
Determinants of Smallholder Food Consumption Commercialization

in Ethiopia

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Abstract

Small holder households in Ethiopia have traditionally consumed food mostly grown on their own farms. While they continue to rely on self-produced grains, vegetables, meats, and eggs for a large portion of their diet, households are now purchasing more of their food from the market. This study is intended to investigate the determinant factors of food consumption commercialization (market based consumption). In this regard, it has employed descriptive and econometric approaches. As indicated in the study results, on average, about two-third (65%) of smallholders consume their entire food item from market purchases, while around one third (35%) of the sample households do not consume from the market. This implies that most smallholders were market oriented in their consumption. Applying the generalized linear model (glm) for the fractional response variable of commercialization, determinants of market based consumption (commercialization in food consumption) have been investigated. The results indicated that while sex (female), education, religion, TLU, production commercialization, agro-ecology (cool), and land size 0.5 to 2 hectares affect consumption commercialization positively and significantly; age, family size, regional states, marital status, level of output, extension service, credit service, distance to weekly market, and land size above 2 hectares affect negatively and significantly, calling for remedies to improve commercialization.

Key Words: Commercialization, Consumption, fraction, glm, market.

Introduction

Smallholder commercialization is a crucial feature of the structural transformation process considered by most development economists to be the major pathway from a semi-subsistence agrarian society to a more diversified and food secured economy with higher general living standards. Smallholder commercialization may refer to a virtuous cycle in which farmers intensify their use of productivity-enhancing technologies on their farms, achieve greater output per unit of land and labor expended, produce greater farm surpluses (or transition from deficit to surplus producers), expand their participation in markets, and ultimately raise their incomes and living standards. Commercially oriented farmers focus on maximizing profits, generally purchase

agricultural inputs as well as household food items, and tend to specialize in crops that complement each other in terms of land rotation, the machinery used, marketing seasons, etc. As part of the transformation process, this study has focused on consumption aspect of commercialization (FAO, 2014). Most of the literatures on smallholder commercialization deal only with the output side of commercialization. However, sustainable commercialization of smallholders requires not only the integration into the input markets as discussed by Pingali & Rosegrant (1995), but also food consumption decision of the household. To contribute to redressing the gap in the commercialization literature on the determinants of food consumption commercialization (food market participation) of households, determinants of smallholder food consumption commercialization has been addressed in this study.

Conceptual framework

Since the 1980s, smallholder commercialization has received greater attention as part of the agricultural transformation process and as a consequence of urbanization and economic growth (Pingali, 2001). Most literatures on small scale farming focus on commercialization on the production side, where agricultural commercialization may refer to the trend toward increasing the proportion of agricultural production that is sold by farmers in the market. That is, a smallholder could be regarded as a market oriented if its production plan follows market signals and produce commodities that are more marketable.

In this regard, the methodological approaches to commercialization can roughly be divided in to two categories on the basis of the aggregation methods used: econometric and index aggregation approaches. Some authors use econometric models derived from the conventional non-separable agricultural household models to evaluate their resource allocation decisions for producing commodities consumed at home (food crops) or those supplied to markets (cash crops). Others use simple indices to look at the proportions of resources or income derived from the market.

Various authors have used different yardsticks in measuring the level of smallholder commercialization, which are usually emanated from the way commercialization is conceptualized. Literatures show that the common approach to measuring the degree of smallholder commercialization is based on the proportion of the value of agricultural products sold or the value of agricultural inputs bought to the total household agricultural income (Strasberg *et al.*, 1999; Berhanu & Moti, 2010; Bekele *et.al*, 2010; and Justus, *et.al*. 2015). Analogous to the commercialization in production, commercialization in consumption of small scale farming has conceptualized in this study as the ratio of consumption levels from the market (purchased) to the total consumption level. That is,

$$CC_i = \frac{\text{Consumption from market purchase}_i}{\text{total consumption}_i}$$

Where, CC_i = level of consumption commercialization for household i .

Data and Methodology

Data Type and Source

The data type used in this study is mainly a secondary data that have obtained from CSA (Central Statistical Agency of Ethiopia), an Ethiopian Socioeconomic Survey (ESS) dataset. The ESS is a collaborative project between the CSA and the World Bank Living Standards Measurement Study-Integrated Surveys of Agriculture (LSMS-ISA). ESS is a long-term project to collect panel data and this data is of the second wave collected during 2013/14.

