Assessment of Vulnerability to Persistent Deprivation: Evidence from A Peripheral Pastoralist Population in Ethiopia

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Abstract

This paper examines household vulnerability to poverty in a traditional pastoralist society inhabiting a peripheral dryland environment. The extent and determinants of vulnerability to poverty among a pastoralist population in southern Ethiopia is examined based on single cross-section consumption data and asset-based approaches. A considerable segment of households that are vulnerable is the non-poor, which implies that the conventional stance of targeting the currently poor alone is not enough. In aggregate, results for this sampled peripheral population generally indicate trends inconsistent with Ethiopia's recent macroeconomic developments of remarkable growth performance and falling poverty rates. Overall, the prevailing status and trends signify the need for comprehensive long-term programme design that equally embraces poor and non-poor pastoralists.

JEL Classification: O12, O13, Q56
Keywords: Borana, Pastoralism, Poverty, Vulnerability, Ethiopia

1. Introduction

This paper assesses household vulnerability to poverty by looking at a traditional pastoralist society inhabiting a peripheral dryland environment. Vulnerability is a dynamic and broad concept, which takes into account the future risk of shocks and consequent destitution of individuals/households (Dutta et al, 2011). In particular, climate-induced recurrent pastoral shocks can limit the long-term livelihood sustainability of the system of traditional pastoralism. Pastoralism is a livestock-based system of production that supports millions of inhabitants in African dryland areas. African mobile herders traditionally raise livestock on extensive communal rangelands where the climate does not aid crop-based livelihoods (Berhanu, 2011). In traditional pastoralist systems, livestock herders normally attempt to accumulate livestock assets while facing the hardship of adverse exposure to risk of failures and an associated state of chronic deprivation (poor well-being). The traditional pastoralist mode of asset accumulation often exhibits cyclical movements, which take the form of booms of aggressive herd build-ups, partly as a traditional pastoral risk management strategy, followed by the depressed state of consequent range degradation and crushing effects of climatic shocks, and thereafter the system's resilient recovery efforts in response. African pastoralist livelihood systems are often characterized by gloomy predictions associated with the adverse long-term downward spiral effects of their increasing susceptibility to repeated catastrophic external shocks and various livelihood pressures (Webb and Coppock, 1997; Morton and Meadows, 2000; UN OCHA-PCI, 2006). This pastoralism has often been accompanied by a tendency of national governments to look upon pastoralism as a transitory mode of life, and thus, relatively speaking, an area of less priority concern in their investment plans (Rass, 2006).

Ethiopia is among the top five countries in Africa where pastoralism is practiced in the vast arid and semi-arid lowland territories of the country (Markakis, 2000; Berhanu, 2011). Pastoralism is a direct source of livelihood to 12 million–15 million traditional herders who live in precarious conditions in arid and semi-arid peripheral areas where they manage about 60% of the country's landmass. The pastoral sector, with an estimated share of 42% of the national livestock population, is a key source of high-quality indigenous livestock for urban meat supply, and provides foreign exchange earnings from live animal and meat exports in the present context of increasing global demand for livestock products. Recent Ethiopian export statistics

(NBE, 2016) indicate that, on average, 12.2% of the country's foreign exchange earnings originate from supplies from the livestock sector. Nearly 70% of this comes from live animal and meat exports. It is estimated that 95% of Ethiopia's live animal and meat exports come from pastoral areas, and the largest proportion of this formal channel livestock export supply currently originates from the Borana rangelands (see Teklewold et al, 2008). Moreover, estimates show that 40–50% of meat supplies to domestic markets come from pastoral areas, and 20% of plough oxen used by surrounding highland farming communities originate from lowland pastoralist territories (Future Agriculture, 2014). The pastoral sector is also a source of cattle for cross-breeding dairy development programmes in the highlands Here, from about 25 indigenous cattle breeds identified in Ethiopia (see Shapiro et al, 2015), with the exception of a few breeds such as Horo cattle, the Borana breed has been the most extensively demanded breed in productivity enhancing cross-breeding programmes in the country. Despite these valuable contributions, Ethiopia's pastoral areas are currently characterized by extreme vulnerability to climate-induced shocks and consequently have a high incidence of poverty. Peripheral pastoralist societies, which inhabit remote lowland and border areas, are generally one of the most vulnerable segments of the rural poor in Ethiopia. Pastoralist livelihood prospects and future well-being are inextricably linked to the complex dynamics of evolving processes of change in the natural habitat of dryland ecosystems, and to their socioeconomic and political isolation and prolonged marginalization (that is, powerlessness and exclusion from political processes of the country). Pastoral household vulnerability to poverty in the dryland areas of Ethiopia is generally believed to be driven by a catalogue of challenges, which include climate variability, catastrophic asset losses (huge livestock deaths) triggered by periodic droughts, stiff resource competition, politically motivated threatening risks of violent conflicts, and inappropriate policy interventions (Rettberg, 2010; Pavanello, 2009; Devereux, 2006). These multiple external pressures along with other trends, such as high population growth and a shrinking grazing resource base, may have brought about pastoralists' increased risk of exposure to widespread permanent destitution.

In particular since the great Sahelian drought of the early 1970s, Ethiopia's pastoralists have notoriously experienced devastating cyclical droughts and erratic climatic conditions. This has caused increasing vulnerability and their subsequent heavy and growing dependence on external relief assistance. The poverty rate is currently the highest and above the national average in the pastoralist regions (UNDP, 2015). The livestock commercialization and increased pastoralist market integration efforts of past internationally financed large scale rangeland development interventions have largely failed to achieve their main aims (Coppock, 1994; Berhanu, 2015). The recent moderate efforts of rangeland development and social protection programmes in these areas also don't show substantial outcomes in poverty reduction.

The existing social protection programmes in pastoral areas of the country are primarily aimed at households that are currently observed to be poor. These targeted programme interventions are generally based on some ex post measure

of pastoral households' well-being. However, poverty as a structural problem or stochastic phenomenon is often triggered by recurrent exposure to a wide variety of shocks, which could push the rich into poverty or keep the currently poor in a state of permanent deprivation (Chaudhuri et al, 2002). In other words, in addition to current income, the well-being of a pastoral household is substantially determined by its environmental circumstances, that is potential exposure to adverse shocks. The concept of vulnerability, therefore, in a sense signifies the existence of livelihood risks which can adversely affect households' welfare. The dynamic and multidimensional nature of poverty entails the need for an ex ante strategic focus on attacking poverty, especially in view of the prevailing environment of various livelihood risks that create adverse conditions and increase the likelihood of falling into poverty traps (Naudé et al, 2009). It is particularly critical in the unique case of traditional pastoralist societies that strategic interventions should be guided by forward-looking measures which reflect the future prospects of pastoral households' well-being. Therefore, this paper's main aim is to estimate vulnerability measures in the context of traditional pastoralist societies through a case study from the southern Ethiopian rangelands.

