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Vulnerability analyses of Climate Change Impact on Cotton and Sugarcane Commodities in Ethiopia

By

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Abstract

We have studied the vulnerability of expected poverty empirically in sugarcane and cotton producing areas in the northern part of Ethiopia and in the rift valley. We have found out that a significant portion of households that are non-poor can actually fall back into poverty as households face variability in consumption. We also found that literacy rate has been important in reducing poverty by a much larger magnitude so much so that the average household where every eligible person is literate is not vulnerable.

1. Introduction

Agriculture has been the dominant force in the economic conditions of majority of Ethiopians and continues to dominate economic outcomes in Ethiopia. Even when Ethiopia is looking to embark on structural transformation through nurturing its manufacturing sectors, the importance of agriculture as provider of industrial inputs and consumer of industrial output could hardly be overlooked. Major players in agricultural production are smallholder farm households. Smallholder farm households are important for agricultural production in Ethiopia making up 96% of total area cultivated (Taffesse et al., 2011). In this study, we intend to study the vulnerability to poverty of households that are expected to be useful links in the transition from agriculture to industry, namely, farm households involved in the production of sugarcane for the production of sugar and cotton producers.

Although small holder farmers comprise the majority of agricultural production, the picture is different coming to cotton production where smallholders make up only 38% of the area cultivated with cotton and 30% of cotton production 2011/12 (Dessalegn, 2012). However, in terms of number, they make up 99% of the farmers. The issue is similar for sugarcane. Out-growers only supply sugarcane to Wonji sugar factory but at the current rate of expansion of sugar factories, the role of out-grower is only going to increase.

Hence, issues concerning smallholder farm households have greater significance in both shaping the economic outlook of the country and the welfare of sizeable farm households. Worldwide consultations with the poor have revealed that they are preoccupied with dealing with risks and uncertainty, and their inability to effectively deal with shocks often lies at the core of their poverty (World Bank, 2001). This has renewed interest in examining the role of risk in the dynamics and causes of poverty (Dercon, 2004).

Needless to say the risk posed by climate change and variability is a major source of concern for countries such as Ethiopia which is exposed to the climate shocks. The paper is organized as follows, in section 2 we discuss the concept of vulnerability and review the literature; section 3 covers the empirical methodology for the study; section 4 presents the data, section 5 gives a first look at the result; section 6 provides an elaborate discussion and finally section 7 concludes.

2. Understanding Vulnerability

When measuring the welfare status of households and designing policy, the usual approach is to look at poverty in relation to either income or consumption. However, poverty measured in income or consumption is a measure that primarily takes snapshot image of the status of households. Vulnerability is a concept that is closely related with poverty but has distinct features. It differs from poverty in that vulnerability is about what is going to happen in the future (as opposed to poverty which measures whether an individual is poor) and it also refers to welfare broadly (not just poverty). As will be discussed below, one can also consider

vulnerability to expected utility. Economists have long recognized that a household's sense of well-being depends not just on its average income or expenditures, but on the risk it faces as well, particularly in households with fewer resources (Ligon and Schechter, 2003).

Returning to the discussion of vulnerability to poverty, it is the likelihood that at a given time in the future, an individual will experience poverty. Chaudhuri et al. (2002) lays out two points that distinguishes poverty from vulnerability. First, vulnerability assessments have to be explicitly forward-looking and the vulnerability of households is unobservable to the policymaker given the data whereas poverty assessments are couched in temporal terms and the policymaker, given the right data, does actually observe the current poverty status of the household. The second difference is also related to the first difference and is concerned with the fact that vulnerability is a dynamic process describing the inter-temporal situations of households as opposed to the observed consumption status at a point in time. Therefore, household vulnerability to poverty depends on its future income prospects, the degree of income volatility it faces, its ability to smooth consumption in the face of income or other livelihood shocks (Chaudhuri, 2003).

In general, Hoddinott and Quisumbing (2003) define vulnerability as the likelihood that, an individual will have a level of welfare below some norm or benchmark at a certain future date where the welfare measure and the future date has to be defined. Vulnerability is important because it tries to understand the possibility of future outcomes. A household that is not poor today is not guaranteed to remain non-poor if the household is likely to experience a significant shock.

