience capacity that are used in this analysis. The descriptive statistics of the observed variables of the ABS resilience dimension in table 6.1 shows that about 87%, 89% and 90% of the sample household have access to health services in their *kebele* in 2012, 2014 and 2016 respectively indicating an improvement in accessing health services. And about 44%, 53% and 54% of household also reported they have access to market services in their *kebeles* in the 2012, 2014 and 2016 survey rounds respectively.

In the case of access to credit, the proportion of household with access to credit is similar in both survey rounds with a 19% each with declining rate by 4% in 2016. Overall, there is an increase in the proportion of households who have access to basic services which indicate its importance for households' resilience capacity. The descriptive statistics of the observed variables of the AC resilience dimension also show their importance for household resilience (Table 6.2). Diversification of livelihood strategies are found to be crucial to enhance the AC dimension of household resilience. Access to income diversification opportunities is necessary to stabilize income flows and consumption,

especially in the presence of weak financial systems. Non-farm sources of income augment farm income and enhance savings under normal circumstance. In addition to agricultural income, income diversification activities in this study include non-farm business activities, wage work and earning remittances.

The aggregate income diversification index revealed great difference across survey rounds with declining rate i.e. from 0.86 in 2012 to 0.07 in 2016. This may be because during the 2016 survey round Ethiopia experienced the worst drought in decades which affected all sorts of income sources. This can be observed by the variation in income diversification index (Table 6.2). However, in terms of diversifying crop and livestock varieties, the result shows an increasing trend. This is mainly because rural household in Ethiopia tend to growing a mix of basic crops and keeping at least some livestock due to the risky nature of their production system.

Furthermore, educational level of the household head is thought to influence the return to family labor. Households headed by literate heads are thus expected to have better resilience capacity because of their better management know-how. The proportion of household heads who can read and write stays relatively similar across survey periods. The descriptive statistics of ASS dimension of resilience capacity indicate their influence on households' resilience capacity (Table 6.2). Land ownerships as in important components of the ASS dimension of resilience capacity revealed an average size of 0.88 hectare in per capita. The study also measured livestock numbers in standard unit of TLU. The number of livestock in TLU unit increased from an average of 0.88 in 2012 to 0.98 in 2014 despite declines to 0.75 in 2016. Moreover, a retrospective look at the aggregate data shows that

the mean wealth index declines between survey rounds. The descriptive statistics of the observed variables SSN dimension of resilience capacity are also found in table 6.2.

The descriptive statistics of the observed variables SSN dimension is also found in table 6.2. The amount of informal transfer increased from an average of 94.34 ETB in 2012 to 126.00 in 2014. However, informal transfer declines to 84.2 in 2016. A similar trend is also observed in the case of formal transfer from government and non-government organizations.

Table 6.2. Descriptive statistics of resilience explanatory variables

Resilience Capacity Dimensions	Variables	2012	2014	2016
ABS	Access to credit services (=1)	0.19 (0.39)	0.19 (0.39)	0.15 (0.36)
	Access to health services (=1)	0.87 (0.33)	0.89 (0.32)	0.90 (0.30)
	Access to market services (=1)	0.44 (0.50)	0.53 (0.50)	0.54 (0.50)
	Access to extension services (=1)	0.24 (0.43)	0.33 (0.47)	0.38 (0.48)
	Distance to nearest district town in kilometers	22.5 (24.3)	22.4 (24.1)	22.4 (24.1)
AC	Income diversification index	0.86 (0.25)	0.22 (0.32)	0.07 (0.16)
	Livestock diversification index	0.39 (0.31)	0.46 (0.30)	0.41 (0.26)
	Crop diversification index	0.25 (0.25)	0.27 (0.42)	0.43 (0.23)
	Ability to read and write (=1)	0.37 (0.48)	0.37 (0.48)	0.38 (0.48)
ASS	Wealth index	0.59 (0.38)	0.48 (0.22)	0.50 (0.21)
	Size of agricultural land measured in hectare	0.87 (5.96)	0.88 (24.7)	0.88 (6.10)
	Livestock number in TLU per capita	0.88 (1.63)	0.98 (1.63)	0.75 (1.30)
SSN	Cash transfers per capita from formal source	47.16 (200)	53.5 (214)	16.0 (1124)
	cash transfers per capita from informal sources	94.34 (521)	126 (721)	84.2 (594.5)

Source: Author's computation using ESS; 2012, 2014 and 2016.
Note: Standard deviation in parentheses

6.4.2. Measuring Dimensions Household Resilience Capacity

It is a key factor for enhancing households' resilience by improving their access to services, although it is beyond their control (Alinovi et al, 2009). A factor analysis is run to estimate ABS (a latent variable) using the principal axis factoring method and the scoring method suggested by (Bartlett, 1937). The factor generated is quite meaningful and can be considered as the underlying latent variable (ABS) as it meets all statistical requirements. The variables show a common pattern, which demonstrates the positive impact of access to services of credit, extension, health, town and market availability on the latent variable

access to basic services, while the distance in km to the district capital town negatively affect the latent variable ABS (Table 6.3). All the indicator variables show expected correlation coefficients with the latent variable ABS.

In terms of the second resilience capacity dimension (AC), factor analysis is also run to estimate AC (a latent variable) using the principal axis factoring method and the scoring method suggested by Bartlett (1937). These observed variables play important role in estimating the AC dimension although they differ in their correlation coefficients. Only, the role of the variable literacy seems less in all measures. As expected, the factor loadings and correlation coefficients of all variables showed expected correlation with the latent dimension (AC) confirming theoretically consistent sign except 'income' variable which deviates from the expected at least in the 2016 survey round. This may be because income diversification decisions have tradeoffs for adaptive capacity between good and bad times.

Table 6.3. Resilience variables factor loadings and correlations

Resilience Capacity Dimensions	Variables	2012	2014	2016
ABS	Access to credit services (=1)	0.51 (0.91)	0.47 (0.89)	0.47 (0.89)
	Access to extension services (=1)	0.53 (0.92)	0.50 (0.92)	0.41 (0.89)
	Access to health services (=1)	0.11 (0.36)	0.16 (0.55)	0.27 (0.87)
	Distance to nearest district town in kilometers	-0.05(-0.10)	-0.16 (-0.27)	0.02 (0.06)
	Access to market services (=1)	0.01 (0.02)	0.02 (0.06)	0.03 (0.43)
AC	Income diversification index	0.36 (0.65)	-0.40 (-0.79)	0.44 (0.83)
	Livestock diversification index	0.34 (0.61)	0.20 (0.39)	-0.41 (-0.76)
	Crop diversification index	0.40 (0.73)	0.32 (0.63)	0.07 (0.14)
	Ability to read and write (=1)	0.01 (0.03)	0.18 (0.44)	0.05 (0.12)
ASS	Livestock number in TLU per capita	0.16 (0.73)	0.25 (0.71)	0.18 (0.71)
	Size of agricultural land measured in hectare	0.06 (0.28)	0.11 (0.31)	-0.08 (-0.32)
	Wealth index	0.15 (0.67)	0.248 (0.72)	0.17 (0.68)
SSN	Cash transfers per capita from formal source	* (0.74)	* (0.82)	* (0.75)
	cash transfers per capita from informal sources	* (0.73)	* (0.64)	* (0.69)

Source: Author's computation using ESS; 2012, 2014 and 2016.
Note: Correlation in parentheses; * minimum-maximum indexing method used.

The ASS dimension is also estimated by factor analysis using principal factor axis method. Prior to predicting ASS as a latent variable, the factorability of the observed variables is investigated. As indicated in table 6.3, the overall factor loading captured by factors shows their positive contribution to ASS as expected except some deviations for 'land' in survey round three. This may be because during drought period, agricultural productivity per hectare is very low regardless of land size.

In the case SSN index construction, the observed variables are standardized to produce the latent variable SSN with zero mean and variance equal to one in preparation for the second stage of analysis to estimate resilience. As expected both of the observed variables have good positive correlation coefficient with SSN across survey rounds.

6.4.3. Measuring Household Resilience Capacity

After independently estimating the four dimensions of resilience capacity using factor analysis, SEM techniques is applied to assess the importance of each dimension and estimate the overall resilience capacity index. The latent variables presented in the previous section have been used as observed variables to estimate the final latent variable, resilience. In SEM, to get sound parameter estimates in terms magnitude, direction (consistent with theory) and statistically significant coefficients, the estimated model is well fitted after some modifications.

Table 6.4. Importance of dimensions of resilience capacity

Resilience Capacity Dimensions	2012	2014	2016
ABS	1*** (constrained)	1*** (constrained)	1*** (constrained)
AC	1.62*** (0.16)	3.11*** (0.24)	0.20* (0.12)
ASS	0.51*** (0.04)	0.34*** (0.025)	-0.12** (0.045)
SSN	-0.14*** (0.02)	-0.39*** (0.03)	0.02 (0.0255)
Observations	3398	3306	3055
Chi2(2)	54.75	107.51	56.25
p-value	0.000	0.000	0.000
RMSEA	0.054	0.079	0.017
p-value_RMSEA	0.05	0.05	0.05
CFI	0.944	0.902	0.906
TLI	0.888	0.805	0.812

Source: Author's computation using ESS; 2012, 2014 and 2016.
Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

In all survey rounds, ABS is constrained to a value of 1 and used to measure endogenous latent variables representing household resilience. As shown in table 6.3, all dimensions of resilience capacity found to be significantly correlated with resilience in all survey rounds, except SSN during survey round three. As expected AC dimension influences resilience capacity positively in all survey rounds. AC dimension has the largest positive effect on resilience having a standard coefficient (correlation coefficient) of 1.62, 3.11 and 0.19 in 2012, 2014 and 2016, respectively.

Similar studies in Ethiopia (Guyu and Muluneh, 2015; Temesgen et al., 2016) also found positive and strong association between such AC and ASS dimensions of resilience capacity and overall household resilience. The findings of this study is consistent with the empirical evidence from Ethiopia by (Temesgen et al., 2016), which indicate that AC dimension as a key determinants of household resilience.

ASS and SSN dimensions of resilience capacity showed a mixed result across survey rounds which deviates from the expected relationship. For example, in survey round three ASS dimension influences resilience negatively and similarly SSN dimension influence resilience negatively in survey round one and two. (Temesgen et al., 2016) found that ASS is an important dimension or pathway towards greater household resilience in Ethiopia. Overall, the findings of our research is consistent with other studies in Ethiopia (Tesso et al., 2012) and elsewhere ((Alinovi et al., 2010; d'Errico et al., 2016) that documented higher household asset imply better household resilience capacity.

Despite the argument about the theoretical importance of social capital, empirical evidence in Ethiopia including this study (Guyu and Muluneh, 2015; Kebede et al., 2016; Paul and Weinthal, 2018) and in other countries show mixed results regarding the effect of social capital on households overall resilience capacity. Overall, the SEM result showed that the resilience of households is highly dependent on adaptive capacity (in other words, income, crop and livestock diversifications as well as literacy) and household assets (i.e., wealth, land and livestock).

6.4.4. Profile of Household Resilience Capacity

In addition to estimating the regression coefficient of dimensions of resilience capacity, it is imperative to discuss the resilience capacity index found in SEM and the dimensions of resilience capacity from different perspective which helps to make specific interventions. Analysis of the dimensions of resilience capacity is particularly important for understanding the underlying differences among various segments of populations. The household resilience capacity enables computation of additional aggregated capacities, including the regional and different household characteristics levels.

Identifying the differences in resilience capacity between social groups and isolate the more relevant dimensions of resilience capacity, as well as variables determining such disparities is of crucial importance for shaping proper policies aiming to increase resilience capacity of the households in need. Moreover, the study also demonstrates how the contributions of the dimensions of resilience capacity change over time. For the purpose of this study, analysis is made for the major regions, household heads' sex and educational status. Such kind of estimations are consistent with previous studies in developing countries (Alinovi et al., 2010; FAO, 2016) and in Ethiopia (Temesgen et al., 2016) which decompose overall resilience capacity across different characteristics.