Sampling Procedure/Design of ESS

The sample design of ESS is a stratified, two-stage probability sampling design where the regions of Ethiopia serve as the strata. Quotas were set for the number of enumeration areas (EAs) in each region to ensure a minimum number of EAs are drawn from each region. The ESS data is representative at the regional level for the most populous regions of Amhara, Oromiya, SNNP, and Tigray only. For the reason of representativeness, this study has focused on these regions, while other regions were included as one category for comparison.

The first stage of sampling entailed selecting enumeration areas (i.e. the primary sampling units, PSU) using simple random sampling (SRS) from the sample of the Agricultural Sample Survey (AgSS) EAs (CSA, 2015). The sampling frame used to select the PSUs of EAs in AgSS was the list containing EAs of all regions and their respective households obtained from the 2007 (1999 E.C.) Population and Housing Census frame. Consequently, at the starting of ESS in 2011/12, Annual AgSS, all sample EAs were selected; and from this frame the ESS EAs were selected based on probability proportional to size of population (PPS) of the total EAs in each region (in both rural and small towns, where small town samples come from the universe of small town EAs). Based on this sampling frame, 290 EAs and 43 EAs for rural and small town respective samples were selected from the AgSS EAs.

The second stage of sampling was the selection of households to be interviewed in each EA, where 12 households were randomly selected in each EA from the sample of 30 AgSS households. Thus, the final numbers of household successfully re-interviewed in wave 2 were 3,776 from rural and small town areas, where this study has employed.

Method of Data Analysis

After computing the level of commercialization in consumption through index method, determinants for the level of commercialization for consumption have been investigated. The methodological issues that arise with such fractional dependent variables imply that the effect of any particular X_i cannot be constant throughout the range of x . That is, the drawbacks of linear models for fractional data are analogous to the drawbacks of the linear probability model for binary data that the predicted values from the standard linear regression models (as OLS) can never be guaranteed to lie in the unit interval and the implied constant marginal effects of the covariates are not compatible with both the bounded nature of the fractional data and the existence of a mass point at unity in their distribution (Ramalho *et.al.*, 2010; Papke & Wooldridge, 1996).

To some extent this problem can be overcome by augmenting a linear model with non-linear functions of x , like logit transformation or grouped logit models. However, such non-linear models are appropriate if the values for the proportion y are strictly within the unit interval ($0 < y < 1$). That is, neither zeros nor ones can be included in the strategy, as the transformation $[y/(1-y)]$ is not defined for those values (Baum, 2008).

Alternatively, some researchers (e.g., Rajan and Zingales, 1995) have considered using censored normal regression techniques (i.e., Tobit model) on proportional data that contain zeros or ones. While seemingly appropriate for modeling the conditional expectation of a continuously measured proportion, the censored normal regression model is a conceptually flawed model for proportional data. This is because, as Maddala (1991) observes, these fractional data are not observationally censored but rather are defined only over the interval $[0,1]$ implying that the conditional expectation of a continuous proportion variate is only defined on the bounded interval, $[0,1]$. Therefore, the conditional mean must be a nonlinear function of the explanatory variables, and heteroskedasticity becomes a concern. Moreover, the conditional variance must be a function of the conditional mean since the conditional variance must change as the conditional mean approaches either boundary. Therefore, the use of such linear conditional expectation function to study the conditional mean of a fraction leads to specification errors of both the mean and the variance structure of the conditional distribution (Ramalho et al., 2010). As a result of these errors, the estimates of the regression coefficients and their variances are biased and inconsistent; which raises questions about their conclusions.

To address these specification errors, writers as Papke and Wooldridge (1996) and Kieschnick and McCullough (2003), examine the specification of regression models for fractional data observed on $(0,1)$. Consistent with the above points, they found evidence confirming that for such data the conditional expectation function is nonlinear, and the conditional variance is a function of the mean. Of the various econometric specifications that Kieschnick and McCullough (2003) test, they fail to reject the applicability of either a regression model based upon the beta distribution that they propose or the quasi-likelihood model proposed by Papke and Wooldridge (1996).