2. Research problem

Poverty reduction is a challenging strategic issue of concern in dryland areas of Ethiopia. However, a general understanding of the current status of welfare is not enough to successfully attack poverty in these marginal environments without taking into account the prevailing condition of pastoral households' risk of exposure to sudden deprivation and possible permanent destitution. Temporary income shocks may entail transitory poverty among pastoral households. However, an important task that is crucial for policy is the identification of those that are potentially becoming vulnerable to shock-induced poverty traps due to their inability to recover from inherently damaging recurrent exposure to extreme events such as droughts. This will help to focus efforts and commit resources to effectively prevent massive pastoralist destitution instead of temporarily focusing on those who are currently poor. Conventional poverty measures are well-established tools for expressing the current welfare status and the incidence of deprived well-being in a population. However, welfare status measured at a particular point in time does not necessarily reflect the future well-being of a household. Since household welfare is also crucially associated with the level of likelihood to be exposed to risk, the presently non-poor themselves may experience undesirable shifts in their status as a result of negative shocks. This is especially the case among peripheral pastoralist communities living in fragile dryland environments that are characterized by significant uncertainty and erratic weather conditions. A feature of vulnerable livelihoods in the context of pastoralism is that, in addition to controlling the risks and instability typically inherent in the system, pastoralist societies are also often considered to suffer from "induced vulnerability", which characteristically arises from unexpected or cumulative incapacity to run the system due to structural shifts fundamentally trigged by external shocks (Krätli et al, 2013).

The static standard poverty measures commonly used in poverty reduction efforts normally fail to take into account the impact of household dynamic exposure to the risks of policy-induced external pressures and other exogenous shocks prevalent in pastoral production systems. Therefore, in addition to observed current welfare levels, it is essential to assess the expected poverty status in rangeland ecosystems. Poverty reduction efforts and strategic policy interventions in pastoral areas should rather essentially take into account the level of pastoral household vulnerability to poverty, which is crucial to gain a full understanding of the risk of these households

staying into or falling into poverty in the future. Targeted intervention efforts by the government and non-governmental agencies in these areas, often with exclusive focus on the currently poor, clearly fail to look further and do not consider the unique nature of these environments in terms of their susceptibility to higher expected poverty. Therefore, a detailed and systematic assessment of household vulnerability to poverty in this unique setting of higher risk of susceptibility to sudden destitution is indispensable. Preventive anti-poverty intervention efforts need to be considered ex ante rather than is the case in the predominant approach, which entails that social protection and related poverty alleviation programmes are implemented ex post.

A significant policy issue in the prevailing precarious circumstances of peripheral herder societies is the need to emphasize their vulnerability to asset poverty, and hence the implied capacity to maintain sustainable livelihoods, rather than interventions that are merely based on a current state of deprivation. However, there is a shortage of systematic inquiry into the level and determinants of household vulnerability to poverty among the pastoralist populations inhabiting the arid/semi-arid peripheral lowland territories of Ethiopia, partly due to them being remote and isolated. It is common for Ethiopia's national statistical surveys to neglect or inadequately cover pastoral systems. The existing few illustrative vulnerability studies in the country have rather entirely focused on the relatively more accessible areas of highland mixed agricultural systems (e.g. Deressa et al, 2009; Calvo and Dercon, 2013). Therefore, based on data generated through an own recent survey of the region, this paper intends to bridge this gap by assessing the vulnerability of mobile pastoral herders through a case study from southern Ethiopia. It specifically addresses the following questions: To what extent is the peripheral herder vulnerable? What are the major determinants of vulnerability to poverty among the pastoralist population? How severe is the plight of the target population in terms of vulnerability to asset poverty?

3. Research objectives, methodology and data source

The general objective of the paper is to assess the nature of household vulnerability to poverty in the special context of pastoralist production systems. It is specifically designed to investigate the extent and determinants of vulnerability to poverty among the pastoralist population in the Borana rangelands of southern Ethiopia.

Conceptual framework and empirical methodology

The notion of vulnerability embraces adverse exposure to risk and the associated state of deprivation. Vulnerability is a general term with widely differing technical meanings across disciplines. However, the general focus in many cases is the measurement of welfare as compared to some benchmark in a complex uncertain environment of stochastic shock exposure and the associated capacity of adaptive response mechanisms (Hoddinott and Quisumbing, 2003). Development economists broadly consider vulnerability as a risk of falling into or remaining in an undesirable state of well-being due to some form of exposure to idiosyncratic or covariate shocks. The multidimensional nature of well-being signifies that it can be expressed in terms of various types of measures including income, consumption and other proxies such as asset-wealth status. This essentially denotes the linkage between the concept of poverty, which refers to the ex post realization of a household's state of well-being, and the notion of vulnerability (to a state of deprived well-being) as the ex-ante probability of an attained level of welfare (Chaudhuri et al, 2002). A distinction between poverty and vulnerability is that the latter is extended to include risk, which is signified by a condition where the currently non-poor are in danger of being in a state of deprived well-being due to unpredictable future misfortunes (covariate and idiosyncratic shocks).

There is considerable disagreement in the burgeoning vulnerability literature as to how the term should be conceived and measured. Well summarized presentations of suggested approaches and perspectives are found in Hoddinott and Quisumbing (2003) and Guimaraes (2007). The complex and daunting task of predicting future poverty has prompted several approaches, which suggested different measures of vulnerability (e.g. Chaudhuri et al, 2002; Christiaensen and Subbarao, 2004; Dutta et al, 2011; Calvo and Dercon, 2013; Gallardo, 2013).

Vulnerability as expected poverty (VEP) is the most commonly used approach in recent studies. Here, following Chaudhuri et al (2002), we consider vulnerability

as the probability of falling below an established welfare threshold indicator, Z. We accordingly define the vulnerability of household h at time t as the probability that the household will be poor at time t +1:

$$\boldsymbol{VEP_{h,t} = Pr\left(C_{h,t+1}\right) < Z} \tag{1}$$

where $C_{h,t+1}$ is a household's per capita consumption at time t+1 and Z is the appropriate poverty line. At a general conceptual level of conceived underlying influential factors and associated behavioural response mechanisms, a pastoral household's measured well-being at any period of time is given by:

$$\boldsymbol{C_{h,t} = C\left(X_{h,}A_{h,}\beta_{t,}\alpha_{h}, e_{ht}\right)} \tag{2}$$

where $C_{h,t}$ = a household's measured well-being at time t, X_h = a vector of a household's socioeconomic characteristics (including, among other things, household size and composition, age, gender, human capital and wealth status), A_h = a household's adoptive risk management response, β_t = a vector of parameters describing the aggregate state of macroeconomic and socio-political factors at time t, α_h = unobserved but fixed household characteristics, and e_{ht} = stochastic factors that contribute to differences in inter-household welfare levels. Vulnerability to poverty can be derived by substituting from Equation 2 into Equation 1:

$$VEP_{ht} = Pr\left(C_{h,t+1} = C\left(X_{h,}A_{h,}\beta_{t+1,}\alpha_{h,}e_{t+1}\right) \leq Z|X_{h,}A_{h,}\beta_{t,}\alpha_{h,}e_{ht}\right) \tag{3}$$

Equation 3 represents a general conceptual expression that vulnerability to poverty is broadly based on the stochastic properties of periodic movements in a household's measured well-being, which are in turn affected by a host of influences of specific household characteristics, aggregate socioeconomic and natural environmental factors, and corresponding mechanisms of adaptive response behaviour directed to smooth out possible fluctuations in household consumption. It is a general formulation that the probability of falling into poverty, in addition to the current status of household socioeconomic characteristics and underlying response behaviour, is based on unanticipated changes in the structure of the economy (represented by β_{t+1}) and aggregate shocks (e_{t+1}). The possible contributions of β_{t+1}, which is considered to be stable or constant across households, and aggregate shocks ($e_{h,t+1}$), are usually neglected due to lack of information, especially in estimations based on single period cross-section consumption or income data.