As depicted in table 5.1, resilience index changed over the three periods indicated a slight increase in the 2014 survey round with an average 0.47 resilience capacity as compared to the 2012 survey round with 0.40 mean resilience capacity at national level. Average national resilience capacity declines during 2016 survey round (0.43). However, average resilience capacity does not show the whole story. For example, see resilience distribution for the three survey rounds (figure 6.1).

The dispersion of the distribution is stark, implying that there exist significant differences in the resilience ability of households in rural Ethiopia. That means, some rural households are likely to respond much better than others to shocks. Notably, significant fractions of households score much above the mean, implying that inequality in resilience capacity is driven mostly by the upper part of the distribution, i.e. by households that are supposed to perform much better than the mean.

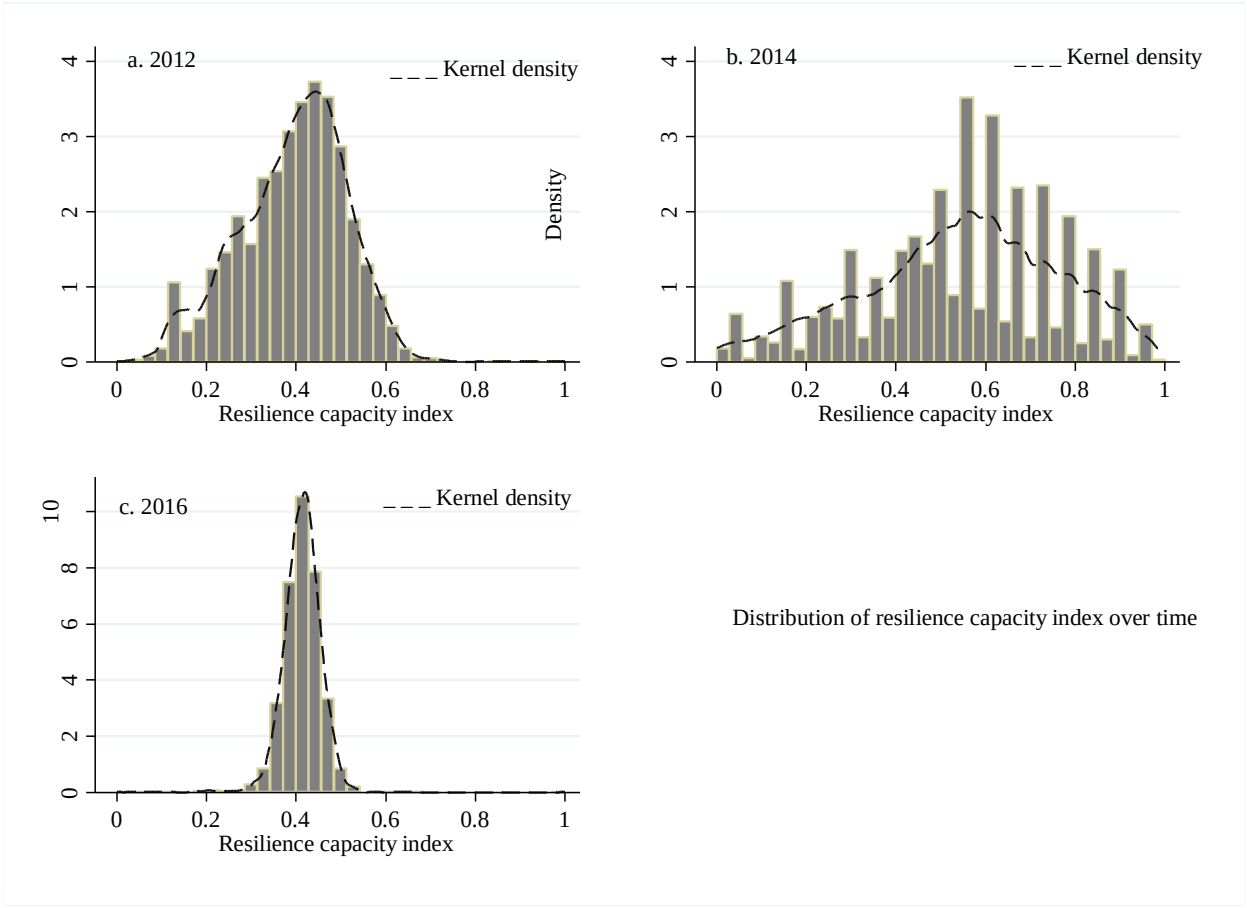

Figure 6.1. Distribution of overall resilience capacity index

Source: Author's computation using ESS; 2012, 2014 and 2016.

In an attempt to closer look at household resilience in the major regions of the country, there is a clear difference in overall resilience capacity with its dimensions across regional states of the country over years as depicted in table 6.5. The regions of Ethiopia compared in this study are Tigray, Amhara, Oromia, SNNP, the remaining Others regions combined. Rural households resided in SNNP scores the highest resilience capacity, followed by Oromia in survey rounds of 2012 and 2014. Looking at the dimensions of resilience capacity (Figure 6.2) and variables contributing to the resilience capacity of the most resilient regions, it appears that their resilience capacity is mainly driven by AC, as they show the better income, livestock and crop diversification. Moreover, their higher resilience capacity is also characterized by relatively good access to basic services like health center, market center, credit access, as well as shorter distances to district towns, which determines ABS. However, in survey round three, the highest resilience capacity is observed for Tigray and Amhara regions indicating the dynamics of regional resilience capacity over time due to differences in the ASS dimension.

Table 6.5. Profile of overall household resilience capacity

	2012	2014	2016
National	0.39	0.54	0.41
Regions			
Amhara	0.39	0.49	0.43
Oromia	0.43	0.61	0.40
SNNP	0.44	0.67	0.42
Tigray	0.35	0.46	0.43
Others	0.35	0.43	0.40
Sex of head			
Male	0.40	0.55	0.41
Female	0.38	0.53	0.43
Literacy status of head			
Illiterate	0.39	0.47	0.41
Literate	0.40	0.64	0.41

Source: Author's computation using ESS; 2012, 2014 and 2016.

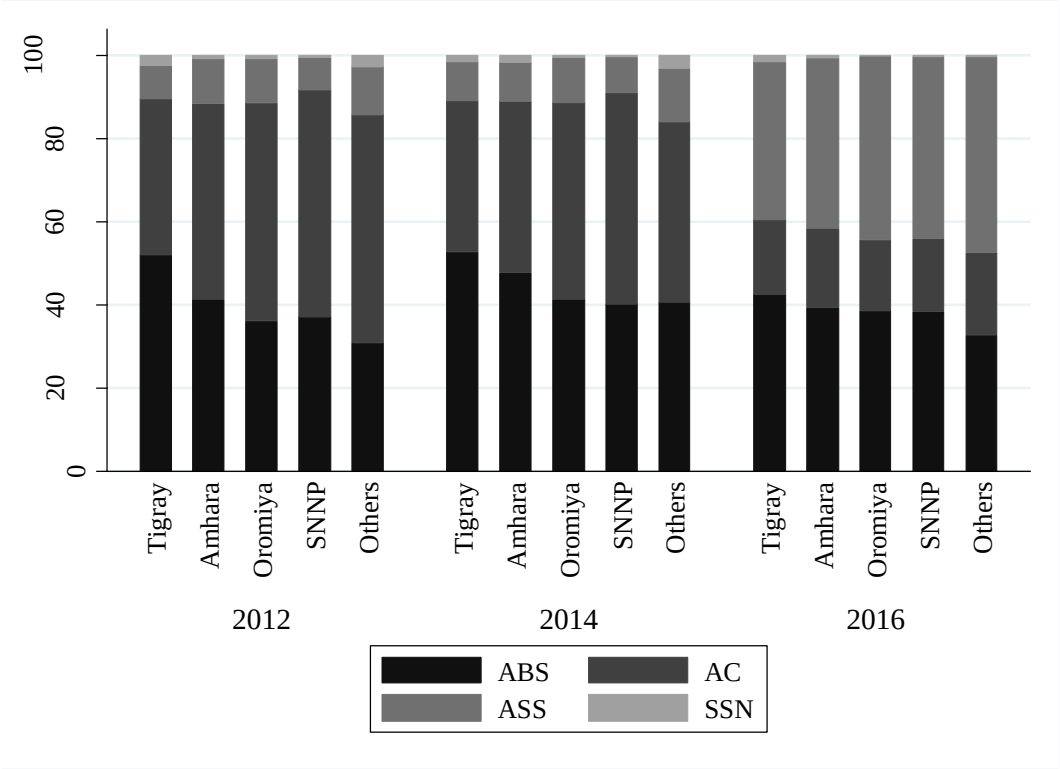

Figure 6.2. Dimensions of resilience capacity index across regions
Source: Author's computation using ESS; 2012, 2014 and 2016.

On the other hand, the region with the lowest resilience capacity is the Others region in all survey rounds. With regard to the dimensions of resilience capacity, this region is characterized by relatively low AC and ABS (figure 6.2 and 6.3). Low livelihood diversity, combined with low access to education, suggest that it scores low in terms of adaptive capacity. As expected the region is with very low in terms of access to different services as compared to Others regions.

In terms of sex, there is a slight difference in resilience capacity between male and female headed households. As illustrated in table 6.5, male headed households are, on average, much more resilient than female households in both years. And overall, the study implies that female headed households are consistently less resilient across survey rounds.

Moreover, the disparities in resilience capacity among male and female headed households is coupled with the disparities in their dimensions of resilience capacity (figure 6.3). While the pattern of importance of the dimensions of resilience capacity is similar in both sexes, the contribution of the dimensions of resilience capacity across survey rounds.

When the study compared dimensions of resilience capacity across sex over years, in survey round three, both sexes score better in terms of ASS and ABS. The role played by SSN is marginal in both sexes across survey rounds despite female-headed households have relatively better access to safety nets. Overall, female headed households are associated with higher resilience capacity and its dimensions of resilience capacity (table 6.5 and figure 6.3). The results are consistent with other studies such as Temesgen et al., (2016) and (Alinovi et al., 2010).

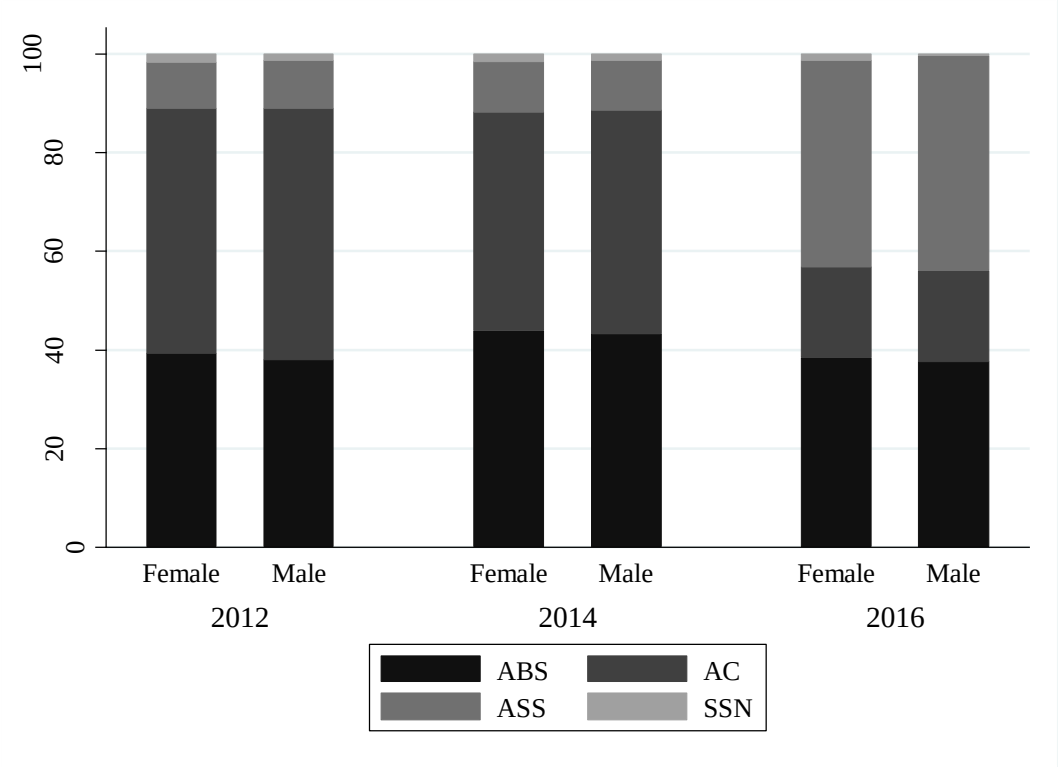

Figure 6.3. Dimensions of resilience capacity index by heads' sex

Source: Author's computation using ESS; 2012, 2014 and 2016.