There are a number of studies looking at vulnerability in Ethiopia (see Dercon and Krishna, 2004 and Dercon 2004). A study by Dercon (1999) elaborates this point very well using data on poverty between 1989 and 1995 in Ethiopia the result of which we have presented in Table 1 to illustrate the point. Between 1989 and 1995, rural poverty has come down from 61 to 46 %. Of the 46 % who were poor in 1995, 31% were also poor in 1989 but the remaining 15% were not poor in 1989. This illustrates that despite not being poor in 1989, 15 percent of the rural population were vulnerable to poverty. Hence, policy makers should also be concerned about not only brining people out of poverty but also keeping them out of it.

Table 1. Movements In and Out of Poverty in Rural Ethiopia (cell percentages)

	Status in 1995		
Status in 1989	**Poor**	**Non-poor**	**Total**
Poor	↔ 31	↑ 30	61
Nonpoor	↓ 15	↔ 24	39
Total	46	54	100

Source: *(Dercon, 1999)*

A survey of the literature by Hoddinott and Quisumbing (2003) summarizes three methods of measuring vulnerability. These are: vulnerability as expected poverty (VEP), vulnerability as low expected utility (VEU) and vulnerability uninsured exposure to risk (VER).

Vulnerability to expected poverty

In the survey, Vulnerability is defined as the probability that a household will fall into poverty in the future as measured by the level of consumption. In particular, it measures the probably that a household will have consumption level below the consumption poverty line one period ahead. Chaudhuri, Jalan, and Suryahadi (2003) and Christiaensen and Subbarao (2005) use such method.

Vulnerability as low expected utility

Vulnerability as low expected utility will take into account the perceptions of households to risk. For example, consider a household facing two scenarios:

Scenario one: A household faces the expected consumption level C^* (below the poverty line) with the probability 1 or Scenario two: A household faces 0.5 probability of consumption level above C^* (and above the poverty line) and 0.5 probability of consumption level below C^*. But the overall expected level of consumption is C^*.

A risk averse household prefers the first scenario because the expected consumption level is sure. But, the first scenario increases the vulnerability to expected poverty to 1 from 0.5 compared scenario two. Hence, vulnerability to expected poverty can go in different direction to a household's preference.

Vulnerability as low expected utility can be defined as the difference between the utility derived from some level of certainty-equivalent consumption, Z_{CE} at and above which the household would not be considered vulnerable and the expected utility of consumption (see Ligon and Schechter (2002, 2003)).

Vulnerability to uninsured exposure to risk

Vulnerability to uninsured exposure measures the extent to which exposure causes welfare loss as such it is a backward looking measurement of shocks. It particularly looks at exposure to covariant shocks (e.g. rainfall shock, drought etc.) and idiosyncratic shocks (e.g. illness or death member of the household).

3. Econometric Specification

In this paper, we will focus on vulnerability to expected poverty. We will follow Chaudhuri (2002) and Chaudhuri et al. (2003) to empirically measure vulnerability among cotton and sugar cane producing households. That is, we measure the probability that a household will find itself poor at some future date. This probability depends not only on the mean consumption but also on the expected variance of consumption (the risk element). While poverty deals mainly with expected

mean, the measure of vulnerability deals both with expected mean and the variance of food consumption expenditure.

In order to estimate the variance of consumption, one will need a panel data. However, it is not always possible to have a panel data and it will be necessary to make some assumptions. The assumption basically is the temporal heterogeneity in consumption is identical to variation across sections (Chaudhuri 2002).

We begin by assuming that the stochastic process generating the consumption of a household h is given by:

$$\mathrm{Ln}\ \mathrm{C_h} = \mathrm{X_h}\beta + \mathrm{e_h} \qquad 1$$

where $\mathrm{C_h}$ is per capita consumption expenditure, $\mathrm{X_h}$ represents a bundle of observable household characteristics, characteristics such as household size, location, and educational attainment of the household head, etc., β is a vector of parameters, and ehe$_h$ is a mean-zero disturbance term that captures idiosyncratic factors (shocks) that contribute to different per capita consumption levels for households that are otherwise observationally equivalent.