A central assumption of using single cross-section data for vulnerability assessment is fundamentally associated with its key consideration that cross-section variability approximates inter-temporal variation. A larger part of the observed cross-sectional variability in household consumption levels is assumed to be explained by differences in their observable characteristics rather than unobserved household-specific determinants that are persistent over time (Chaudhuri, 2003). In this sense, cross-sectional variance may capture inter-temporal variability resulting from idiosyncratic risks. The approach assumes that household risk response mechanisms are generally similar over time, the macroeconomic environment is fairly stable, and that shocks do not result in "survivorship bias" (Chaudhuri, 2003; Hoddinott and Quisumbing, 2008). It is often indicated that the approach may not produce good vulnerability estimates in the case of time varying (household invariant) large common economic shocks. Despite the limitations, the approach remains attractive mainly due to its simplicity and absence of panel data, which is especially severe in our special context of remote territories that are usually ignored in regular nationwide surveys.

Estimation of vulnerability measures based on cross-section consumption data

The adopted empirical model is based on the approach of procedures developed for the assessment of vulnerability as expected poverty (VEP), as elaborated by Chaudhuri et al (2002) (also, Chaudhuri, 2003). It usually proceeds from the specification of a relationship expressed based on an assumed stochastic process generating the consumption of a household, which is given by:

$$lnC_h = X'_h\beta + e_h \; where \; e_h \sim N(0, X_h\theta) \tag{4}$$

where $\ln C_h$ is log per capita consumption expenditure, X_h is the vector of explanatory variables, β is the vector of parameters and e_h is mean-zero stochastic errors which capture idiosyncratic shocks to measured household well-being. It is assumed that the stochastic term (e_h), which represents idiosyncratic shocks that contribute to differences in household per capita consumption levels, are identically and independently distributed over time (not serially correlated). The variance of the disturbance term e_h, is assumed to depend on a vector of observable household characteristics and is commonly represented by the simple functional form of:

$$\sigma^2_{e,h} = X_h\theta$$

The parameters β and Θ are estimated using the three-step feasible generalized least squares (FGLS) procedure. In the first stage, Equation 4 is estimated using an ordinary least squares (OLS) procedure. Next, the squares of the estimated residuals generated are regressed against covariates of the consumption model to obtain the predicted values of the disturbance term:

$$\hat{e}^2_{OLS,h} = X_h\theta + \eta_h \tag{5}$$

The obtained predicted values of the disturbance term in Equation 5 are then used to transform the same equation as follows:

$$\frac{\hat{e}^2_{OLS,h}}{X_h\hat{\theta}_{OLS}} = \left[\frac{X_h}{X_h\hat{\theta}_{OLS}}\right]\theta + \left[\frac{\eta_h}{X_h\hat{\theta}_{OLS}}\right] \tag{6}$$

This transformed equation (Equation 6) is estimated using OLS to obtain an asymptotically efficient FGLS estimate represented by $\hat{\theta}_{FGLS}$. It is noted that $X_h\hat{\theta}_{FGLS}$ is a consistent estimate of $\sigma^2_{e,h}$, the variance of the idiosyncratic component of household consumption expenditures.

Now, the estimates:

$$\hat{\sigma}_{e,h} = \sqrt{X_h\hat{\theta}_{FGLS}} \tag{7}$$

are used to transform the consumption model (Equation 4) as follows:

$$\frac{LnC_h}{\hat{\sigma}_{e,h}} = \left[\frac{X_h}{\hat{\sigma}_{e,h}}\right]\beta + \frac{\boldsymbol{e_h}}{\hat{\sigma}_{e,h}} \tag{8}$$

Equation 8 is estimated using OLS to obtain a consistent and asymptotically efficient estimate of β.

Using the estimates of $\hat{\beta}$ and $\hat{\theta}$, we can find the estimated log-consumption and variance of log-consumption for each household as follows:

$$\widehat{lnC_h}|X_h = X_h'\hat{\beta}$$

$$\widehat{Var}[lnC_h|X_h] = \hat{\sigma}^2_{e,h} = X'_h\hat{\theta} \tag{9}$$

Assuming that consumption is log-normally distributed and letting $\Phi(.)$ denote the CDF of the standard normal distribution, the probability that a household with characteristics X_h, will be poor in the future is given by:

$$V\hat{E}P_h = \hat{P}r(lnC_h < lnZ|X_h) = \Phi\left[\frac{lnZ - X_h\hat{\beta}}{\sqrt{X_h\hat{\theta}}}\right] \quad (10)$$

We consider a pastoral household as vulnerable to poverty if its $V\hat{E}P_h$ is greater than a probability threshold P:

$$\hat{V}_h = \begin{cases} 1 \; if \; V\hat{E}P_h > P \\ 0 \; if \; V\hat{E}P_h \leq P \end{cases}$$

where $\hat{V}_h$ his a binary indicator variable of whether household h is vulnerable or not. It is expected that $0 < \hat{V}EP_h < 1$ and the commonly used reference threshold for P is 0.5. A vulnerable household is one whose probability of shortfall exceeds 0.5, which is considered as having a chance of 50% or more to fall below the poverty line in the future. The level of vulnerability is thus determined by identifying the proportion of households which scores P > 0.5 (Pritchett et al, 2000; Christiaensen and Subbarao; 2004; Ozughalu and Ogwumike, 2013).

The dependent variable of the model (Equation 4) in this case is log household annual per capita consumption expenditure in adult equivalent measure. Following the national standard, it includes expenditure on food (including beverages) and basic non-food items comprising expenditure on clothing, footwear, toiletries and medical expenses. Total household expenditure as a proxy for income, in the context of the traditional pastoralist society, is the sum of purchases and in-kind consumption of own production (livestock products and cereals). A significant proportion of the traditional pastoral household budget is consumption of own production, and consideration of purchases alone significantly underestimate welfare levels. The threshold indicator is the national consumption poverty line (equal to 4337 Ethiopian Birr) computed in 2011 prices (MOFED, 2013), slightly adjusted for general year-on-year and regional inflation (CSA, 2013) and aligned with the year of household survey (2013). The explanatory variables of the empirical model include household socioeconomic characteristics (age of household head, age squared, gender of household head, household size, level of education of household head, livestock size in standard livestock units, computed shock survival status); some pastoral and non-pastoral adaptation choice variables (cereal cultivation, asset diversification and low-return non-pastoral activity engagement); and location/distance. We consider adaptive response capacity to variable climatic conditions (captured by the adaptation choice

variables) as an important determinant of pastoral household vulnerability to poverty. (See descriptive statistics in Table A3 in the Appendix).

Here we control for the individual impact of exposure to common shocks by including the calculated index of shock survival (as a measure of the capacity to withstand shocks). We computed the variable "shock survival index" in an attempt to capture the effects of past recurrent exposures to climate-induced shocks. It is a ratio of current stock size to the highest reportedly attained pre-shock livestock holding multiplied by frequency of exposure to known catastrophic asset shocks in the area (Berhanu and Beyene, 2015). Frequency of exposure here refers to the number of times a respondent household experienced drought-related covariate shocks of huge livestock losses from the days of first start-up seed stock (upon first marriage) of family herds. The index is generated based on our unique recall interview technique of generating longitudinal data in the cross-section pastoral household survey using the traditional Borana Gada calendar (see Berhanu and Beyene, 2015).