In terms of household educational status, despite major differences across survey rounds, there is a very small difference in resilience capacity among household's heads categorized based on their educational status especially in the 2012 and 2016 survey rounds. During the 2014 survey round, literate household heads are, on average, much more resilient than households with no education (table 6.5).

To better understand the determinants driving the difference in resilience capacity between household heads' educational status, the mean of dimensions of resilience capacity indexes is depicted in figure 6.4. Akin to household resilience capacity, there is a major difference in terms of the dimensions of resilience capacity across survey rounds. During the 2012 survey round, literate household heads score better in terms of ASS and ABS, AC and SSN play only a marginal role. However, in survey round three the same group of households score better for ASS and ABS and the role played by AC is marginal.

The decomposition of household's resilience capacity by educational attainment indicated that illiterate household heads are more likely to be less resilient in terms of overall and the dimensions of resilience capacity metrics (table 6.5 and figure 6.4). This highlights the significance of education in enhancing household resilience, a finding consistent with (Tesso et al., 2012; Guyu and Muluneh, 2015; Temesgen et al., 2016).

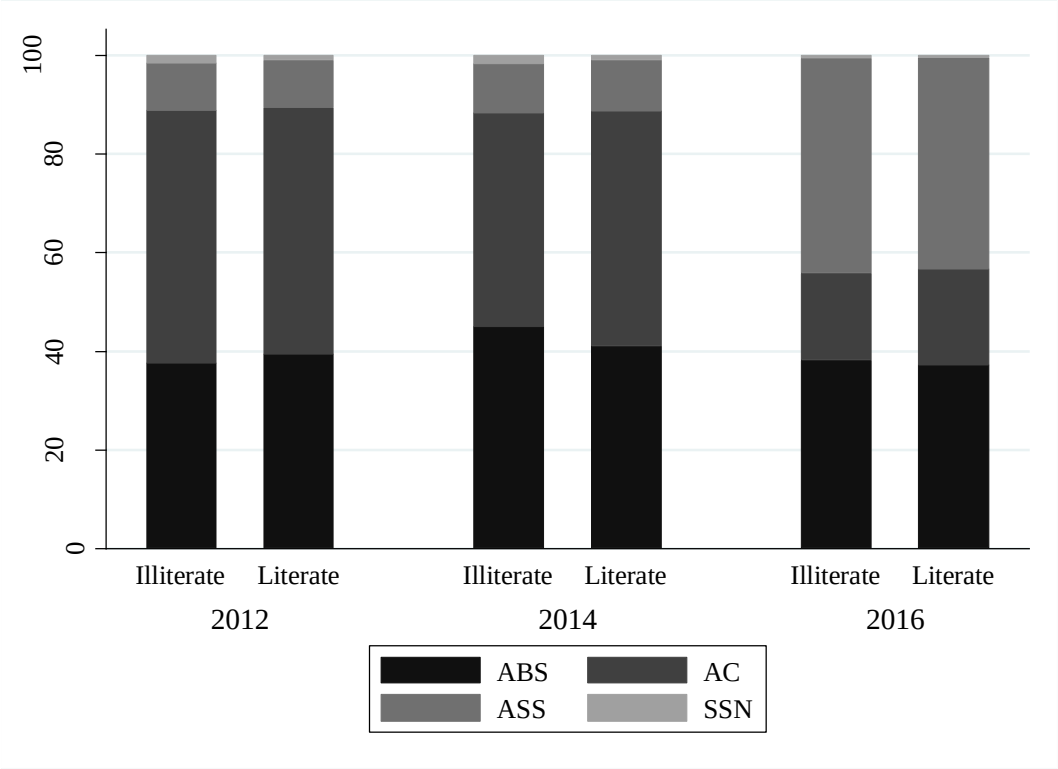

Figure 6.4. Dimensions of resilience capacity index by educational status

Source: Author's computation using ESS; 2012, 2014 and 2016.

6.5. Summary

Drawing upon three waves ESS panel data, this chapter estimate overall household resilience capacity and its dimensions. Unlike the concept of vulnerability (in this study), resilience is multidimensional and has unobservable nature. As a multidimensional concept, it considered a number of dimensions that can be context and time specific. Its unobservable nature reflects resilience cannot be measured directly rather be indirectly with its underlying structure. This study therefore, aggregate the various dimensions of resilience capacity into one single measure: a household resilience capacity index. In doing so, while factor analysis multivariate statistical technique is applied for construction of the four dimensions of resilience capacity index, structural equation modeling is used to construct the overall aggregate resilience capacity index and assess the role of household

resilience originally proposed by (Alinovi et al., 2008, 2010) and later modified by (FAO, 2013, 2016). There is strong evidence that adaptive capacity, access to basic service and household assets are positively associated with household resilience capacity. The results also suggest that household resilience capacity is negatively associated with social safety nets.

The study indicated the differences in overall resilience capacity and its dimensions between regions, social groups as well as the contributions of the dimensions of resilience capacity and the change over time. On average, resilience capacity is found to be higher in SNNP and Oromia regions. Their higher resilience capacity is mainly driven by adaptive capacity (as they show better income, crop and livestock diversification) and better access to services is characterized by availability of health and market centers, credit access as well as shorter distances to the nearest district town. On the other hand, the regions with the lowest average resilience capacity are Others and Amhara. These regions lower resilience capacity is characterized by low adaptive capacity and access to services.

Chapter 7. Shock Exposure and Coping Strategies in Rural Ethiopia

7.1. Introduction

In sub-Saharan Africa including Ethiopia, poverty continues to prevail especially in rural areas where household face high risk of falling into poverty in the future due various risks and shocks (Jabeen, 2014). In responding or mitigating those risks and shocks, rural household often use complicated *ex-ante* risk management and *ex-post* coping strategies (Dercon, 2002). However, shocks or unexpected negative events still occur and cause serious adverse impacts on household income and consumption, then in turn drive towards poverty (Tongruksawattana et al., 2010). In depth understanding these risks or shocks and their consequences is indispensable for the design of effective poverty alleviation or/and reduction policies and strategies (Jabeen, 2014; Bonfrer and Gustafsson-Wright, 2016). Indeed, recognizing the role played by a range of different types of shocks in perpetuating poverty is a relatively recent strand of development research that mainly concerned with determining the effect of household consumption, income and labor supply (Debebe et al., 2013).

The literature on vulnerability to poverty side recommend shock-coping activities as dependent on shock type and household characteristics (Hoddinott, 2006; Rashid et al., 2006; Berloffa et al., 2009) on one side and the need to further explore the issue interaction on strong empirical grounds on the other side (Tongruksawattana et al., 2010). A deeper understanding of household ability to respond to and to insure against different types of shocks calls for a multi-shock analysis, an examination of coping responses triggered by each type of shock and an evaluation of the short and long-term consequences of the coping strategies adopted in response to a shock.

In developing countries, there are studies that have analyzed the incidence, distribution and welfare implication of shocks nowadays (Dercon et al., 2005; Heltberg and Lund, 2009; Wagstaff and Lindelow, 2014). In Ethiopia too, there are few studies that deal with shocks and coping strategies (Asfaw and Braun, 2004; Dercon et al., 2005; Porter, 2012; Debebe et al., 2013). Based on a large scale panel household survey data, this chapter identify and document the major shocks and assess households' behavior regarding decisions to take coping action and the choice of coping strategies using both descriptive and regression analysis.

The chapter unfolds by providing in section 7.2 the data used and section 7.3 the empirical strategy used for analyzing the determinants of *ex-post* coping strategies (hereafter coping strategies). Section 7.4 addresses results and discussions on the frequency, scope, distribution of shocks, and then goes to provide the determinants of major shocks incidence; the frequency and distributions of coping strategies and a multivariate probit analysis of which explanatory variables trigger which coping responses. Section 7.5 provide summary of the chapter.

7.2. Data

The data that form the empirical analysis of this objective is the rural category of the ESS. In order to identify and document the major idiosyncratic and covariate shocks households exposed to and their coping strategies as well as make some descriptive statistics, this study used the 2012, 2014 and 2016 ESS rounds information. However, this study made analysis using a multivariate probit analysis of which explanatory variables trigger which coping based on the recent 2016 ESS round cross-sectional data.

A range of explanatory variables are included in the model including, a binary variable capturing whether the household has experienced drought (=1), food price rise (=1), input price rise (=1), illness (=1), age of the household head, household size, a binary variable to capture the household's head status as being female headed (=1), married head (=1), christian religion of head (=1), literate head (=1), dependcy ratio, number of oxen owned, debt money, a binary variable capturing whether the household is located in the region of Tigray (=1), Amhara (=1), Oromia (=1) and SNNP (=1).

7.3. Empirical Strategy

Faced with adverse shocks, households opt to adopt a mix of coping strategies as a way of management rather than relying on a single strategy to exploit complementarities among alternatives. In this case, households were asked to indicate for each coping mechanism whether they used it (1) or not (0) in case of a shock in the past 12 months prior to the survey.

Three major coping strategies are included: saving, livestock sell and engagement in spiritual activities. Therefore, the dependent variable is whether a household has adopted the above specified coping strategy in response to any shock. In the case of the independent variables, different sets of variables that include specific shocks, household and community characteristics are considered in this study. To explore these coping strategies triggered by any shocks, and analyze the factors associated with the use of specific coping strategies econometric model is adopted in this study.

The theoretical framework adopted for modeling the household's coping strategies is based on random utility theory. Depending on the assumed form of the distribution of the random disturbance term qualititative choice model such as logit or probit models can be estimated.

However, as rural households apply a mix of coping strategies in the face of shocks; these strategies could be correlated since the same unobserved household characteristics influence their choice.

In this type of situation, it is necessary to use a model which estimates the influence of exogenous factors on the use of different coping strategies simultaneously while allowing for the error terms of each of these strategies to be freely correlated, failure to which lead to biased estimates and therefore the application of standard univariate logit or probit models would produce inefficient estimates (Greene, 2008). To address this potential problem, this study employed a multivariate probit (MVP) model to investigate the inter-dependent coping strategy implementation decisions. This study followed Lin et al. (2005) in formulating the multivariate model which has three dependent variable, $y_1, \ldots, y_3$ such that;

$$y_i = 1 \text{ if } \quad \beta_i x' + \varepsilon_i > 0$$

and

$$\mathbf{y_i = 0} \text{ if } \quad \mathbf{\beta_i x' + \varepsilon_i \leq 0} \qquad \mathbf{i = 1, 2, 3} \tag{7.1}$$

where x is a vector of explanatory variables; $\beta_1, \beta_2, \text{and } \beta_3$ are conformable parameter vectors and $\varepsilon_1, \varepsilon_2, \text{and } \varepsilon_3$ are random errors distributed as a multivariate normal distribution with zero mean, unitary variance and an n x n correlation matrix.