In Papke and Wooldridge (1996), direct models for the conditional mean of the fractional regression approach that keep the predicted values in the unit interval through a more refined and flexible analyses using the generalized linear model (GLM) has been proposed. These writers provided further developments and applications of this method, a Bernoulli quasi-maximum likelihood estimation to obtain robust estimators (and inference) of the conditional mean parameters with satisfactory efficiency properties with fractional response variables. The generalized linear model (glm) approach was enhanced for handling proportion data in which zeros and ones as well as intermediate values may appear. This approach makes use of the logit link function (that is, the logit transformation of the response variable) and the binomial distribution, which may be a good choice of family even if the response is continuous. The variance of the binomial distribution must go to zero as the mean goes to either 0 or 1, as in each case the variable is approaching a constant, and the variance will be maximized for a variable with mean of 0.5. This approach is preferred to that of dropping the observations with zero or unit values, which would create a truncation problem. The most common of those methods, where the mean function takes the logistic form, has since been

applied in numerous empirical studies, including Wagner (2001). In this study we follow this generalized linear model for our fractional consumption commercialization variable. The model variables and their hypothesized sign of the study are described in table 1.

Table 1. Model Variables and their prior sign

Definition of variable	Unit- how measured	Variable code	Prior sign
Consumption Commercialization index	Fraction	mktconsindex	Dependent
Value of annual crop production	Continuous- Birr	lnoutput	-
Region	Category- 0 if Tigray	region	
Urban-Rural	Dummy-0 if rural	rural	
Age of the HH head	Continuous- Years	age	-/+
Gender of the HH head	Dummy-0 if male	sex	+
Education level of HH head	Category- 0 if can't R & R	educ	+
Marital status of HH head	Category- 0 if not married	marital	+
Religion	Category- 0 if orthodox	religion	
Family size	Continuous- Number	Famsize	-
Size of land holding	Category- 0 if <0.5 har	landsiz	-
Livestock ownership	Continuous- № in TLU	Intlu	+
Production commercialization	Fraction	overallindex	+
Distance to the weekly market	Continuous- Km	dist_market	-
Access to market information	Dummy- 0 if no	mktinfo	+
Agro-ecology	Dummy- 0 if warm	agroecol	
Agricultural Extension service	Dummy- 0 if no	extension	+
Credit access	Dummy- 0 if no	credit	-/+

Results and discussion

This section has presented the discussion for the analysis results of the study on the determinants of commercialization in consumption. However, before directly starting the commercialization analysis, respondents have been described by different socio-economic variables as follows.

Description of Respondents

Smallholder farmers were described by sex, marital status, religion, age and education level of household head. Moreover, description has made based on urban-rural and regional locations. While the total panel households in both rounds of data collection were 3776, the analysis shows lower than this number for some variables indicating that there was no information on the remaining units.

The analysis results by demographic characteristics of the sampled household indicates that majority of them were male in their sex (74%), married (68%) by their marital status, can't read and write (64%) in their education, orthodox (44%) in their religion and between 30 to 65 age range (72%). Regarding the location of the sampled households, more than 88 percent come from rural areas, while the remaining from small towns. Region wise, around 78 percent of households were sampled from the four more populous regions (SNNP, Oromia, Amhara, and Tigray), while each of the

remaining six regions account for 3.7 percent of respondents on average. Based on their land holding size, while around 83 percent of households have two hectares or less (so that they were considered as smallholders) more than half of this (42%) were with land holding size of 0.5 to 2 hectares. Out of the smallholders (83% of holding ≤ 2 hars), more than one-fourth of them (27%) have land size between 1 to 2 hectares; and around 24% were with land holding size of 0.5 to 1 hectare, while the remaining half own below 0.5 hectares. On both of the extreme values, about 15% of HHs have very small land size (< 0.05 hars); and only 2.6% have large land holding size of > 5 hars, while 14% were within 2 to 5 hectares holding size.

Commercialization in food Consumption

In order to assess the level of smallholder’s commercialization in consumption, consumption of smallholders by source has been analyzed. Whatever the smallholder consumed were sourced from purchases from market, and/or from own production sources. Accordingly, the ratios of consumed from purchased to total consumption and consumed from own production to total consumption were examined in order to examine the levels of commercialization in consumption and consumption orientation production of smallholders respectively.

The study results showed that most farm households were market-oriented in consumption as around 64.55 percent of the consumption commodities come from market. That is, the mean value for the ratio of consumption from purchase in market to total consumption (commercialization in consumption) was 0.6455, while the range was between zero and one. The extreme index value of zero tells that none of the consumption commodities of the households come from market purchases, where this accounts for about 35 percent. On the other hand, the index for the second extreme case of value one has accounted for about 64.5 percent, indicating that consumption of those households totally depends on market purchases. Overall, these results highlighted that majority of the commodities consumed by smallholders come from the market through purchase, implying that smallholders were market oriented in their consumption. The detail is in table 2.