It is customary to assume that the idiosyncratic shocks to consumption are identically and independently distributed over time for each household. While estimating expected consumption, making assumption will not bias the expected consumption estimate; it does lead to incorrect standard errors. This will only result in efficiency loss when examining expected consumption. But in the case of measuring vulnerability, the variance also enters the formula and will affect the estimation of vulnerability as will be shown below.

In order to address this, we allow the variance of $\mathrm{e_h}$ (and hence of $\mathrm{Ln\ C_h}$) to depend upon observable household characteristics in some parametric way in the following functional form:

$$\sigma^2_{\mathrm{e_h}} = \mathrm{X_h}\theta \qquad 2$$

Chaudhuri (2000) hence applies three-step feasible generalized least squares (FGLS) to estimate efficient coefficients β and θ. In principle, this means, first estimating (1) via OLS, and then estimating (2) again by OLS using the squared residuals of (1) as the dependent variable. The predictions from (2) are then used to weight and re-estimate (2). On the last step, the now efficient coefficients $\hat{\theta}$ can be used to predict again (2), which is then used to weight equation (1) and re-estimate it, obtaining also efficient estimates $\hat{\beta}$ (see Chaudhuri, 2002 or Chaudhuri, et al. 2003).

Using the estimates $\hat{\beta}$ and $\hat{\theta}$, we obtain we are able to directly estimate expected log consumption:

$$\mathrm{ELn}\ \widehat{\mathrm{C_h}} = \mathrm{X_h}\hat{\beta} + \mathrm{e_h} \qquad 3$$

and the variance of log consumption:

$$\mathrm{V}\left(\mathrm{Ln}\ \widehat{\mathrm{C_h}}\middle|\mathrm{X_h}\right) = \widehat{\sigma^2_{\mathrm{e_h}}} = \mathrm{X_h}\hat{\theta} \qquad 4$$

for each household h. By assuming that consumption is log-normally distributed (i.e., that $\mathrm{Ln}\ C_h$ is normally distributed), we are then able to use these estimates to form an estimate of the probability that a household with the characteristics X_h, will be poor, i.e, of the household's vulnerability level. Letting Φ (.) denote the cumulative density of the standard normal, this estimated probability will be given by:

$$V_h = \Pr(\mathrm{Ln}\ C_h < \mathrm{Ln}\ z|X_h) = \Phi\left(\frac{\mathrm{Ln}\ z - X_h\hat{\beta}}{\sqrt{X_h\hat{\theta}}}\right) \qquad (5)$$

The method we have outlined is the standard one used in most poverty assessments that rely on regression methods, but with one important difference. In poverty assessments, the disturbance term is implicitly thought of as stemming from measurement error or some unobserved factor that is incidental to the main focus of the analysis. In most cases, therefore, rather than specifying a separate equation such as (2), so that the variance of e_h is allowed to also depend upon the particular characteristics of the household, it is assumed that this variance is the same for all households. Thus, an estimate of β and a single common estimate of σ, the standard deviation of e_h (and hence, $\mathrm{Ln}\ C_h$), are obtained from ordinary least squares (OLS) estimation of (1). With the same additional assumption that we make, which is that $\mathrm{Ln}\ C_h$ is normally distributed; these estimates are used to derive the probability that a household with characteristics X_h will be poor.
There are two problems with the assumption that the variance of the disturbance term (and of log consumption) is the same for all households.

Within the framework we propose in which the variance of the disturbance term is interpreted in economic terms as the inter-temporal variance of log consumption, the assumption that the variance of log consumption is the same for all households seems quite restrictive, regardless of its statistical import. That is because it forces the estimates of the mean and variance of consumption to be monotonically related across households, ruling out the possibility that a household with a lower mean consumption may nevertheless face greater consumption volatility than a household with a higher average level of consumption. Both formal and anecdotal evidence points to high levels of income and consumption volatility for poor households.

4. Data

For cotton, we have focused in two zones in two regions where majority of smallholder cotton production takes place (1 zone in Amhara and 1 zone in Tigray) and we have used stratified two stage cluster sampling. Zones are the strata for the sampling, namely, North Gonder and Western Tigray constitute the study area. The primary sampling units are Kebeles in zones that make up the study area and households are the secondary sampling units. Our sample constitutes 200 households in Western Tigray and 400 households in Amhara.