The MVP model uses the method of maximum simulated likelihood to estimate a set of binary probit models simultaneously. Estimation of the MVP for each equation is undertaken using the STATA user-written command – mvprobit. To calculate the average marginal effect, this study used the simulation procedure proposed by (Cappellari et al., 2003) for a multivariate probit model.

7.4. Results and Discussions

7.4.1. Incidence and Distribution of Shocks

In this section descriptive analysis of shocks by providing an assessment of the incidence, scope (covariate or idiosyncratic) and distribution of shocks (who experiences shocks) are dealt. The data on shocks are obtained by asking households whether they are reported by a set of 15 shocks during 2010, 2012 and 2014 preceding the data of the 2012, 2014 and 2016 survey rounds respectively.

Despite many sets of shocks asked, some of the shocks are reported insignificantly by rural households. From the reported shocks, while floods, crop damage, food price decline, household members and livestock death are reported by small proportion (below 5 percent of the sample), drought, household members' illness, as well as food and input price rise are the key shocks occurred in rural Ethiopia among others and this study also give priority for these four shocks. Therefore, the results generated here are from a comparative static as well as dynamic analysis of the three data sets to obtain a broader and clearer picture of shocks situations and coping behaviors. Table 7.1 provides the incidence of various shocks among the sample households between 2010 and 2014. The incidence of shocks is defined as the proportion of households affected by various shocks which gives an indication of the riskiness of the environment in which the studied households reside (Dercon et al., 2005).

Ethiopia as risk prone country, rural households experience shocks in their life time. The overall situation of households with shocks in the survey rounds can be described as the proportion of households who reported at least one shock experience. While about 47% of the sample households experience at least one type of shocks in the past 12 months in the

2012 survey round, the number radically increases to 59% in the 2016 round. As depicted in table 7.1, food price rise is the most prevalent shock affecting households to such an extent that in the 2012 and 2016 rounds with 25 and 20 percent of households experience it at least once 12 months' prior the survey period respectively. Drought and illness shocks are also among the frequent, each affecting rural households. While about 14.4% in 2012 and 32.5% in 2016 reported drought, the number concedes to 14% and 21.5% in the case of illness shock.

While food price rise, drought and illness ranked from one to third respectively during the 2012 survey round, drought, illness and food price rise take from one up to third in the case of the 2016 survey round. Input prices rise is also another important economic shock reported in the 2012 and 2016 survey rounds, with about 11 percent of households experiencing it in 2012 and closer to 15% encountering it during the 2016 survey round.

Moreover, among the important shocks reported in 2014 and 2016 which has a relatively low incidence rate in 2014 include livestock death. Around 7% and 9% of the sample households reported experiencing this shock in the 2012 and 2016 round while only 3.5% reported it in the 2014 survey round. On the other hand, despite low in terms of percentage, food price reduction affected more households in the 2016 round than in the 2012 and 2014 survey rounds. The other shock variables reported with low frequency in all survey rounds are flood, crop damage, and household members' death.

Table 7.1. Incidence of shocks in rural Ethiopia

Major Shocks	2012 (%)	2014 (%)	2016 (%)
Drought	14.4	9.5	32.5
Flood	3.4	2.2	1.1
Crop damage	4.0	3.0	9.0
Food price increase	24.7	13.0	20.0
Food price decrease	2.0	2.5	4.0
Input price increase	11.0	6.3	15.0
Illness	14.0	10.5	21.5
Members death	3.5	2.0	2.0
Livestock death	7.0	3.5	9.0
Any type of shocks	46.7	37.0	59.0

Source: Author's computation using ESS; 2012, 2014 and 2016.

Generally, households experience a great deal of shocks during the 2016 survey rounds. The results from this study consistent with previous studies in Ethiopia (Dercon and Porter, 2011; Porter, 2012; Yonas and Soderbom, 2012; Gray and Mueller, 2012; Hill and Porter, 2017).

Figure 7.1 indicates the number of shocks faced by rural households against the percentage of households who have faced the corresponding number of shocks. Despite the majority of rural households reported experiencing no shock at all during the survey rounds (53.3% in 2012, 63% in 2014 and 40% in 2016), some of the rural households have experienced multiple shocks.

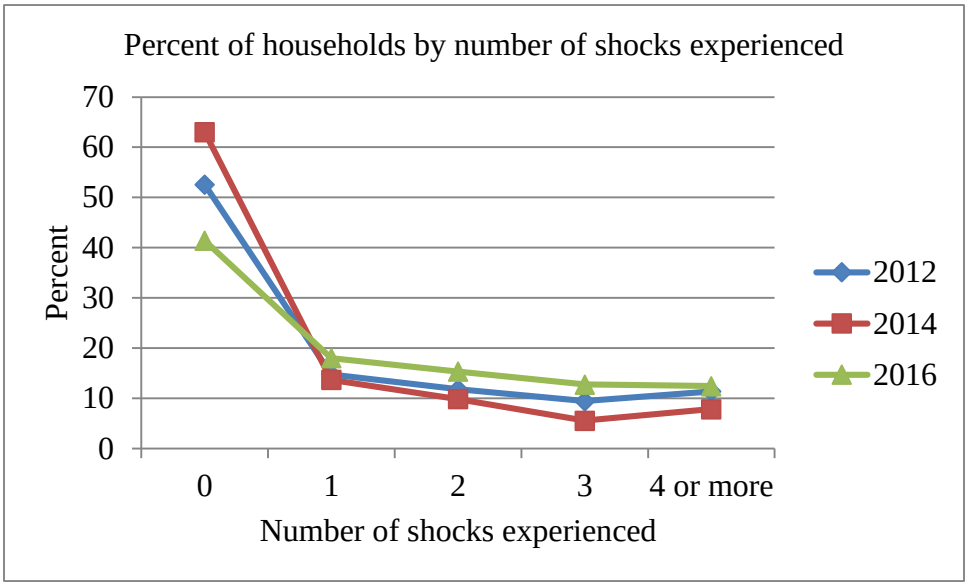

Figure 7.1. Proportion of households affected by shocks

Source: Author's computation using ESS; 2012, 2014 and 2016.

The majority of whom experienced between one and 4 shocks in the three rounds. In the 2012 round, this study found a negative gradient, with a small percentage of households having faced at least four or more shocks (2.45%) while 5.5% of households have faced two shocks and about 37% of households have experienced one shock in the 12 months prior to the survey. Moreover, almost a similar pattern has been observed in the case of the 2014 round (Figure 7.1). However, an opposite pattern has been observed in the case of the 2016 survey round.

A further analysis of the major shocks across the major regional states of Ethiopia and the survey rounds is presented in table 7.2. In terms of drought shock regional distributions across survey rounds, SNNP is the worst hit in the 2012 round (23%), and it is the Others region in the case of the 2014 (13.5%) and 2016 (39%) survey rounds. Amhara and SNNP

are also severely affected by this shock in case of the 2016 round. When the study compared the incidence of this shock in the major regions of the country across the survey rounds, dramatic decline and increase has been observed in the 2014 and 2016 survey rounds respectively in all of the major regions.

When the study compared the incidence of food price rise shock across regions and the survey rounds, while SNNP is the worst affected in 2012 (33%), the highest frequency goes to Others regions in 2014 (34%) and 2016 (39.5%) in Amhara, Oromia and Others regions are also severely affected by this shock in both 2012 and 2016. When the study compared the trend of food price rise across regional states of Ethiopia, a sharp decline and increase is observed in the case of Amhara, Oromia and SNNP regions.

The distribution of input price rise shows that Oromia and SNNP regions are the worst hit while Tigray and Others region are the least affected once during the 2012 and 2016 survey rounds. In terms of illness, SNNP region is the worst hit with 21%, 13.3% and 26.5% in 2012, 2014 and 2016 survey rounds respectively. Amhara and Oromia and Others regions are also severely affected by illness shock. In general, the incidence of shocks varies across the major regions of the country as well as in survey rounds.

Table 7.2. Distribution of shocks across regional states

Years/ Shocks	Regions				
	Tigray	Amhara	Oromia	SNNP	Others
2012					
Drought	8.33	6.90	11.52	22.71	17.92
Food price rise	8.09	18.71	24.46	32.87	26.28
Input price rise	7.11	7.72	18.05	18.92	1.19
Illness	8.58	11.11	14.21	21.22	9.23
2014					
Drought	7.99	6.77	4.45	2.43	13.48
Food price rise	9.14	10.83	12.23	8.38	34.18
Input price rise	4.08	4.35	7.49	6.70	5.81
Illness	7.50	6.77	10.90	13.32	8.33
2016					
Drought	14.5	18.0	13.0	15.6	39.0
Food price rise	7.3	13.6	21.0	18.7	39.5
Input price rise	12.0	13	31.6	31.2	12.2
Illness	7.0	17.0	22.0	26.5	28.0

Source: Author's computation using ESS; 2012, 2014 and 2016.
Note: SNNP= Southern Nations Nationalities and People

An examination of major shocks incidence by household consumption expenditure quintiles in the three survey rounds is presented in table 7.3. Overall, the prevalence of the four major shocks reported becomes more frequent as one moves from the poorest household consumption quintile to the richest quintile in all survey rounds.

The study confirmed that food price rise as one of the most prevalent that affect household consumption with an increasing trend as one moves from the poorest to the richest quintile in the 2016 survey round. Despite a priori expectation of rising food price would affect poor households than the non-poor's, the richest quintile reported rising food price more

than any other quintiles with 23.7% in 2016 survey round. The reason for this may be wealthier households don't produce their own food and bought their food from market. As a result, as the price of food crops rise richer households are forced to pay higher price for food commodities. The majority of the poor, on the other hand, is mainly engaged in food crop production and covers their consumption.

Drought as a covariant shock, affect rural households with different consumption expenditure quintiles similarly. However, the effect on the poor and non-poor households lies on their ability to cope with this shock. As depicted in table 7.3, the prevalence of drought across expenditure quintiles vary in the three survey rounds. This result is consistent with previous studies in Ethiopia (Gray and Mueller, 2012; Porter, 2012; Hill and Porter, 2017). The other prevalent shock that affect rural household consumption in Ethiopia in both survey rounds is illness of household member. The prevalence of this shock did not indicate a clear pattern as one move from household consumption expenditure quintile categories in both of the survey rounds.

Table 7.3. Distributions of shocks by expenditure quintiles

Years/ Shocks	Expenditure Quintiles					
	Poorest (20%)	2	3	4	Richest (20%)	All
2012						
Drought	16.7	11.2	13.7	12.5	17.0	14.2
Food price rise	29.6	23.0	25.0	21.6	23.7	24.6
Input price rise	10	10.4	11.6	11.0	13	11
Illness	14.3	14	15	10	13.4	13.3
2014						
Drought	9.1	10.5	9.9	8.6	8.9	9.4
Food price rise	16.4	10.6	13.5	`13.8	12.7	13.4
Input price rise	4.8	6.9	6.3	8.1	6.1	6.5
Illness	11.4	10.0	9.6	10.0	9.9	10.2
2016						
Drought	26.0	25.9	30.4	31.9	35.2	29.9
Food price rise	14.6	14.2	18.6	22.2	23.3	18.6
Input price rise	12.1	12.1	16.2	19.1	19.1	15.7
Illness	24.6	20.6	23.5	18.1	22.4	21.8

Source: Author's computation using ESS; 2012, 2014 and 2016.

7.4.2. Households' Coping Strategies

In the face of shocks, rural households use a variety of strategies to maintain their level of consumption. In this case, a coping action is defined as an explicit and active undertaking to counteract the negative shock effects as reported by the households. On the other hand, households are categorized as "do not cope" if they did nothing explicitly and directly to deal with any of the shocks due to various reasons or if they responded in a passive way such as slightly reducing consumption.