The asset-based approach to vulnerability assessment

In addition to the probability threshold level, P, another critical consideration in the estimation of Equation 1 is the threshold level of well-being, Z, below which a household is considered to be poor. This is commonly established in terms of a desirable minimum standard level of per capita household consumption or income. However, here we have an additional specific concern: the need to assess the risk of a pastoral household falling below a suggested minimum asset-poverty threshold level, which is often considered as a pitiable level of asset endowment and consequently signifies a possible loss of prospects for wealth accumulation or welfare improvement (Carter and Barrett, 2006). The asset-based approach investigates vulnerability to asset poverty rather than the usual approach of vulnerability to consumption poverty. In a sense it reflects some dynamic element of poverty assessment because asset poverty affects pastoral households' capacity for future accumulation and consumption, i.e. their ability to generate income in the long-run (see Carter and Barrett, 2006). A slightly apparent difference between consumption and asset-based thresholds is that the former is used to estimate vulnerability to absolute poverty (the question of survival) while the latter can also be interpreted as a threshold indicator of the capacity to accumulate or generate future income and consumption. Therefore, in the special context of our pastoralist society, the implications and the extent to which the result of the asset-based approach deviates from the widely used conventional consumption-based approach to vulnerability assessment is additionally explored here as a supplementary exercise. Since assets may be used to smooth consumption, and hence could fluctuate more than the latter, some argue that the asset-based approach might overestimate vulnerability as compared to the opposite result expected when assets are not used to smooth consumption (Chaudhuri, 2003). Therefore, we strongly consider this asset poverty threshold over and above the consumption-poverty threshold most commonly adopted in other studies. Livestock asset-wealth status is

typically a very important indicator of well-being in our special context of traditional pastoralism. The asset-based approach broadly describes well-being in terms of household access to stocks of tangible and intangible assets. The lower the access to those assets the weaker the household's capacity to withstand shocks, and thus the higher is its level of vulnerability (Guimaraes, 2007). Moreover, in the special case of the "tragedy of the commons" narrative, conditions could rather catastrophically signify deteriorating livelihood trends and increasing vulnerability for all in the long run. The "tragedy of the commons" thesis, in the context of pastoralism, refers to a condition where individual self-interest of private livestock accumulation on commonly held pastures will result in overgrazing, severe degradation and ultimate the possibility of desertification. This abysmal scenario is a rather controversial subject in the context of the often argued case of the unique common property management institutions of the system of pastoralism (see McCabe, 1990; Solomon et al, 2007).

A problem with the application of the asset-based approach to vulnerability assessment in its broader sense is the practical difficulty of providing a measured minimum asset (size and combination) level (benchmark) where a household would be considered to be vulnerable. However, in our case, we slightly modify it to adopt a "narrow" context of physical/natural asset endowment, which is legitimate in the unique circumstances of the heavily livestock-asset dependent livelihood system of traditional pastoralism. Traditional herder societies as a group are generally characterized by their mobile nature and therefore less interest in heavy fixed capital asset holdings (e.g. housing), prevailing natural settings of less diversified activity choice, and low level of human capital (educational) attainments. It is, therefore, the level of livestock asset holding which critically determines their current status and future well-being prospects. This refers to the currently accumulated stock necessary to generate current and future streams of income, while the unique nature of livestock capital is that it is susceptible to loss due to natural shocks. Therefore, the identification of a minimum asset poverty threshold, which is a critical point of concern in the economics of poverty traps at the micro-level, is another hurdle in this sort of vulnerability assessment.

In addition to using the above-mentioned national consumption poverty line for the assessment of vulnerability based on the consumption data, two types of asset-based poverty thresholds were identified for the slightly different approach of asset-based vulnerability assessment in the special context of a traditional pastoralist society. Firstly, a previously estimated asset-poverty threshold by Lybbert et al (2004), based on their research in our study area, can be readily used as a benchmark indicator in our attempt to assess the vulnerability of the target population to a possible state of permanent deprivation due to low asset status. In their attempt to estimate the poverty trap threshold for our study area, Lybbert et al (2004) provide an asset-based threshold indicator of 12–15 heads of cattle, and they argue that a pastoralist with a post-shock holding status of below 12 will tend to become destitute with the eventual collapse of herds to one head of cattle, unless otherwise supported by some external help to re-stock. We roughly consider this threshold status of 12 heads of cattle as the lower

bound (the upper bound being 15) threshold for our supplementary assessment of vulnerability to asset poverty. The second asset-poverty threshold is based on the well-known traditional wealth ranking categories of the Borana system. The four main Borana wealth ranking categories are: Qolle (very poor), Deega (poor), Bultiqabesa (middle wealth) and Duresa (rich). This classification is closely associated with the Borana Busa-Gonofa indigenous welfare system of periodic/annual wealth redistribution. A person without cattle is called qolle (very poor). Five heads of cattle was the traditional minimum threshold of asset poverty. It was considered to be the traditional minimum to establish a family, continue to accumulate wealth, and to contribute to the Busa-Gonofa institution (see Berhanu et al, 2007). A person with less than this traditional asset holding threshold was considered to be poor. The old traditional criterion seems to have lost its currency due to range deterioration, animal productivity declines and increasing family sizes. From our community-level discussion, a person with 5–10 head of cattle is now considered to be poor. Therefore, in addition to the traditional asset-poverty threshold of five head of cattle, we also consider a revised minimum threshold of 10 head of cattle. According to our data, about 44.6% of the surveyed households fall below the traditional asset poverty line. This increases to 68.8% when the revised traditional asset poverty line of 10 head of cattle is considered, and 73.7% of our sampled Borana households fall below the lower bound poverty trap threshold suggested by Lybbert et al (2004) (see Table A1 in the Appendix). In the case of consumption poverty threshold, about 45% of the surveyed households fall below the national poverty line. Table A2 in the Appendix indicates the gender dimension of asset poverty among the surveyed Borana pastoralist households. It particularly displays that asset poverty is far more pronounced among female-headed households; nearly 90% of female-headed respondents were found to be below the suggested poverty trap asset threshold for Borana pastoralism.

Study area and source of data

Study area

This study is based on recently generated household survey data in the Borana rangelands of southern Ethiopia. The Borana pastoral area of southern Ethiopia is an important peripheral territory which forms an extensive part of the Ethiopian-Kenyan borderlands that has a total border length of 861 kilometres. The survey area is inhabited by one of the well-known east African pastoral groups, Borana Oromo pastoralists, who also populate the arid areas of northern Kenya across the national frontier. The Borana pastoralist grazing territory is estimated to be about 9% of Ethiopia's total landmass, and it accounts for about 25% of the major pastoral areas of the country (Berhanu, 2015). With a current annual growth rate of 2.8%, according to official projections based on the 2007 national population census, the total population of the area is estimated to be about one million; however, this should

be considered with caution because of incomplete enumeration usually experienced in this remote territory, due to the relatively mobile population who inhabit an area characterized by recurrent conflicts.