Sugarcane is mainly produced by large commercial farms managed by the sugar factories. But the focus of this study is on households engaged in the production of sugarcane for the purpose of sugar production. Of the three sugar factories that are operational (i.e., Metahara, Wonji and Fincha), only Wonji involves out-growers. The out-growers are organized into organizational associations. We have again focused on two zones namely, East Shoa and Arsi where most of the out-growers are located and we used two stage cluster sampling. The primary sampling units are organization associations and the secondary sampling units are households within the sampled organizational associations. Accordingly, we have sampled 300 households for each zone.

The following analysis is based on those households. In order to measure vulnerability, we havel used consumption expenditure per capita of households and grouped our explanatory variables into three: Christaensen and Sabbaro (2003) risk factors, risk exposures and coping capacity.

Risk factors

Variables that are grouped under risk factors affect the level and variability of the households' endowments and income and hence consumption expenditure. In the face of these risks, households allocate their endowments to activities which generate income. Under this category we looked at average rainfall, death of income earner and failure of agricultural business.

Risk exposure

Under risk exposure, we have grouped variables that measure the extent to which the risk factors (shocks) affect household consumption. For example, if a household has good income from a non-agricultural activity, we can say it has limited exposure to shocks such us rainfall. Land size, fertilizer use, proportion of irrigated land and non-farm income are used to measure exposure to risk.

Coping Capacity

The final group of explanatory variables that we have considered includes those variables that improve the capacity of a household to cope when shocks strike and measure the capacity and desire of the household to protect its consumption from income shocks.

Table 2. Descriptive statistics on the risk factors, risk exposure and coping capacity of households in sugarcane and cotton producing areas 2013/14.

	Sugar (N=606)		Cotton (=600)	
	Mean	Std. E.	Mean	Std. E.
Total weekly Expenditure per capita in Birr	132	4	122	5
Risk Factor				
Average daily rainfall in 2013	3.13	0.003	2.060	0.008
Death Income Earner	0.01	0.004	0.005	0.003
Non Agricultural Business Failure	0.02	0.005	0.015	0.005
Risk of Exposure				
Fertilizer use	0.12	0.014	0.130	0.014
Land Size	2.50	0.160	6	0.750
Non-Farm Income in birr last year	7846	988	3243	385.000
Proportion of Irrigated Plot	0.61	0.010	0.020	0.003
Coping Mechanism				
Remittance in birr last year	15877	4956	5345	1673
Household Size	4.90	0.090	5.100	0.090
Age	47	0.660	43	0.470
Total livestock value in birr	2598	391	8776	861
Literacy rate	0.56	0.010	0.510	0.012
Female headed households	0.25	0.020	0.060	0.010
Distance to all season road in 2013/14 E.C. in mins.	22	1.200	215	17.700
Extension visit for Crop	0.47	0.020	0.570	0.020
Extension visit for Livestock	0.41	0.020	0.480	0.020
Credit last year in birr	699	78	4157	328

In general, households in sugarcane producing areas have higher expenditure per capita, diversified income with bigger non-farm income, have significant portion of their land irrigated, live very close to all season roads and have received larger remittance. On the other hand, households in cotton producing areas with larger land size and bigger livestock asset are mainly male-headed household.

5. Result

5.1. Expected mean and variance of consumption

We start by examining the effects of the different explanatory variables defined above on the mean and variance of consumption expenditure for sugarcane and cotton producing areas separately. In doing so, we can better understand the relative importance of the different factors that contribute to vulnerability. As shown in Table 3 for cotton producing areas, rainfall shock is found to be significantly and positively associated with log of consumption expenditure per capita and it is the only risk factor with significant association with consumption expenditure.

Turning to risk of exposure, land size and income for non-agricultural activities are found to reduce the risk of exposure to consumption expenditure falling down. Big family size and being headed by female reduces the ability of households to cope with shocks whereas high literacy rate and livestock asset improves coping ability of households.