Table 7.4 presents the percentage of households that reported using them as their first response to cope with a particular shock in Ethiopian and across the major regions in the

three survey rounds. Nationally, a higher proportion of households reported using their savings to cope with a particular shock (28 percent in 2012, 21 percent in 2014 and 48.6 percent in 2016). While the number of households that reported selling livestock as a 2012 response to shock is fairly constant in the 2012 and 2014 survey rounds (i.e. around 16 percent in 2012 and 16.3 percent in 2014), the percentage reduced to 11 percent in the case of the 2016.

A similar trend is also observed in the case of using government help as a first response to shock. Although around 9.2 percent of reported engaging in spiritual efforts as a first response to a particular shock in 2012, the number rose to 14 percent and 12.6 in 2014 and 2016 survey rounds respectively. Some households responded to their respective shocks by obtaining credit (4 percent in 2012 and 2016 as well as 4.5 percent in 2014), other households reported help from relatives (6% in 2012 and 2014).

The regional distribution of different coping strategies in the major regions of the country and the survey rounds is presented in table 7.4. The result shows sporadic variations across regional states in undertaking a variety of coping strategies as a response to shocks. In Tigray, use saving and sale of livestock are the most important coping strategies used in the face of shocks in all survey rounds. As depicted in table 7.4, while greater proportion of households reside in Oromia region (34%) used saving as an important means of coping, the smaller proportion in Tigray (17%) during the 2012 survey round. Similar trend is also observed in SNNP and Others regions during the 2014 round.

Table 7.4. Distributions of coping strategies by regions

Years/ Coping Strategies	Ethiopia	Regions				
		Tigray	Amhara	Oromia	SNNP	Others
2012						
Savings	28.0	16.86	20.18	33.77	31.42	25.71
Help from relatives	6.0	8.72	5.26	8.04	4.55	5.79
Help from gov't	8.0	9.30	3.33	3.51	3.21	23.73
Livestock sales	16.0	19.77	16.14	16.08	13.96	19.07
Credit	4.0	5.81	5.79	4.68	3.66	2.12
Help from spiritual	9.0	8.72	11.40	2.78	12.91	6.78
Any coping	37.0	20.3	24.4	38.2	50.0	48.0
2014						
Savings	21.0	17.30	17.37	21.11	31.00	16.95
Help from relatives	6.0	6.33	9.58	6.67	4.13	7.14
Help from gov't	4.0	7.59	5.12	2.78	0.95	5.54
Livestock sales	16.0	17.30	13.36	19.26	6.36	27.08
Credit	4.5	2.95	6.68	5.19	6.36	3.20
Help from spiritual	14.0	5.91	6.68	12.04	19.40	10.02
Any coping	26.0	22.0	16,0	32.0	23.0	39.4
2016						
Savings	20.0	18.3	17.1	20.6	22.6	19.3
Help from relatives	3.0	2.0	2.2	4.0	1.7	4.5
Help from gov't	8.0	8.1	7.6	6.5	2.1	15.5
Livestock sales	11.0	11.6	7.6	13.6	9.0	14.3
Credit	4.0	3.0	3.0	5.0	1.7	6.7
Help from spiritual	12.6	12.5	4.2	11.0	12.5	22.0
Any coping	48.6	47.4	36.4	50.4	42.3	66.0

Source: Author's computation using ESS; 2012, 2014 and 2016.

Note: gov't = government; SP= Southern Nations Nationalities and People

In case of using livestock sale as a coping strategy, while greater proportions of households reported livestock sale in Tigray (20%) and Others (19%) regions, households in Amhara, Oromia and SNNP also reported this strategy as pivotal in 2012. In the 2014 round, while the highest proportion of households in Others region (27 percent), smaller portions of households in SNNP (6 percent) reported this coping strategy indicating significant variations across regions. A similar trend is also observed in the case of the 2016 survey round. Moreover, some households apply help from spiritual activities as a coping strategy in face shocks with slight variation in reporting it across regions in the survey rounds. Significant proportion households reported it in the 2014 round than in the 2012 and 2016 survey rounds. The highest proportion is reported in SNNP region (19.4 percent) as compared to the lowest reported in Tigray region (6 percent).

The other coping strategy that depicts drastic variation across regions is getting help from the government in the face of shocks. During the 2012 survey round for instance, about 24% and 9% percent of households reported it in Others region and Tigray respectively and lower proportion of households in Amhara (3%) and in SNNP (3.2%). Disparity across regions is also observed in getting assistance from government in the face of shocks during the 2014 and 2016 survey rounds too. Moreover, disparity is also observed in the case use using credit services as a means to respond shocks across regions and survey rounds. Overall, the result of here revealed significant disparity of coping strategies in the face of shocks across regions in rural Ethiopia in the three survey rounds

Table 7.5. Distribution of coping strategies by expenditure quintiles

Years/ Coping Strategies	Expenditure quintiles					
	Poorest (20%)	2	3	4	Richest (20%)	All
2012						
Savings	14	15.0	17.3	11.2	16.5	15.0
Help from relatives	4.6	2.5	4.6	3.4	4.2	4.0
Help from gov't	7.4	3.0	3.0	3.3	3.7	4.1
Livestock sales	11.6	10.6	10.4	9.8	9.7	10.3
Credit	2.4	3.4	4.2	3.7	5.8	4.0
Help from spiritual	7.0	7.2	9.7	5.1	4.8	6.8
Any coping	39.7	35.9	40.1	29.7	36.2	36.3
2014						
Savings	8.4	7.7	6.9	8.1	7.8	7.8
Help from relatives	2.8	2.4	2.3	3.6	2.2	2.7
Help from gov't	2.3	1.3	2.0	1.4	3.6	2.1
Livestock sales	9.4	9.1	10.0	9.9	7.4	9.1
Credit	2.0	3.1	1.3	1.7	1.7	2.0
Help from spiritual	7.3	6.4	4.9	4.9	5.2	5.7
Any coping	28.4	26.9	23.8	25.4	24.4	25.8
2016						
Savings	18.6	17.3	19.4	18.3	24.5	19.7
Help from relatives	4.5	2.1	2.3	2.6	3.1	2.9
Help from gov't	6.5	6.8	7.8	6.3	7.6	7.0
Livestock sales	10.0	10.2	9.4	12.0	13.1	10.9
Credit	2.8	2.6	3.9	3.6	3.4	3.2
Help from spiritual	10.5	10.4	12.1	13.1	14.3	12.1
Any coping	42.7	41.8	47.7	46.6	54.3	46.6

Source: Author's computation using ESS; 2012, 2014 and 2016.

Note: gov't = government

A further analysis in the distribution of responses to shocks across consumption expenditure quintiles is also important to assess whether certain coping strategies are correlated with wealth groups as depicted in table 7.5.

7.4.3. Shocks and Coping Strategies

In the face of multiple shocks, rural households are attracted by a variety of coping strategies to avoid and minimize the adverse impacts of these shocks as depicted in table 7.7 and figure 7.2. Such decomposition of shocks with coping strategies is in line with other studies (Makoka, 2008; Debebe et al., 2013). As a response to drought, about 73.3% in 2012, 68% in 2014 and 92.3% in 2016 reported help from the governments as an important means coping strategy. In addition, selling livestock, engagement in spiritual activates and using saved money are also the other important coping strategies applied in response to drought shock in rural Ethiopia.

Rural households tend to rely on their own savings to cope with food price rise and illness shocks. In 2012, about 57% and 37.3% of households relied on savings as response to food price rise and illness shocks respectively; the proportion is 33% and 40% in the case of the 2016 survey round. Furthermore, help from the government is also the most frequently used as means to cope drought and food price shocks as compared to input price rise and illness shocks in the three survey rounds. Similarly, the study found that selling livestock is the most frequently used to respond drought and food price shocks as compared to input price and illness shocks during the three survey rounds.

Table 7.6. Distribution of coping strategies by shocks

Years/ Shocks	Coping Strategies					
	Saving	Relative	Gov't	Livestock	Credit	Spiritual
2012						
Drought	32.0	37.3	73.8	38.6	42.5	29.3
Food price rise	57.0	55.2	65.3	62.2	59.0	53.6
Input price rise	30.3	18.7	7.0	30.3	27.6	30.5
Illness	37.3	47.0	17.0	29.2	29.0	35.6
2014						
Drought	22.0	39.0	68.0	45.6	18.8	24.6
Food price rise	34.6	41.1	39.1	51.0	33.0	40.3
Input price rise	24.7	9.0	8.7	18.4	40.6	18.3
Illness	39.0	48.0	21.7	27.6	36.0	32.0
2016						
Drought	52.4	61	92.3	62.4	56.7	62.5
Food price rise	33	38	53.3	40.3	50.4	37.7
Input price rise	27.6	26.3	14.7	34.2	25.2	26.5
Illness	40.0	52.6	33.3	38.7	46.5	40.4

Source: Author's computation using ESS; 2012, 2014 and 2016.
Note: gov't = government

The other shock coping strategy used in rural Ethiopia is the use of credit money. The study found that households relied on this strategy is quite uniformly distributed for input price rise and illness shocks. However, about 59% and 42.5% of households relied on credits as response to food price rise and drought shocks respectively in 2012; the proportion is 50% and 56.7% in the case of the third survey round. Moreover, help from relatives and engagement in spiritual activities that can be considered as social network reveal important results in this study are also pivotal. In 2012 for instance, while about 55.2 and 47% of households applied as means of coping for food price rise and illness shocks respectively as compared to 37.3 and 18.7% for drought and illness shocks. Engagement in spiritual

activities also reveal that about 53.6 and 35.6 percent households used it as a response to food price rise and illness shocks respectively during the 2012 round. The corresponding proportions in the case of the 2014 and 2016 survey rounds are about 40.3, 32 percent and 37.7, 40.4 percent respectively.

Overall, the study indicated that the choice of coping strategies by rural household in Ethiopia depend on the types of shocks households exposed to which is in consistent with previous studies on the issue (Dercon, 2002; Hoddinott, 2006; Makoka, 2008; Debebe et al., 2013).

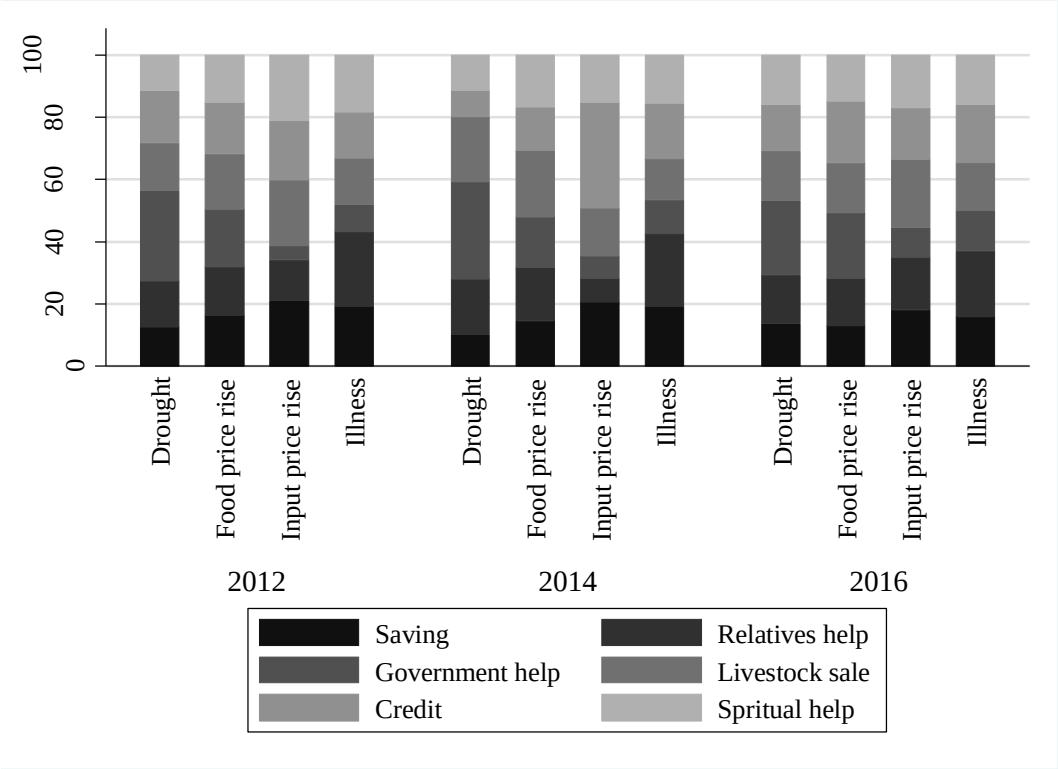

Figure 7.2. Distribution of shocks and coping strategies

Source: Author's computation using ESS; 2012, 2014 and 2016.