Boranaland is ecologically comprised of arid and semi-arid zones with a bi-annual rainfall pattern of ganna in the main season (mid-March to May) and Hagaya as the short-rain season (between September and November), and an annual rainfall of 400–700mm on average. It is estimated that more than 90% of production value added in the Borana pastoral village economy is contributed by traditional pastoralism (Berhanu, 2015). Borana pastoralists raise cattle, camel and small stock but predominantly keep the cattle in their traditional animal husbandry practice. Consistent data on total livestock population in the study area are lacking, which is due to a lack of complete and reliable periodic census data, and recurrent herd fluctuations resulting from catastrophic drought shocks. Studies have often quoted the old data compiled by the former Southern Rangelands Development Unit (SORDU), which indicate a total headcount of 1.6 million cattle, 1.1 million sheep and goats, 0.3 million camels and 66,000 equines. Conversely, Desta (2001) reports one million cattle and claims that the number of sheep and goats is correspondingly lower. Dryland farming is a relatively recent phenomenon (predominantly from the 1980s) and is a less widespread practice that is limited to the semi-arid grazing territories of the area. Particularly from the decades after the crushing effects of the Sahelian droughts of the early 1970s, the Borana pastoralist system, is often depicted as having a remarkably vivid experience of a dramatic twist in increasing exposure to welfare deterioration and widespread pastoralist destitution. The external deriving factors of this pastoral crisis are often cited as recurrent droughts, inappropriate programme interventions, and incessant violent conflicts, partly associated with bad governance (Berhanu, 2011).

The data

We use the pastoral household database, which was created based on a survey conducted by the investigator in 2012/2013. It was a complex survey in which a total of 327 randomly selected pastoral households were interviewed using structured tabular and verbatim questionnaires. The household survey was conducted at selected sites in various locations of arid and semi-arid areas of different traditional grazing territories of the Dire region (Garacha-Tula, Malbe, Wayama and Golbo) in the Borana rangelands, which were identified based on range ecology, distance, and other socioeconomic and environmental characteristics of the region. This was particularly intended to ensure sufficient variation and representativeness of the selected sample. The Dhas and Dubuluk survey sites (located in the Garacha-Tula traditional grazing territory) fairly represent the typical cattle-focused tradition of Borana pastoralism. However, Dhas is located far off the main road while Dubuluk is a vibrant livestock market centre on the main asphalt road to the Kenyan border. The Dhoqole and Haraweyu survey sites are located in the Malbe grazing territory. The former, a short distance from the main

road, is a zone of relatively low cattle potential and is more suited to keeping small stock, while the latter is far up in the central plateau bordering the Gomole traditional grazing territory. The Bokkola site is located on the Wayama plain. It is unique in that it is near the national border where camel adoption is relatively more prevalent in herders' species portfolios, and there are also some possible cross-border livelihood opportunities for a number of pastoral households. The Dilo survey site, located in the Golbo grazing territory, is an arid zone where opportunistic dryland farming efforts are virtually absent. The Romiso area, on the other hand, is characterized by its relatively more recognized practice of cultivating crops in addition to pastoralism. A fairly well systematized approach of sampling procedures and close supervision of the data collection processes were adopted in order to ensure the reliability of generated data on pastoral herds, household budgets and time allocation. It involved allocating sufficient time, firstly, to the identification of selected study sites and, secondly, to selecting respondent households for detailed enumeration. Random selections of respondent households were normally preceded by participatory wealth ranking exercises in which the wealth status of listed households were painstakingly identified with the help of knowledgeable community informants selected from each survey site.

As mentioned above, survey respondents were selected from seven survey sites in the traditional pastoralist grazing territories of the Borana rangelands. We first followed the track of our 2002/2003 pastoral household livelihood survey in which four study sites were covered in the Dire region (Gracha-tula and Malbe grazing territories) (see Berhanu et al, 2007). The 2012/2013 survey (see Berhanu and Beyene, 2015; also Berhanu, 2015) increased the covered area by including three additional sites from Wayama, and the more arid Golbo traditional grazing territories. The present study is, therefore, based on fairly well-spread data collection sites in four of the main seven traditional grazing territories of Borana pastoralism. As mentioned, site identification and selection were carefully done in order to ensure sufficient variation, and to capture the effects of differences in location and range of ecological conditions.

The study site selection and consequent sampling exercises usually involved preceding reconnaissance visits and some relevant conversations with key informants. The selection of sample sites was followed by a complete listing and random draw of pastoral villages (encampments) within reachable distance of selected areas for detailed enumeration. Sample respondents, stratified based on wealth status differentials, were then randomly chosen from a prepared list of households in the selected encampment. Following purposeful selection of survey sites, the process typically involved a three-step participatory sampling frame preparation and sample selection procedure, which was facilitated by groups of key community informants from pastoralist encampments (ollas). The first step in the sampling procedure established the arda (a small traditional territorial unit of cluster of pastoral village encampments) sampling frame (list), which was within a reachable radius of the centre of a survey site. All pastoralist encampments (ollas) in the ardas were subsequently listed. A limited number of encampments in each arda was then randomly selected from the arda sampling frame. The second step was to exhaustively list all households in the randomly selected encampments and correspondingly record their wealth status based on community defined wealth

strata. A random sample of households was finally established in the third step, which was fairly based on a proportionate selection from each stratum. The selected sizes from each stratum at different sites generally reflect the local conditions. Selection of the total sample size was influenced by cost considerations and survey management, which recognized the existing long distances between the selected sites in this sparsely populated extensive rangeland system. The sample size for each survey site was generally equal, except for the Dilo and Bokola sites where it was doubled, mainly based on considerations related to their unique characteristics mentioned before. The distribution of sizes of sampled households by wealth stratum and survey site is shown in Table 1.

Table 1: Distribution of sizes of sampled households by wealth strata and survey sites

Survey site	Borana wealth ranking categories				
	Very poor	Poor	Middle	Rich	Total
Dhas	3	13	9	10	35
Dhoqole	3	18	4	10	35
Dubuluk	7	15	4	9	35
Dilo	10	36	8	22	76
Haraweyu	2	13	9	11	35
Bokkola	5	36	14	15	70
Romiso	1	13	8	19	41
Total	31	144	56	96	327

This carefully managed survey was conducted in a peripheral pastoralist region, which was usually missed in the conventional nationwide household surveys. The periodic survey enumeration process (intended to expand in size and coverage in the future) was closely monitored and guided by the author who usually stayed in the area throughout the survey rcperiods. The enumeration process involved some multi-visit interviews and verifications by trained enumerators selected from the area and placed among the pastoralist communities in the village in order to build trust and confidence. The present sample also includes a sub-sample of 78 households covered in the investigator's 2002/2003 survey of the area. This longitudinal information is also prudently explored here, and estimated results are used to enrich and complement the overall findings.

4. Estimated results

The comparative status of poverty incidence and depth of poverty among the sampled peripheral population are shown in Table 2. As can be seen, the depth of poverty among the surveyed Borana households is twice the reported national average. The depth and severity of poverty are particularly very noticeable for pastoralist female-headed households. Absolute poverty among the surveyed female-headed Borana households is 54.2%, which is twice the rate reported for the same social group at the national level. Incidentally, at the national level the reported poverty indexes are relatively lower for female-headed households than for their male counterparts. The possible underlying reason, according to the official national poverty report, is the supposed increased access to land for female-headed households, and also the added advantage of focused attention from the productive social protection programmes (MOFED, 2013), a claim which does not appear to hold in peripheral pastoralist settings. In general, the estimated poverty rate among the sample respondents was found to be 45%, compared to the national average of less than 30%. Despite the reported substantial drop in the national poverty rate from 46% in the mid-1990s to the present level of below 30%, it tended to have increased in the pastoralist regions, and this is particularly attributed to the limited poverty reduction efforts and the regions' special feature of recurrent exposure to natural and human-made shocks (UNDP, 2015).