Turning to the determinants of the volatility of consumption, our model does poorly to explain that. The only determinant that is in line with expectation is that those households who have better remittance flow were able to reduce variation in consumption. But we also have strange result where non-agricultural business failure has reduced consumption variation and proportion of irrigated plot increasing consumption variation.

Table 3. Determinants of vulnerability in cotton producing areas

	Log of Total Expenditure Per Household Member			Var (Log of Total Expenditure Per Household Member)		
	Coef.	Std. Err.	t-value	Coef.	Std. Err.	t-value
Risk Factor						
Average daily rainfall in 2013	**0.266**	0.12	2.28	0.20	0.11	1.88
Death Income Earner	0.028	0.26	0.11	-0.23	0.19	-1.22
Non Agricultural Business Failure	0.052	0.15	0.34	**-0.18**	0.08	-2.28
Risk of Exposure						
Fertilizer use	0.057	0.06	0.93	-0.04	0.04	-0.91
Land Size	**0.013**	0.00	2.82	0.00	0.00	0.45
Non-Farm Income ('000) last year	**0.006**	0.00	2.52	0.00	0.00	0.5
Proportion of Irrigated Plot	0.576	0.30	1.9	**0.88**	0.33	2.65
Coping Mechanism						
Remittance ('000) last year	0.006	0.01	0.49	**-0.02**	0.01	-2.14
Household Size	**-0.127**	0.01	-11.47	0.00	0.01	-0.1
Age	0.000	0.00	-0.05	0.00	0.00	1.31
Total livestock value ('000)	**0.003**	0.00	2.95	0.00	0.00	-0.9
Literacy rate	**0.423**	0.07	5.65	-0.01	0.06	-0.22

	Female	**-0.222**	0.09	-2.35	0.02	0.07	0.22
	Minute to all season road 2013/14	0.000	0.00	0.83	0.00	0.00	0.95
	Extension visit for Crop	0.049	0.06	0.86	-0.09	0.05	-1.92
	Extension visit for Livestock	**0.180**	0.06	3.2	0.05	0.04	1.14
	Credit ('000) last year	0.003	0.00	1.26	0.00	0.00	-0.32
Constant		**1.413**	0.26	5.36	-0.23	0.24	-0.96
N			594			594	
R2			0.32			0.04	

Table 4. Determinants of vulnerability in sugarcane producing areas

	Log of Total Expenditure Per Household Member			Var (Log of Total Expenditure Per Household Member)		
	Coef.	Std. Err.	t-value	Coef.	Std. Err.	t-value
Risk Factor						
Average daily rainfall in 2013	0.242	0.250	0.97	0.090	0.193	0.47
Death Income Earner	-0.210	0.190	-1.11	-0.056	0.125	-0.45
Non Agricultural Bussiness Failure	**-0.334**	0.116	-2.89	**-0.136**	0.057	-2.4
Risk of Exposure						
Fertilizer use	0.010	0.058	0.17	-0.027	0.038	-0.71
Land Size	**0.098**	0.030	3.3	0.055	0.032	1.71
Non-farm Income ('000) last year	**0.003**	0.001	3	0.000	0.001	0.33
Proportion of Irrigated Plot	0.038	0.057	0.66	0.059	0.042	1.4
Coping Mechanism						
Remittance ('000) last year	0.001	0.002	0.68	0.000	0.002	-0.11
Household Size	**-0.115**	0.010	-11.92	-0.002	0.007	-0.34
Age	0.000	0.001	0.33	0.000	0.001	-0.34
Total livestock value ('000)	0.002	0.002	1.02	0.000	0.002	0.22
Literacy rate	**0.461**	0.068	6.73	-0.065	0.053	-1.24
Female	-0.006	0.047	-0.14	-0.003	0.034	-0.09
Minute to all season road 2006	-0.001	0.001	-1.01	0.000	0.001	-0.55
Extension visit for Crop	-0.030	0.071	-0.43	0.046	0.056	0.83
Extension visit for Livestock	0.061	0.072	0.84	-0.086	0.056	-1.53
Credit ('000) last year	0.014	0.010	1.41	-0.003	0.005	-0.57
Constant	1.260	0.778	1.62	-0.030	0.603	-0.05
N	592			592		
R2	0.28			0.05		

Returning to the sugarcane producing areas, the conditions of households is quite different. As shown in

Table 2, large proportion of the farm in the area is irrigated. As a result the average rainfall is not statistically a significant determinant of consumption level (see

Table **4**). The risk factor that is significant is failure in non-agricultural businesses. This shows that households' vulnerability and factors contributing to that are different in different parts of the country. As before, non-farm income and land size reduces the exposure to risk and better literacy rate improves the ability to cope in a household is affected by shock. Finally, big family size reduces the ability of households to cope with risk.