7.4.4. Determinants of Coping Strategies

This model involved the simultaneous estimation of three probit models. Table 7.7 shows the association between a limited number of factors and the three most used coping strategies. The multivariate probit results suggest interdependence across the equations (the estimated correlation coefficients $\rho 21$, $\rho 31$ and $\rho 32$ are significant), implying that the multivariate probit model is indeed the preferred model over individual probit models for each coping strategy separately. Moreover, the Wald $\chi 2$ has a value of 1414.21 and is statistically significant at the 1% level, implying that the independent variables significantly explain the variations in the respective dependent variables. The Likelihood ratio test of the null hypothesis that the error terms of the three equations are significantly zero (i.e. are uncorrelated) is rejected at the 1% level. This therefore provides justification for the use of the MVP model.

Therefore, it is instructive to note that in this case the measures are taken after the given shock factor has occurred. Experiences with shocks are significantly associated with household ability and willingness to take coping measures. The coefficient on drought, food price rise and illness shocks have a positive sign for all coping strategies and is statistically significant in all cases. That is, households who faced those shocks are more likely to resort to use their saving, sell livestock and engage in spiritual activities.

In the case of marital status of the household head, the study observed that married household heads are less likely to sell their livestock as a coping strategy. With regard to the literacy of the household head, while household heads whose literacy level is literate are more likely to use saving, the case for getting help from the government and selling livestock is on the contrary as compared to their counterpart illiterate household heads.

While households who have higher number of dependents are less likely to involve in asking credit money, households who own higher number oxen are more likely to sell their livestock to cope with shocks. The final set of independent variables in table 7.7 relates to location or administrative regions of rural households. The residence of rural households affects the choice of coping strategy to varying degrees. Households reside in Tigray are less likely to use most of the coping strategies except use of savings. Moreover, households in Oromia are also less likely dependent on savings to respond the impact of shocks.

Table 7.7. Determinants of coping strategies

Variables	Saving	Livestock sale	Spiritual help
Drought (=1)	0.649***	0.598***	0.682***
	(0.069)	(0.077)	(0.074)
Food price rise (=1)	0.297***	0.343***	0.219***
	(0.078)	(0.086)	(0.085)
Input price rise (=1)	0.523***	0.684***	0.363***
	(0.074)	(0.080)	(0.084)
Illness (=1)	0.753***	0.501***	0.606***
	(0.064)	(0.075)	(0.071)
Age of head	-0.002	0.001	-0.001
	(0.002)	(0.002)	(0.002)
Household size	0.007	0.018	0.016
	(0.014)	(0.015)	(0.015)
Female headed (=1)	0.069	-0.168**	-0.053
	(0.075)	(0.093)	(0.089)
Married head (=1)	0.086	-0.147**	-0.034
	(0.068)	(0.076)	(0.076)
Literate head (=1)	0.177***	-0.173**	-0.062
	(0.063)	(0.075)	(0.075)
Dependency ratio	-0.014	0.031	-0.006
	(0.018)	(0.021)	(0.021)
Oxen owned	0.011	0.001***	-0.050**
	(0.015)	(0.018)	(0.021)
Tigray (=1)	-0.224**	0.001	-0.108
	(0.104)	(0.121)	(0.115)
Amhara (=1)	-0.002	-0.095	-0.488***
	(0.084)	(0.102)	(0.120)
Oromia (=1)	-0.269***	-0.008	0.052
	(0.089)	(0.103)	(0.094)
SNNP (=1)	0.022	-0.396***	-0.014
	(0.093)	(0.129)	(0.106)
Constant	-1.456***	-1.899***	-1.549***
	(0.158)	(0.180)	(0.179)
Observations	3,036	3,036	3,036

Source: Author's computation using ESS, 2016.

Note: The reference category for the regional dummies is Others; $\rho 21 = -0.322^{***}$, $\rho 31 = -0.326^{***}$, and $\rho 32 = -0.140^{***}$; Log likelihood: −3027.734, Wald $\chi 2$ test: 1414.21; Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

7.5. Summary

This chapter analyzed different strategies in which rural households respond to shocks and risks. In particular, the study revealed that rural households faced multiple shocks during the three survey rounds with prominent shocks being drought, food and input price rise as well as household member illnesses. The study also shown greater disparity in the incidence of shocks by households' regional location and welfare groups across survey rounds. The study also shown that rural households use a variety *of* coping strategies to deal with shocks. These include using savings, getting help from relatives, the government and spiritual institutions, selling livestock and getting credit, among others. However, most of the strategies available tend to be beyond the reach of most of the poor households and as a result they are used by wealthier households. Using savings and getting credit are among others for the wealthier households.

The important descriptive findings led to the discussion of analyzing the determinants of households' coping strategies. The study revealed that the choice of a particular coping strategy depends on the major types of shocks faced, household characteristics like household size, sex, number of dependents, oxen ownerships, the status of indebtedness, as well as households' regional residence of Tigray, Amhara, Oromia and SNNP

Chapter 8. Summary, Conclusions and Policy Implications

8.1. Introduction

Ethiopia is one of the poorest countries in the world, where the scourge of poverty continues to haunt the lives of millions. The considerably high poverty rates in rural Ethiopia makes poverty reduction a challenging task for the government and its development partners. There is growing consensus among researchers and development practitioners that effective poverty reduction programs should be designed based on forward looking empirical evidences. Despite this consensus, limitations of econometric models and lack of comprehensive panel data have brought serious challenges on how to effectively measure household poverty in an *ex-post* and *ex-ante* form. Particularly, the lake of nationally and regionally representative panel data at household level in Ethiopia has been a major drawback in the quest to understand how structurally poor, vulnerable or resilient households are.

Against this background, it is of interest to know the factors that drive poverty, its different manifestations and its prevalence over time. Using the rural category of the Ethiopian Socioeconomic Survey data− three period panel data set (2012, 2014 and 2016), nationally and regionally representative, 3089 households in sample size, this study analyzes households' vulnerability and resilience to poverty in rural Ethiopia during 2012-2016. The study addressed four specific objectives. First, the study identified and assessed the determinants of household poverty dynamics. Second, it estimated and identified the determinants of household vulnerability to poverty. Third, it investigated household resilience. Fourth, the study has also identified and profiled the major shocks and households' shock coping strategies and analyzed the determinants of these strategies.

Apart from these four issues, the environment in which the studied households live is put into account by presenting the context of rural Ethiopia and its regional states in chapter 3.

The aim of this chapter is three-fold. First, to summarize the results presented in the preceding chapters as well as to provide conclusions. Second, to highlight the major contributions of our research to knowledge and suggest key policy recommendations based on the findings. Third, to outline the limitations of the study and suggest the direction for future research. This chapter is, therefore, organized as follows: section 8.2 provide summaries and conclusions from the four empirical chapters in the study. The major contributions to knowledge and policy implications, presented in section 8.3 and 8.4 respectively. Finally, a section on study limitations and areas for future research (section 8.5).

8.2. Summary and Conclusions

This section summarizes the major findings from the study and provide conclusions that are drawn from the findings.

8.2.1. Household Poverty Dynamics in Rural Ethiopia

A profile of rural poverty dynamics across studied households' regional residence and their major characteristics as well as the determinants poverty dynamics is presented in chapter 4. The three period panel data also show a great deal of household movement into and out of poverty between 2012 and 2016. Over the entire 2012–2016 period, 12.5 percent of households were poor in both surveys, 18.5 percent of households moved out of poverty while 24 percent of households moved into poverty, and 45 percent of households were

non poor in both 2012 and 2016. This movement is also observed across major regions of the country.

In order to understand the causes of the high rural poverty and the movement of households into and out of poverty, the study used fixed effects model. The result from the model revealed very pivotal and interesting results. While female headship of the household, number of working members, distance to main road and market center in kilometer, and households' location in midland agro-ecology are the determinants of chronically poor households; the education level of the head, number dependents in the household, and distance to market center are the determinants of transient poverty in rural Ethiopia.

8.2.2. Household Vulnerability to Poverty in Rural Ethiopia

A thorough investigation of household vulnerability to poverty is presented in chapter 5. Under the framework of vulnerability as expected poverty, the study analyzed household vulnerability to poverty following Chaudhuri et al. (2002) methodology using a three-period panel data. Our results during the study periods suggest that, while poverty and vulnerability are closely corresponding and overlap to some extent, they are distinct concepts. In other words, not all the poor are vulnerable, while a significant proportion of the non-poor are vulnerable. Overall, the study found the following major results: 1) poverty and vulnerability are still prevalent in rural Ethiopia during the study period from 2012 to 2016; 2) regional disparity of poverty and vulnerability is substantial across the period.

It is important to note that vulnerability is a function of the expected mean and variance of household consumption. This study therefore, concluded that vulnerability to poverty is

both a function of low expected mean of household consumption as well as the high volatility in the expected variance of household consumptions. Moreover, the average probabilities that a rural household will fall into poverty by regional states and survey rounds indicated that vulnerability to poverty varies over time and space. The result depicts that vulnerability is either slightly increasing or remaining flat from one survey round to the next. Moreover, the sample households in SNNP region has the highest average level of vulnerability in the 2014 and 2016 survey rounds.

8.2.3. Household Resilience Capacity in Rural Ethiopia

A detailed comparative investigation of household resilience is presented in chapter 6. Adapting the contemporary resilience notion from food security literature, this study measures resilience capacity at household level and provides empirical evidence on how the estimated resilience index contributes to understand poverty reduction/food security attainments in rural Ethiopia.

Following the framework and methodology of FAO (2016), household resilience is analyzed using a three-period panel data. Contrary to the concept of vulnerability as understood in this study (the study used only *ex-ante* household consumption as vulnerability indicator), resilience in this case has a multidimensional and unobservable nature. As a multidimensional concept, resilience considered a number of dimensions that can be context and time specific. Its unobservable nature reflects resilience cannot be measured directly rather be indirectly with its underlying structure. The measurement of resilience in this study therefore, aggregated the various dimensions into one single measure, this study call it resilience capacity index. In doing so, while factor analysis multivariate statistical technique is applied for construction of the four dimensions of

resilience capacity index, structural equation modeling is used to construct the final aggregate resilience capacity index and assess the determinants of household resilience.

The result indicated that adaptive capacity, access to basic service and household assets are positively associated with household resilience capacity. The results also suggest that household resilience capacity is negatively associated with social safety nets. The study indicated the differences in overall resilience capacity and the dimensions of resilience capacity between social groups as well as how the contributions of the resilience dimensions change over time.

On average, resilience capacity is found to be higher in the SNNP and Oromia regions. Their higher resilience capacity is mainly driven by adaptive capacity (as they show better income, crop and livestock diversification) and better access to services characterized by availability of health and market centers, credit access as well as shorter distances to the nearest district town. On the other hand, the regions with the lowest average resilience capacity are Others and Amhara. These regions lower resilience capacity is characterized by low adaptive capacity and access to services.

Overall, our result contends that improving our understanding of what contributes to, or constitutes, household's resilience requires not only the development and field-testing of robust and measurable indices, but also a better insight into the multiple access to services, adaptive capacity and asset factors that influence and affect household capacity to respond to shocks and risks.