Table 2: Consumption poverty indexes (sample and national averages)

Poverty index	Total	Male-headed	Female-headed
Head count index (P0)			
Borana sample	0.447	0.412	0.542
National	0.296	0.300	0.277
Poverty gap index (P1)			
Borana sample	0.190	0.163	0.309
National	0.078	0.080	0.074
Squared poverty gap index (P2)			
Borana sample	0.107	0.090	0.193
National	0.031	0.031	0.029

Source: Computed from author's field survey data, and MoFED (2013)

Table 3 provides the estimated vulnerability rates of pastoralist households' probability of falling into both consumption and asset poverty in the future. Taking a 50% vulnerability threshold, i.e. considering that a pastoralist household has a 50%

or more chance of falling into poverty in the future, the rate of vulnerability in terms of risk of exposure to both asset and consumption poverty is generally found to be considerable. A close look at individual household records signifies that there is a considerable indication that female-headed households are both consumption and asset poor. Moreover, nearly 80% of the households that are vulnerable in terms of both consumption and asset poverty are those which have generally lost resilience due to consecutive failures to survive past shocks. Similarly, asset poor households that have less adaptation experience in terms of extensive and regular engagement in non-pastoral income-generating activities are also more likely to be vulnerable in terms of consumption/income poverty. In general, however, both threshold indicators measure different poverty dimensions and have differing implications. The aggregate national poverty line is based on the cost of basic needs computed by considering the bundle of food (typically consumed by the poor) required to supply the predetermined minimum calorie intake, plus specific allowance for non-food goods consistent with the spending pattern of the poor (MOFED, 2013). The distinction is that, in contrast with the aggregate national consumption poverty line, the asset-poverty threshold is remarkably closely associated with sustainable wealth accumulation potential in the pastoral rangelands. It is, therefore, instructive to observe that vulnerability to asset poverty is found to be very noticeable in this region that experiences the increasing difficulties of recurrent exposure to asset shocks primarily due to frequent droughts and climatic variability. Desta and Coppock (2004) reported the case of a secular decline in per capita cattle holdings in the Borana rangelands. It is a serious condition of the pastoralist system's generally increasing exposure to the likelihood of prevalence of poverty traps due to dwindling asset holdings and general deterioration in range productivity. Quite notably, anecdotal evidence indicates that the Borana pastoralists may have tended to defend their current consumption positions by increasingly resorting to selling assets. It is fairly common to hear some Borana herders say: "loon garacha tu fixe", meaning "we have all consumed the animals to survive." It implies the need for restocking efforts and alternative livelihood opportunities for asset accumulation in this increasingly difficult environment of changing socioeconomic and climate conditions.

Table 3: Pastoralist household vulnerability to consumption and asset poverty (headcount percentage)

Threshold indicator			Vulnerability rate
1.	Consumption poverty		36.1%
2.	Asset poverty		
	a)	Traditional threshold (lower bound)	58.1%
	b)	Traditional threshold (upper bound)	78.3%
	c)	Suggested poverty trap threshold (lower bound)	81%

Source: Computed from author's field survey data

Table 4 shows that 44.6% of the sampled households were found to be below the indigenously defined traditional (lower bound) asset poverty line. Vulnerability to poverty here essentially refers to households which would remain in poverty plus those that are expected to become poor in the future. Table 4 indicates that a considerable segment of those considered vulnerable under different assessment thresholds include the non-poor, which represents, for example, 17.4% (as compared to 18.7% for the poor and vulnerable) of the total (36.1%) consumption-based vulnerability rate for all households.

Table 4: Disaggregated poverty-vulnerability matrix of respondent pastoralist households (50% vulnerability threshold)

Threshold indicator and status category	Vulnerability status		Overall %
	Vulnerable	Non-vulnerable	Total
Based on consumption poverty line	36.1%	63.9%	100%
Poor	18.7%	26.0%	44.7%
Non-poor	17.4%	37.9%	55.3%
Based on asset poverty line			
Traditional threshold (lower bound)	58.1%	41.9%	100%
Poor	35.4%	9.2%	44.6%
Non-poor	22.7%	32.7%	55.4%
Traditional threshold (upper bound)	78.3%	21.7%	100%
Poor	60.6%	8.2%	68.8%
Non-poor	17.7%	13.5%	31.2%
Suggested poverty trap threshold (lower bound)	81.0%	19%	100%
Poor	65.1%	8.6%	73.7%
Non-poor	15.9%	10.4%	26.3%

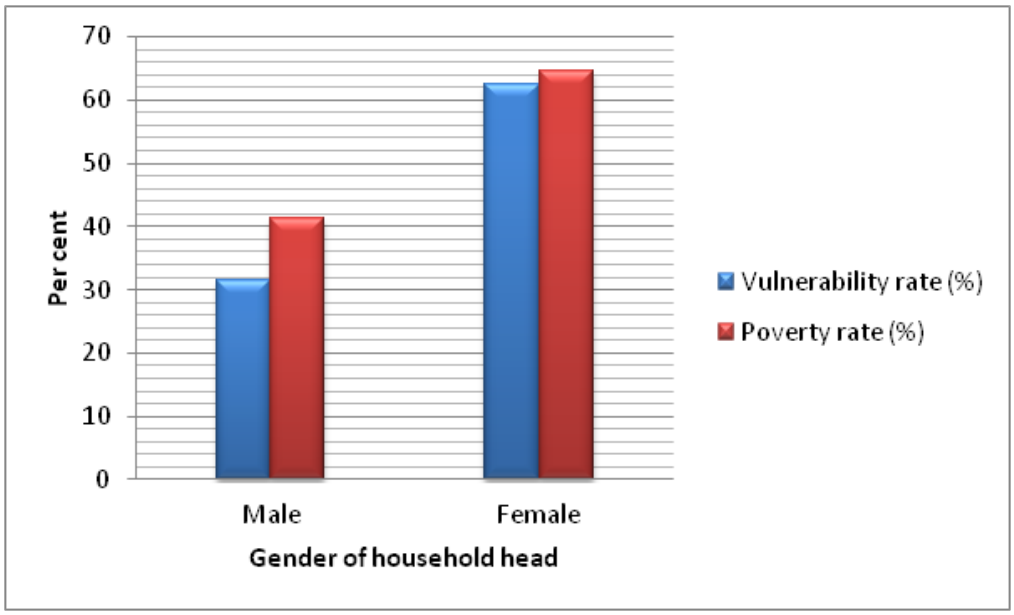
Source: Computed from author's field survey data

Figure 1 indicates the gender dimension of poverty and vulnerability to poverty among the sampled pastoralist households. As can be seen, the risk of falling into consumption poverty is far higher for female-headed household respondents, almost twice the figure for their male counterparts.

The probit regression results of the major determinants of household vulnerability to consumption poverty are reported in Table 5. Being a female-headed household significantly increases vulnerability to poverty. As portrayed above, female-headed pastoralist households exhibit a higher level of vulnerability to poverty compared to male-headed ones. We further tested the significance of this apparent high vulnerability differential by estimating the model separately for the two groups of households. The computed likelihood ratio (LR) statistic is 40.74, and is almost twice the 99% critical value of $\chi^2(9) = 21.67$; i.e. the null hypothesis of no vulnerability difference between male and female-headed households is rejected. This problem appears to be a structural one of local socio-cultural underpinnings. For example, a Borana female household head, especially when she is widowed at a young age with little children (traditionally without much chance of being remarried), usually can be reduced to a state of being permanently poor. They are often too poor to pursue high

return, non-pastoral activities. The family livestock herds of widowed young women may be placed with a caretaker manager, she then has less decision making power, until her male children are teenagers, at which stage they can reclaim the herds and start to make their own decisions. In such a traditional arrangement, despite possible good intentions, the family herds may initially fail to flourish owing to the common failure of the caretaker to take good care of the herds, and later perhaps as a result of imprudence and lack of thrifty animal husbandry care by conceited young sons.