5.2. Vulnerability of households

So far, we have studied the determinants of the level and variation of consumption in sugarcane and cotton producing areas. Our primary focus is the vulnerability of households and therefore we will turn to the discussion on vulnerability. As stated before, we will be focusing on vulnerability to expected poverty following the discussion in section 3, we assume that households consumption follow a log normal distribution and we also assume households experience difference variation to consumption. We use the efficient 3 stage feasible estimates from Table 3 and

Table **4** estimate the mean and variance of consumption as shown in equation 3 and 4.

In order to predict vulnerability, we have to define the poverty line and we have used US 1.25 per day as poverty line. We also need to define at what percentage level a household is considered vulnerable. As a cut off, we have used 0.5 and households with probability of falling into poverty in the next period over 0.5 will be considered vulnerable. Then using equation 5, we have estimated the level of household vulnerability. The result is presented in Figure 1where vulnerability is plotted against consumption expenditure per capita. On the vertical axis, we have the predicted level of vulnerability ranging from zero to one. On the horizontal axis, we have log consumption expenditure per capita. The red vertical line is the poverty line and the horizontal red is cut off for separating those who are vulnerable and from those who are not.

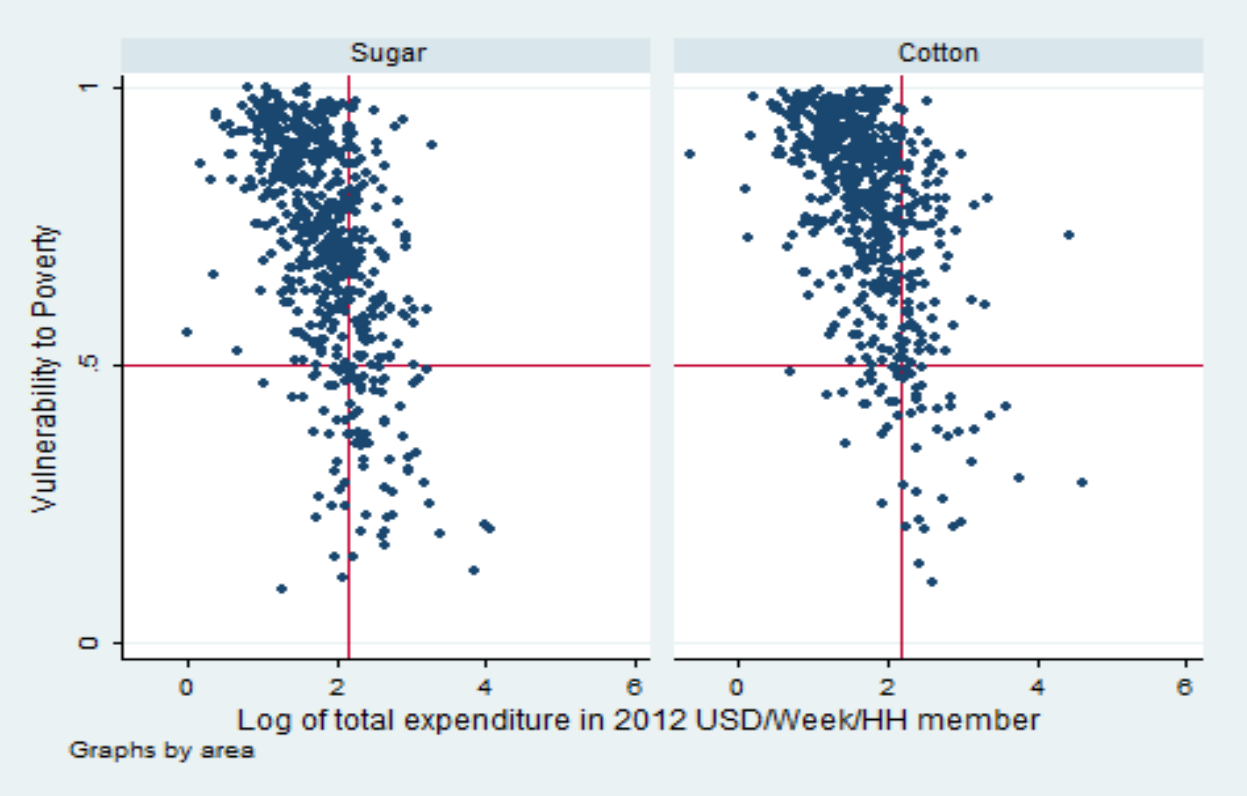

Figure 1 Vulnerability and consumption expenditure

In Figure 1, those below the vulnerability cut off and to the left of the poverty line are those who are rich and are not vulnerable. We also have rich people above the vulnerability cut off in both sugar and cotton producing areas. This means, these people although not poor are likely to fall back into poverty. This is the result of expected shock in their consumption. Therefore, it is important to study poor people as well as vulnerable people in a forward looking manner. The focus of the next section will be examining further who those vulnerable households are.

5.3. Discussion

We compared the level of vulnerability across levels of poverty, gender, non-farm income, livestock asset, literacy rate and family size.

Table 5. The average vulnerability across level different household categories

	Sugar		Cotton	
	Mean	Standard Deviation	Mean	Standard Deviation
Overall	72.4%	0.008	78.0%	0.007
Poverty				
Poor	78.0%	0.008	82.2%	0.007
Non-poor	57.7%	0.016	62.4%	0.018
Gender				
Male	73.5%	0.010	78.0%	0.008
Female	69.1%	0.014	77.6%	0.032
Non-farm Income				