8.2.4. Shock Exposure and Coping Strategies in Rural Ethiopia

Chapter 7 of this dissertation documented the major shocks rural households in Ethiopia encountered and the main coping strategies household used to respond the adverse impacts of those shocks. Moreover, the chapter analyzed the determinants of these strategies applications by households using multivariate probit model.

A comparative static analysis of the three-period panel surveys shows a consistent pattern of shock-coping situations in rural Ethiopia. While about 47% of the sample households experience at least one type of shocks in the past 12 months in the 2012 survey round, the number radically increases to 59% in the 2016 round. And overall households experience a great deal of shocks during the 2016 survey round than the other survey rounds. Food price rise, drought, illness and input price rise are the most prevalent shocks that affect rural households in Ethiopia. Sporadic variation is observed in the distribution shocks across major regional states as well as survey rounds. While SNNP s and Amhara regions are the worst hit by drought, food and input price rise in the three survey round, Tigray and Oromia are relatively affected by those shocks. This indicate the high exposure of households to various shocks in rural Ethiopia and hence are at risk of falling into poverty in the future.

In responding such shocks, the study found that 37% and 26% of all households actively undertook actions to cope with shocks in the 2012 and 2014 survey rounds respectively while the number rose to 48.6% in the 2016 round. The main coping strategies are using saving, getting assistance from relatives and government, borrowing money on credit, selling livestock and engaging in spiritual activities. This study also found clear differences in terms of coping strategies across shock types.

The results of the multivariate probit model revealed that households' coping strategies are significantly triggered not only by major shocks they encountered, but also by some household and community as well as regional characteristics. While the three shocks, namely, drought, food price rise and illness are more likely to trigger all the three coping strategies, input price rise typically trigger a need for using saving, borrowing money on credit, selling livestock and engaging in spiritual activities.

Religion and literacy status of the household head are found to be significant determinants of the choice of some coping strategies. Households with Christian religion are less likely to use saving and relative help. While literate heads are more likely to use their savings, they are less likely to depend on help from the government and selling livestock for shock coping. Households with higher number of oxen are more likely to adopt selling livestock as a coping strategy. The residence of rural households in the major regions of the country significantly affect the choice of particular coping strategies such as savings and selling livestock.

8.3. Contribution to Scholarship and Originality

This section provides a brief description of the research issue in each empirical chapters and our contribution to the existing body of knowledge. Unlike previous studies that rely on *ex-post* static analysis of household poverty, this study examined this issue with regard to dynamic measure of *ex-post* and *ex-ante* poverty. Given the evidence that dynamic measurement of poverty using *ex-post* and *ex-ante* estimates of poverty provide different policy implications, this study separately examined the determinants of dynamic poverty in the cases of dynamic poverty determinants (chapter 4) and vulnerability to poverty (chapter 5). Although the need of measuring dynamic poverty is highlighted in the

literature, the empirical work is still limited, especially in the context of rural Ethiopia, even after the catastrophic 2015/2016 drought. Moreover, most studies on dynamic poverty have limitations in sample size and appropriate long term panel data to generate full-fledged results. While most studies are on case study basis for national and regional level inferences, others are based on cross-sectional data due to lack of long term panel data sets like in many developing countries. Hence, since the majority of studies have these limitations, studies that generate a national and regional level estimates are keenly needed. Chapter 4 and 5 contribute to this limitation in the literature by applying quantitative models that measure *ex-post* and *ex-ante* determinants of poverty.

In conventional welfare literature, there is still fierce ongoing debate on the divide between vulnerability and resilience. Chapter 6 measure household resilience as a multidimensional latent construct that complement vulnerability to poverty assessment. This chapter makes two major contributions to household welfare literature. First, household welfare and hence poverty is a broader concept that includes multiple indicators, our analysis goes beyond the single measurement (poverty and vulnerability in this study). This study used 14 indicators to represent four dimensions of resilience capacity: access to basic services, adaptive capacity, assets and social safety nets. Thus, our analysis contributes the general paucity of research on multidimensional resilience measurement, especially in the case of rural Ethiopia. Second, the rapidly concern on shock induced recurrent negative welfare outcomes (poverty, food insecurity), resilience become an emerging issue to understand the capacity of households in dealing with shocks while maintaining their wellbeing. Recognizing the relationship of resilience with poverty and vulnerability, our analysis

contributes to the literature on household resilience research as one objective to reduce poverty and vulnerability rather than resilience as the objective of development efforts.

In chapter 7 investigates the determinants of a household's decision to undertake coping actions and the choice of a specific coping activity in order to provide more effective risk management strategies. Despite, many studies try to understand the effect of shocks with direct welfare outcome variables, there are limited empirical evidence on households' shock coping strategies. This chapter is concerned with documenting the major shocks households exposed to and to understand how households cope with shocks in rural Ethiopia. This study thereby contributes to the overlooked quantitative analyses on the choice of a specific coping activities in the face of shocks.

8.4. Implication for Policy

The results from this study point to a number of policy issues that need to be addressed if household poverty is to be significantly reduced in rural Ethiopia. The implications for policy arising from this study are substantial. Poverty in Ethiopia is prevalent and is still a serious development concern. In other words, why have policies and programs not successful in reducing poverty? Therefore, the growth oriented anti-poverty policies should be revisited as a development agenda of the country. Specifically, the issue of vulnerability as characteristics of household well-being has important implication in order to effectively target the sections of the population that are at risk of welfare losses in the future. Poverty reduction strategies and programs need to consider not only the currently poor but also the vulnerable. For instance, if the government need to put in place some poverty reduction measures based on the poverty incidence among the sample rural households in 2014, the program would not include the 19% of the households that are non-poor in 2014 but had a

more than 33% chance of being poor by 2016. Therefore, it is that group that needs to be included in poverty reduction strategies if policy makers and development practitioners wish to effectively target populations at-risk of falling into poverty in the future.

The identified determinants of poverty dynamics and vulnerability would also provide important policy implications. The education of household head and its members predisposes household to poverty, both observed and expected an aggressive human capital development policy must be strengthened to mitigate high levels of poverty among rural household in Ethiopia. As households' income sources increases, both observed and expected poverty decreases, therefore, strengthening diversified income sources is another necessary component in the strategy for militating against high levels of poverty among rural household in Ethiopia. Overall, the results of this study imply that policies and strategies aimed at reducing poverty should seriously consider factors that make households chronically poor and vulnerable to poverty. Given the government's resource constraint for anti-poverty interventions, the findings suggest more careful investigation into the vulnerable, chronically poor and non-poor households are necessary to make efforts for more accurate and effective policy targeting for poverty reduction.

As the results from resilience assessment complement to some extent with the results of *ex-post* and *ex-ante* poverty analysis, policies aiming at poverty reduction should consider factors that increase the resilience capacity of households living in risky environments. Given that adaptive capacity is highly relevant in explaining resilience, poverty reduction policies and programs should focus on diversifying households' livelihood strategies and improving their education.

Moreover, policies should target and prioritize programs that enhance household assets with a strong focus on improving access to essential social services (market, credit, extension). To improve the well-being of the currently poor as well as the most vulnerable, resilience oriented programming is an important development strategy for rural Ethiopia. Overall, the results from resilience analysis could contribute for policy design and program interventions as; it helps in identifying the most relevant characteristics that contribute to build resilience capacity at household level as well as it can be used to reduce the multidimensionality of the resilience capacity into an index suitable for targeting purposes. From a pro-poor perspective, our resilience assessment pivot to identify the least resilient households and help in designing targeted specific interventions to enhance their own resilience capacity, and hence reducing the household vulnerability to poverty.

Moreover, policy makers need to institute strategies that reduce households' exposure to shocks and enhance their coping capacity. Household welfare development in the form of improved health services to reduce illness and raise labor productivity, improved education to build skills and broaden livelihood opportunities beyond agriculture can be effective in reducing household poverty and vulnerability. To strengthen household's coping capacity, it is necessary for policy makers to extend the scope and intensity of public support scheme to especially attend the poor not only giving relief transfers in the short-run but also giving assistance in building savings, create favorable credit borrowing conditions in the long-run. In addition, public efforts can be fostered to promote livestock ownership alongside the promotion of traditional social networks.

8.5. Study Limitations and Areas for Future Research

While the study provides an exposition on poverty dynamics, vulnerability to poverty, resilience and coping strategies in rural Ethiopia, it is important to keep in mind that these findings are based on households; subjective assessments and recall of shock events. The shock module used in this study is based on a one-year recall period. As such it is likely that the quality of data might have been compromised by the length of the recall period[17]. Moreover, the study equates past shocks with future risks. The disregard of the actual exposure to, as well as of the probability and potential severity of, risks leads to criticize the common focus of vulnerability literature on fate rather than on fear in households (Dercon, 2008).

While the shock variables used in this study tended to focus on capturing the role of shocks on household consumption paths, they do not necessarily reflect adequately the future risk profile of household consumption. Thus, it may be very useful to additionally capture household risk perception. The contribution of risk perception data on vulnerability to poverty is immense in several ways and found in vulnerability studies (Ligon and Schechter, 2003; Elbers et al., 2007; Dercon, 2008). It would have been more interesting if the study could have investigated the impact of future shocks (risk perception) on households' poverty dynamics and their vulnerability.

A number of areas for future research are identified and suggested. First, a possible extension of this study is to analyze the vulnerability and resilience on urban households. Most studies in developing countries and in Ethiopia show that poverty analysis are

[17] There is a wide debate in the literature on the effect of the length of the recall period on the quality of survey data (Green, 2008).

conducted separately between rural and urban areas, even though they are closely linked through different factors like migration, remittances food markets and other factors. Because of the high number of the rural population (around 85 percent) in Ethiopia, the country's development policies and programs focus on the rural population including poverty analyses research. Despite this reality, urban poverty is one the country's serious challenge since the 1990's. For instance, according to the government data, while the number of rural poor accounts 45.4% (2000), 39% (2005), 30.4% (2011); the number of poor in urban areas account 37% (2000), 35% (2005) and 26% (2011) (MoFED, 2012), indicating poverty has urban dimension in Ethiopia. Moreover, the existing limited empirical studies indicated that urban poverty in Ethiopia is also one the serious challenge facing urban households (Bigsten et al., 2003; Bigsten and Shimeles, 2011; Yonas and Soderbom, 2012). Therefore, to fully understand the nature and prevalence of poverty in Ethiopia, it is advisable to analyze the determinants of *ex-post* and *ex-ante* household poverty as well as household resilience in the context of urban households.

Second, among the vulnerability to poverty measures, the vulnerability as uninsured exposure to risks provides a suitable basic analytical framework to assess resilience (FAO, 2013, 2016). Therefore, a comparison of uninsured exposure to risks measure and household resilience capacity measure can be made to validate the reliability of resilience measurement methodology for vulnerability to poverty. Thirdly, measuring poverty most of the time depend on the basis of household consumption expenditure or energy intake that ignore households' deprivation on multiple fronts such as education, health, and living standard (i.e., multidimensional poverty). And little is known about the prevalence of multidimensional poverty and vulnerability to poverty in Ethiopia because of the empirical

work concentrated on examining the uni-dimensional measure of poverty (using household consumption) including this study. As the ESS data contains rich information on these aspects at household level, the multidimensional nature of poverty, and hence vulnerability can be assessed in rural Ethiopia context.

Finally, the issue of resilience has been increasingly recognized as a potentially useful concept to help practitioners, policy-makers and researchers better understand the links between shocks, response and longer-term development outcomes like poverty and food insecurity (Béné et al., 2014; Constas et al., 2014; d'Errico et al., 2016). Although it is very encouraging in operationalizing the resilience concept as a policy objective, the way to fully operationalize it still takes long process and need further necessary evidences especially issues related with shocks and risks. And extra avenues for further research are still needed in the context of poverty analysis. This study therefore, underscore the need for further in depth resilience enquiry alongside *ex-post* and *ex-ante* poverty analysis.