Figure 1: Vulnerability to poverty by gender



Source Computed from author's field survey d¬¬¬ata

As expected, the risk of falling into poverty is strongly and negatively associated with increasing livestock asset holding, but it significantly increases with household size. The expected significantly negative relationship between vulnerability and pastoralist risk management diversified portfolio adoption (asset diversification) is quite noticeable, and this underlines the importance of conversion of livestock assets by large stock owners to relatively high return, non-pastoral activities such as livestock trade and investment in real estate in rangeland towns. The estimated relationship is similarly negative (but statistically insignificant) for those that have chosen low-return participation, which refers to non-pastoral adaptation options such as petty trade and causal labour engagements, often chosen by pastoralist households to defend their livelihoods. The estimated relationship with respect to cereal cultivation, on the other hand, is consistent with the commonly held pessimistic view about opportunistic dryland farming in this marginal environment that has very erratic rainfall. Contrary to the government conventional stance of promoting sedentarized cereal cultivation in the rangelands, pastoralist household range enclosures for cereal cultivation is

somewhat positively associated with vulnerability to expected poverty. A rush for cereal cultivation in this dryland ecosystem may rather generally increase the risk of vulnerability to poverty rather than reducing it. The negative repercussions of rangeland degradation and the consequent reduced livestock productivity implied by increasing the level of use of fragile rangeland soil for the relatively low-return cereal cultivation could be enormous (Berhanu and Beyene, 2015). The estimated significantly negative relationship between distance and vulnerability to poverty shows that those in peri-urban areas and around major market centres are more vulnerable. The poor and destitute tend to move to peri-urban areas for very low-return, non-pastoral activities though these activities do not seem to be significantly helpful in terms of escaping the likelihood of becoming trapped in poverty.

Table 5: Probit regression results of determinants of vulnerability to consumption poverty

Explanatory variables	Coefficients (Robust S.E)	P-values	Marginal effects
Age of household head	0.4180162*** (0.0800192)	0.000	0. 0953052*** (0.01241)
Age squared	-0.0043834*** (0.0007749)	0.000	-0.0009994 *** (0.00011)
Gender of household head(male=1))	-1.485194*** (0.2891986)	0.000	-0.4819088*** (0.10435)
Household size	0.0993431* (0.0521671)	0.057	0.0226496* (0.01286)
Education	-0.0124627 (0.0605328)	0.837	-0.0028414 (0.01389)
Livestock size	-0.0249029** (0.0106591)	0.019	-0.0056777** (0.00243)
Cereal cultivation	0.9150265 *** (0.2829872)	0.001	0.1809276*** (0.05476)
Asset diversification	-0.8920245** (0.3990969)	0.025	-0.1370757** (0.04121)
Low-return activity participation	-0.1282746 (0.2067551)	0.535	-0.0288183 (0.04564)
Distance	-0.0070494 * (0.0038901)	0.070	-0.0016072* (0.00091)
Constant	-8.664108*** (1.853569)	0.000	
Wald χ2(10)	86.37		
N	327		
Pseudo R2	0.4440		

Note: Numbers in parentheses are robust standard errors; *** significant at 1% level; ** significant at 5% level; * significant at 10% level.
Source: Computed from author's field survey data

Here we turn to the sub-sample longitudinal data of 2003 and 2013 in order to reveal some illustrative results. The fairly simple illustrative instance of the dynamics of shift in wealth status between 2003 and 2013 among our sub-sample of surveyed pastoralist households is provided in Table 6. It is important demonstrative evidence of the often claimed increasing difficulty of asset accumulation and problems of escaping poverty that have been experienced in the Borana pastoralist system in recent decades. It was found that, after three drought shocks (2006, 2008, 2011) between our survey periods (2003 and 2013), a great majority of the tracked households remained trapped in poverty over the decade; 91.2% of the previously poor and very poor were stuck in their unfavourable positions. The three households who improved their position represent isolated instances, including a situation where relatively young female-headed households were specifically supported by some wealthy stock owners. Conversely, it was found that a significant proportion (44%) of previously middle and rich stock owners had lost their statuses (Table 6). Some of these households appear to have generally lost resilience due to old age of its members, and an inability to recover from the hard-hitting blows of consecutive shocks during the period. A notable point here is that those previously better-off households had, due to a lack of other skills, focused on keeping their wealth in terms of livestock alone. Non-poor stock owners who lack diversified wealth/activity portfolios (expressed in terms of participating in high return activities such as livestock trade, urban-based rental housing investments and other small business activities), especially given the recurrent natural shocks, are found to be susceptible to the risk of falling into poverty.

Table 6: Trends in shift of household wealth status between 2002/2003 and 2012/2013 (N=78)

Current	Previous very poor	Previous poor	Previous middle	Previous richs
Very poor	14	5	5	1
Poor	3	12	4	3
Middle	0	3	4	5
Rich	0	0	0	19
Total	17	20	13	28
Slightly gained position	3	3	None	-
Number lost position	Not applicable	5	9	9

Source: Computed from author's field survey data

The estimated results of trends in asset poverty rates and vulnerability to asset poverty over the survey period are presented in Table 7. Using all the asset poverty threshold indicators, it is demonstrated that (though with some degree of caution due to the size of the sub-sample) vulnerability to asset poverty among the sampled households increased dramatically over time. The asset poverty rate was also substantially increased. The observed increasing rate of vulnerability over that of the poverty rate shown in the last column of Table 7 might be taken

as an indication that the latter tends to hide the inbuilt momentum of more future poverty in this dryland environment of frequent exposure to shocks and changing climate conditions. Government interventions in the last two decades have focused on less comprehensive, conventional efforts in water development (for livestock and humans), animal health services, social protection programmes of intermittent direct support and income-generating public works and, more recently, natural resource management initiatives of limited scope and coverage. These initiatives appear to have been too few to halt or reverse the apparent long-term downward spiral of the pastoralist production system due to recurrent shocks that have ravaged the region in the last 40 years (see Berhanu, 2011; Berhanu and Beyene, 2015). In total, as revealed by the earlier analytical results, it can be stated that that the continuously reported spectacular growth performance of the county in recent years seems to have generally failed to have the positive trickle-down effect of changing the conditions of the peripheral pastoralist population. It is a relatively neglected, peculiar environment which requires specially focused strategies relevant to the pastoralist system.