Below Average	73.8%	0.009	80.1%	0.008
Above Average	68.9%	0.018	69.4%	0.018
Livestock Asset				
Below Average	72.4%	0.009	78.2%	0.008
Above Average	72.7%	0.021	77.2%	0.015
Literacy				
No one is literate	79.6%	0.014	83.3%	0.012
Some members Literate	78.4%	0.008	80.6%	0.007
Everybody is Literate	47.6%	0.018	49.5%	0.024
Family Size				
Above Average	84.1%	0.007	87.7%	0.007
Below Average	58.5%	0.011	70.6%	0.010

The most significant improvement in vulnerability comes from literacy. A household where everybody is literate is found to be on average not vulnerable using a cut off of 0.5 where the levels of vulnerability are 0.476 and 0.495 in sugarcane and cotton producing areas respectively. Family size increases the risk of being vulnerable by over 25 and 17 % in sugarcane and cotton producing areas respectively. The average vulnerability of non-poor households is 0.57 showing that there are non-poor households who are vulnerable. Our analysis also shows that the importance of non-farm income in reducing the level of vulnerability in both areas of our study.

6. Conclusion

The process of policy design should take into account that households' vulnerability condition might be different from the poverty status and we need not just consider the welfare status of households at a certain point. It is important to study the welfare status of households over a period of time as some households could be non-poor at one point as measured by the current level of consumption but are likely to face significant variation in consumption that could pull

them back into poverty. This is found to be true for both sugarcane and cotton producing areas of the country. It is important to realize that households in these areas that are expected to play an important role in the structural transformation of Ethiopia by providing inputs to the manufacturing industry should be examined carefully.

The study found out that rainfall plays an important role in cotton growing areas and it significantly affects the expected mean of consumption. It is also shown that it is important to have non-farm income to reduce exposure to such shocks. Coping mechanisms involve controlling family size, improving the literacy condition of households, and maintaining livestock asset.

Returning to sugarcane producing areas, failure of non-farm business is the main risk factor rather than rainfall. This is to be expected as the majority of plots are irrigated. As in the case of cotton, in sugarcane areas non-farm income reduces the risk of exposure and big family sizes compromise coping capacity. Finally, literacy is critical in improving the coping capacity of households.

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