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Appendices

Appendix 3.3.1. Sections of the ESS Data used for this study

Questionnaire	Section	Topic	Description
Household	Section 1	Roster	Roster of individuals living in the household and basic demographics; for members less than 18, parental education and occupation.
	Section 2	Education	Educational attainment, enrollment, attendance, school characteristics, and expenditure
	Section 3	Health	Health problems, types of injury/illness, medical assistance/ consultation, disabilities, and anthropometrics (children under five years).
	Section 5A	Food Expenditure last 7 days	Food consumption (quantity and value) by any household member in the last 7 days by source for a subset list of food items.
	Section 6	Non-food Expenditure	Household expenditures on non-food items.
	Section 8	Shocks	Shocks during the last 12 months and their impact on income, assets, food production, stock and purchase.
	Section 9	Housing	Dwelling ownership, and characteristics of the dwelling and utilities.
	Section 10	Household Assets	Household ownership of assets.
	Section 11	Non-farm Enterprise	Characteristics of enterprises owned by the household.
	Section 12	Other income	Others sources of household income during the last 12 months.
	Section 13	Assistance	Assistance provided to the household by governmental and non-governmental agencies.
	Section 14	Credit	Loans or credit received by the household.
Agriculture (Post-planting)	Cover	Cover	Holder location identification; household head name, holder name, household size, agriculture holding type (farming, livestock, or both); field staff identification.
	Section 2	Parcel Roster	Information on all parcels owned and/or managed by the holder
	Section 4	Crop Field Roster	Crop planting/management information for each crop on each field.
	Section 7	Miscellaneous	Information on holder characteristics including chemical fertilizer use, and access and use of credit, extension/advisory services.

Appendix 3.3.1. *(Continued)*

Questionnaire	Section	Topic	Description
Agriculture (Post-harvesting)	Section 11	Crop Disposition / Sales	Crop disposition/sale information. This section excludes permanent, tree and root crops.
Agriculture (Livestock)	Section 8A	Livestock Population & Products	Characteristics of livestock owned.
	Section 8C	Livestock Byproduct	Production and utilization of livestock byproducts.
Community	Section 4	Access to Basic Services	Transportation, markets, proximity to the nearest town and major urban centers, electrification, bank and microfinance institutions, piped water.
	Section 10	Market Prices	Market prices in the first closest market center.

Source: Author's compilation using ESS; 2012, 2014 and 2016.

Appendix 3.3.2. Compositions of Food and Non-Food Items (Consumption Expenditure)

Food composition (Amount in 100g of edible portion)			Non-Food composition (ETB)	
S/N	Food items	kcal	S/N	Non-food Expenditures
1	*Teff*	345	1	Matches
2	Wheat	344	2	Batteries
3	Barely	339	3	Candles, incense
4	Maize	363	4	Laundry soap/local soap
5	Sorghum	355	5	Hand soap
6	Millet	363	6	Other personal care goods
7	Horse beans	339	7	Charcoal
8	Chick pea	340	8	Firewood
9	Field pea	340	9	Kerosene
10	Lentils	339	10	Cigarettes, tobacco,
11	Haricot beans	339	11	Transport
12	Niger seed	579	12	Clothes/shoes/fabrics for men
13	Linseed	579	13	Clothes/shoes/fabrics for women
14	Onion	48	14	Clothes/shoes/fabrics for boys
15	Banana	116	15	Clothes/shoes/fabrics for girls
16	Potato	75	16	Kitchen equipment
17	*Kocho/bula*		17	Linens (sheets, blankets)
18	Meat	202	18	Furniture
19	Milk	64	19	Lamp/torch
20	Cheese	355	20	Ceremonial expenses
21	Eggs	158	21	Contribution to *Iddir*
22	Sugar	400	22	Donation to the church
23	Salt	400	23	Taxes and levies
24	Coffee			
25	*Chat*/*khat*			

Source: Author's compilation using ESS; 2012, 2014 and 2016.

Appendix 5.3.1. Ordinary Least Square Model Test Results

Multicolliniarity and model specification tests for vulnerability to poverty model

The 2012 ESS Survey Round (Wave 1)

vif

Variable	VIF	1/VIF
age	31.42	0.031827
age2	31.30	0.031952
grade	4.70	0.212708
lite	3.04	0.329441
ave_educ_mem	2.44	0.409819
agro_mid	1.70	0.587020
agro_high	1.68	0.597002
dist_road	1.27	0.785814
incomd	1.23	0.812123
dist_market	1.21	0.828361
working	1.20	0.834372
depen	1.17	0.852089
social	1.09	0.918355
mmx_abs	1.07	0.932761
female	1.06	0.942385
oxen	1.05	0.950706
Mean VIF	5.41	

As VIF is not greater than 10, no multicolliniearity (N.B, age and age2 >10 b/c of squaring)

. linktest

Source	SS	df	MS		
Model	10.0241095	2	5.01205474	Number of obs	= 3,089
Residual	8.2297e-10	3,086	2.6668e-13	F(2, 3086)	> 99999.00
Total	10.0241095	3,088	.003246149	Prob > F	= 0.0000
				R-squared	= 1.0000
				Adj R-squared	= 1.0000
				Root MSE	= 5.2e-07

lcx	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
_hat	.9999818	.000032	3.1e+04	0.000	.999919	1.000045
_hatsq	1.07e-06	1.88e-06	0.57	**0.569**	-2.62e-06	4.76e-06
_cons	.0000773	.0001363	0.57	0.570	-.0001898	.0003445

As _hatsq is not significant no specification problem

The 2014 ESS Survey Round (Wave 2)

```
vif

    Variable |       VIF       1/VIF
-------------+----------------------
         age |     33.57    0.029791
        age2 |     33.49    0.029856
       grade |      4.22    0.236697
        lite |      3.03    0.330443
ave_educ_mem |      2.08    0.481348
      incomd |      2.02    0.495979
      social |      1.90    0.526141
    agro_mid |      1.55    0.646004
   agro_high |      1.53    0.654698
   dist_road |      1.30    0.771340
 dist_market |      1.25    0.799170
       depen |      1.17    0.851421
     working |      1.14    0.879185
     mmx_abs |      1.10    0.909509
        oxen |      1.07    0.935474
      female |      1.07    0.938262
-------------+----------------------
    Mean VIF |      5.72

. linktest

      Source |       SS           df       MS      Number of obs   =     3,088
-------------+----------------------------------   F(2, 3085)      >  99999.00
       Model |  58.6426036         2  29.3213018   Prob > F        =    0.0000
    Residual |  7.8512e-10     3,085  2.5450e-13   R-squared       =    1.0000
-------------+----------------------------------   Adj R-squared   =    1.0000
       Total |  58.6426036     3,087  .018996632   Root MSE        =    5.0e-07
------------------------------------------------------------------------------
         lcx |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        _hat |   .9999971   5.13e-06  1.9e+05   0.000     .9999871    1.000007
      _hatsq |   1.74e-07   3.07e-07     0.57   0.572    -4.29e-07    7.76e-07
       _cons |   .0000117   .0000214     0.55   0.585    -.0000303    .0000537
------------------------------------------------------------------------------
```

As VIF is not greater than 10, no multicolliniearity (N.B, age and age2 >10 b/c of squaring)

As _hatsq is not significant no specification problem

The 2016 ESS Survey Round (Wave 3)

vif

Variable	VIF	1/VIF
age	35.29	0.028336
age2	35.19	0.028419
grade	4.04	0.247236
lite	3.13	0.319545
ave_educ_mem	1.95	0.512395
agro_low	1.73	0.578581
agro_mid	1.68	0.595712
dist_road	1.26	0.791880
dist_market	1.22	0.819858
depen	1.20	0.834758
working	1.18	0.845189
female	1.06	0.939508
oxen	1.06	0.943592
social	1.02	0.975894
mmx_abs	1.02	0.979340
incomd	1.02	0.981176
Mean VIF	5.82	

As VIF is not greater than 10, no multicolliniearity (N.B, age and age2 >10 b/c of squaring)

. linktest

Source	SS	df	MS	Number of obs	= 3,089
Model	45.7290321	2	22.864516	F(2, 3086)	> 99999.00
Residual	8.3161e-10	3,086	2.6948e-13	Prob > F	= 0.0000
				R-squared	= 1.0000
				Adj R-squared	= 1.0000
Total	45.7290321	3,088	.014808624	Root MSE	= 5.2e-07

lcx	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
_hat	1.000001	7.32e-06	1.4e+05	0.000	.9999864	1.000015
_hatsq	-4.54e-08	4.45e-07	-0.10	**0.919**	-9.18e-07	8.27e-07
_cons	-2.93e-06	.0000301	-0.10	0.923	-.000062	.0000562

As _hatsq is not significant no specification problem

Appendix 6.3.2: Resilience Variables Factor Loadings from Factor Analysis

The 2012 ESS Survey Round (Wave 1)

Factor loadings (pattern matrix) and unique variances for ABS

Variable	Factor1	Factor2	Factor3	Uniqueness
markt	0.0089	-0.0255	0.0526	0.9965
health	0.1130	-0.2090	-0.0103	0.9434
credit	0.5129	0.0640	0.0001	0.7329
ext	0.5279	0.0043	0.0008	0.7213
town	-0.0523	0.2147	-0.0038	0.9511

Factor loadings (pattern matrix) and unique variances for AC

Variable	Factor1	Factor2	Uniqueness
cropd	0.3996	0.1087	0.8285
lived	0.3400	0.0675	0.8799
incomd	0.3584	-0.1940	0.8339
literacy	0.0095	0.3312	0.8902

Factor loadings (pattern matrix) and unique variances for ASS

Variable	Factor1	Factor2	Uniqueness
welthd	0.1458	-0.0131	0.9786
land_pc	0.0592	0.0304	0.9956
tlu_pc	0.1591	0.0007	0.9747

The 2014 ESS Survey Round (Wave 2)

Factor loadings (pattern matrix) and unique variances for ABS

Variable	Factor1	Factor2	Uniqueness
markt	0.0189	-0.1880	0.9643
health	0.1642	-0.0973	0.9636
credit	0.4719	0.0982	0.7677
ext	0.5035	0.0139	0.7463
town	-0.1574	0.2149	0.9291

Factor loadings (pattern matrix) and unique variances for AC

Variable	Factor1	Factor2	Uniqueness
cropd	0.3207	0.1272	0.8810
lived	0.2035	-0.1870	0.9236
incomd	-0.4012	0.0336	0.8379
literacy	0.1822	0.0589	0.9633

Factor loadings (pattern matrix) and unique variances for ASS

Variable	Factor1	Uniqueness
welthd	0.2476	0.9387
land_pc	0.1100	0.9879
tlu_pc	0.2459	0.9395

The 2016 ESS Survey Round (Wave 3)

Factor loadings (pattern matrix) and unique variances for ABS

Variable	Factor1	Factor2	Factor3	Uniqueness
markt	0.0089	-0.0255	0.0526	0.9965
health	0.1130	-0.2090	-0.0103	0.9434
credit	0.5129	0.0640	0.0001	0.7329
ext	0.5279	0.0043	0.0008	0.7213
town	-0.0523	0.2147	-0.0038	0.9511

Factor loadings (pattern matrix) and unique variances for AC

Variable	Factor1	Factor2	Uniqueness
cropd	0.3996	0.1087	0.8285
lived	0.3400	0.0675	0.8799
incomd	0.3584	-0.1940	0.8339
literacy	0.0095	0.3312	0.8902

Factor loadings (pattern matrix) and unique variances for ASS

Variable	Factor1	Uniqueness
welthd	0.1458	0.9787
land_pc	0.0592	0.9965
tlu_pc	0.1591	0.9747