Table 7: Vulnerability to asset poverty in 2003 and 2013

Threshold indicator	Vulnerability rate (%)		Poverty rate (%)		Ratio of Δ in vulnerability to Δ in poverty rate
	2003	2013	2003	2013	
Traditional threshold (lower bound)	19.2	36.0	24.4	38.5	1.19
Traditional threshold (upper bound)	56.4	74.4	50.0	62.8	1.41
Suggested poverty trap threshold (lower bound)	64.1	84.6	57.7	66.7	2.28

Source: Computed from author's field survey data

Table A4 in the Appendix shows fixed effects model estimation results (selected after Hausman specification test) of the determinants of household livestock asset holdings (2003–2013). The exploratory estimated results may in some respects signify a level of association rather than direct causality. However, it is apparent that the dynamics of household asset holding over time is found to be significantly determined by the level of household recurrent shock survival over time, which is shown here by the strongly significant coefficient of the shock survival index. The highly significant negative coefficient of the variable year dummy (a key variable of interest here) is an important result consistent with the previously mentioned case of the observed significant decline in pastoralist household asset holding over time.

5. Conclusions and policy implications

This paper examined the level and determinants of vulnerability to poverty in the context of a traditional pastoralist system based on survey data generated from southern Ethiopian rangelands. The main findings and observations are summarized as follows:

The risk of a pastoralist household falling into poverty is considerably high both in terms of consumption poverty and vulnerability to a deprived state of asset holding, the latter being important as a major determinant of future wealth accumulation potential and avoidance of poverty traps. Stock owners with less diversified portfolios and asset poor households of inadequate adaptation experience with a lack of regular non-pastoral income sources are likely to be more vulnerable. The present poverty status of the sampled pastoral households is well above the national poverty rate, and the estimated high vulnerability to asset poverty further demonstrates the additional difficulty of poverty eradication in peripheral lowlands, where they have a specific mode of production, as well as socio-cultural and ecological features. The persistent nature of poverty typically underscores the need to uniquely consider the precarious condition of marginal lowlands in the overall national strategy for poverty eradication. Livestock is the essential source of livelihood and sustained welfare levels in pastoralist production and their socio-cultural setting. However, vulnerability to asset poverty is high, even by the lowest traditionally set asset poverty threshold, and this essentially signals a critical area for serious consideration by pastoral area development planners and administrators.

The results of both consumption and asset-based assessment approaches indicate that a considerable segment of vulnerable households are the non-poor. This implies that intervention efforts which ignore the non-poor, by following the conventional stance of only targeting the currently poor, are not enough. The risk of pervasive future poverty would likely embrace middle wealth and wealthy stock owners who periodically slip into poverty. This would definitely hamper the already daunting task of fighting poverty in the marginal environments. The profound immiserizing effect of the vulnerability of the non-poor in the context of the traditional pastoralist community is that it could potentially further undermine the existing indigenous social welfare mechanism of protecting the poor.

Considering the gender dimension, the poverty rate is higher for female-headed household respondents. The risk of falling into future poverty is even much higher

for female-headed households than male-headed ones. Female-headed Borana households, especially those in the middle age group, are often found to manage fairly large families five to six people. This group, therefore, requires special attention in targeted interventions such as periodic restocking programmes.

It was found that a currently disadvantaged status of livestock asset poverty is a strongly significant determinant of the likelihood of a pastoralist household's future status of deprived well-being. Moreover, estimated model results show that the activity of rangeland enclosures for cereal cultivation is positively associated with pastoralist household vulnerability to poverty, indicating the insignificance and possible harmful effects of sedentarized farming in the context of the study area.

The rather exploratory and illustrative results of the dynamics of shifts in wealth status and vulnerability to asset poverty demonstrated by the longitudinal data of our sample group of Banana households convey a clear message to rangeland development planners both at the regional and national levels. It is found that more than 90% of previously poor remained poor over the decade, while more than 40% of the non-poor faced the often shock-induced inescapable experience of slipping into the deprived state of asset poverty. This implies that the peripheral pastoralist community may have remained too remote to enjoy the benefit of Ethiopia's spectacular growth performance in recent years. The rate of asset poverty has dramatically increased over time, and this has clearly happened with further evidence of secular declines in household asset holding in the study area. These results show that the daunting task of poverty eradication in the pastoralist lowlands has become even more challenging. In addition to the required concerted effort of improving the status of the trapped destitute, the need to defend the position of the non-poor has also become inevitably more important, given the existing condition of recurrent asset shock exposures, than the prevailing initiatives that only target the poor. This requires investment in sustained and effective development efforts directed at supporting large stock owners to adopt risk management diverse wealth portfolios through a gradual shift to high return, non-pastoral activity investments.

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Appendix

Table A1: Percentage distribution of asset-poverty headcount index (traditional and suggested thresholds) (2013, N = 327)

Threshold indicator	Threshold	% of household in asset poverty
Traditional (lower bound)	5 head of cattle	44.6
Traditional (upper bound)	10 head of cattle	68.8
Suggested poverty trap threshold (lower bound)	12 head of cattle	73.7
Below national (consumption) poverty line	4337 Birr (adjusted)	44.7

Source: Computed from author's field survey data

Table A2: The gender dimension of asset poverty (N = 327)

Threshold indicator	Male-headed (%)	Female -headed (%)
Below traditional threshold (<5)	43.0	54.2
Below traditional threshold (<10) (upper bound)	66.3	83.3
Below suggested poverty trap threshold (<12) (lower bound)	71.0	89.6
Below national (consumption) poverty line	41.2	64.6

Source: Computed from author's field survey data

Table A3: Definition and descriptive statistics of selected variables

Variable	Observations	Description	Mean	SD
Number of cattle	327	Number of cattle owned by the household	12.0	20.7
Per capita consumption	327	Per capita consumption expenditure in adult equivalent measure (Eth. Birr)	6433.5	5930.1
Age of household head	327	Age of household head	55	16.9
Gender of household head	327	Dummy for gender of household head, 1 if male; 0 otherwise	0.85	0.4
Household size	327	Household size	6.1	2.7
Education	327	Household head level of education in years	0.3	1.3
Livestock size	327	Livestock size in a standardized unit (TLU)	13.7	20.1

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Table A3 Continued

Variable	Observations	Description	Mean	SD
Shock survival index	327	Shock survival index (see text for explanation)	1.18	1.1
Cereal cultivation	327	Adoption of cereal cultivation, 1 if yes; 0 otherwise	0.65	0.5
Asset diversification	327	Conversion of livestock assets to relatively high return, non-pastoral activities such as trade and real estate investments in rangeland towns, 1 if yes; 0 otherwise	0.11	0.3
Low-return activity participation	327	Low-return, non-pastoral activity participation such as casual labour, 1 if yes; 0 otherwise	0.39	0.5
Participation in social protection	327	Participation in social protection programmes (direct support and cash/food for work), 1 if yes; 0 otherwise.	0.29	0.45
Distance	327	Distance from main market centre (km)	45.3	34.0

Table A4: Determinants of household livestock (cattle) asset holding (2003–2013)

Explanatory variables	Fixed effects estimation	
	Coefficients	P-values
Age of household head	0 .8165478***	
	(0 .2539664)	0.002
Household size	1.315529 **	
	(0.5069529)	0.011
Education	-0.1347786	
	(.572677)	0.815
Shock survival index	2.541226 ***	
	(0.9486088)	0.009
Cereal cultivation	1.959737	
	(2.29813)	0.396
Asset diversification	-2.514587	
	(7.816875)	0.749
Low-return activity participation	-4.043776 **	
	(1.873881)	0.034
Year dummy (2003=0)	-12.48312 ***	
	(3.517495)	0.001
Constant	-32.68361**	0.019
	(13.65608)	

Note: Numbers in parentheses are robust standard errors; *** significant at 1% level; ** significant at 5% level; * significant at 10% level.
Source: Computed from author's field survey data

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