Table 2: Range of the indices for consumption from the market and own production

Consumption from market purchase		Consumption from own production	
Range of the Index	Percent	Percent	Range of the Index
0 (DON’T consume from mkt)	34.93	67.79	0 (DON’T consume from own)
(0 to 0.25)	0.29	0.13	(0 to 0.25)
[0.25 to 0.5)	0.14	0.12	[0.25 to 0.5)
[0.5 to 1)	0.39	0.25	[0.5 to 1)
1 (consume ALL from mkt)	64.25	31.71	1 (consume ALL from own)
Mean purchase index	64.55	31.93	Mean own index

Source: Author’s computation based on CSA-LSMS-ISA data, 2017

On the other hand, the ratio of consumption from own production to total consumption has calculated for smallholders. These results show that on average around 31.71 percent of the households consume all of their food items from own harvest, while the index ranged between zero and one values. While all of the consumption items come from own production for around 32 percent of crops, all the remaining 78 percent of the households consume their food items that do not come

from own production. This indicates that small farmers were not consumption-oriented producers, as evidenced above that most of them were market oriented consumers. These details are displayed in table 2.

Consumption commercialization by food item

The consumption commercialization has been analyzed by food items and their source. The results showed that on average, around two-third (65%) of smallholders in the study area consume food items that are totally from the market, with highest of sugar & salts (99%) and lowest of cereals (36%). On the other hand, around one-third (32%) of the households consume their food items totally from own production, on average, with highest of cereals (59%) and lowest of stimulants (0.4%).

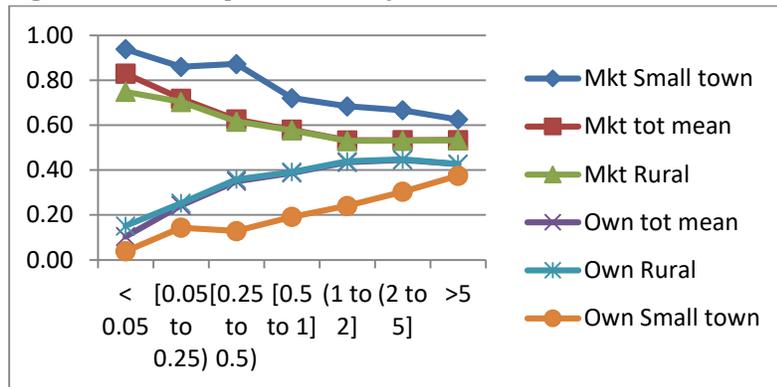
When these consumption commercialization indices disaggregated further across urban-rural location, the results indicated that while the consumption index from market was higher for small towns than rural, the opposite is true (it was lower in small towns than rural) for own consumption index. Around 60 percent and 92percent of the food item consumed by households in rural areas and small towns respectively came from purchase in the market, with highest of sugar & salts (98%) and lowest of cereals (in rural, 28.6%) and livestock products (in small towns, 78.4%). On the other hand, more than one-third (36%) and only 6 percent of the food item consumed by households in rural areas and small towns respectively came from own production, with highest of cereals (64%) and lowest of stimulants (0.13%). The implication of these results indicate that on average households were not consumption-oriented producers; rather were market-oriented consumers.

These consumption commercialization results have been analyzed by disaggregating using household head demographics such as sex, age, education, region, marital status and religion. These demographic analysis results of consumption commercialization indicated that male headed households have (0.63) significantly (at 5% level of significance) lower market based consumption index than their female counter parts (0.68), while the opposite is true for own sourced consumption (male have higher index than female). As education level increases, consumption commercialization (from market) increases on average, while consumption from own production declines. This may be due to the fact farmers are becoming aware of diversified and market based feeding system as a result of increase in their educational level. The opposite result happened with age level. That is, as age increases, on average household increase own consumption and decreasing market based consumption. On average while SNNP has the minimum and maximum marketed consumption and own consumption values respectively, Tigray has the opposite index values. On the other hand, while those never married households have the maximum and minimum market based consumption and own consumption indices values respectively, the opposite is true for those married households. This may be logical due to the fact that consumption of those married households with much more family size have to depend on their production (rather than on market). Finally, while market based index was maximum and minimum for those Muslim and Protestant households respectively, the opposite is true for own production consumption.

Consumption commercialization by land size

Consumption index results have also been disaggregated by land size of household head. As indicated in the figure below, as cultivated land size increases, the consumption from market decreases while consumption from own production increases. The market based consumption index was highest and lowest in small towns and rural areas respectively. On the other hand, own production consumption index was lowest in small towns and highest in rural areas.

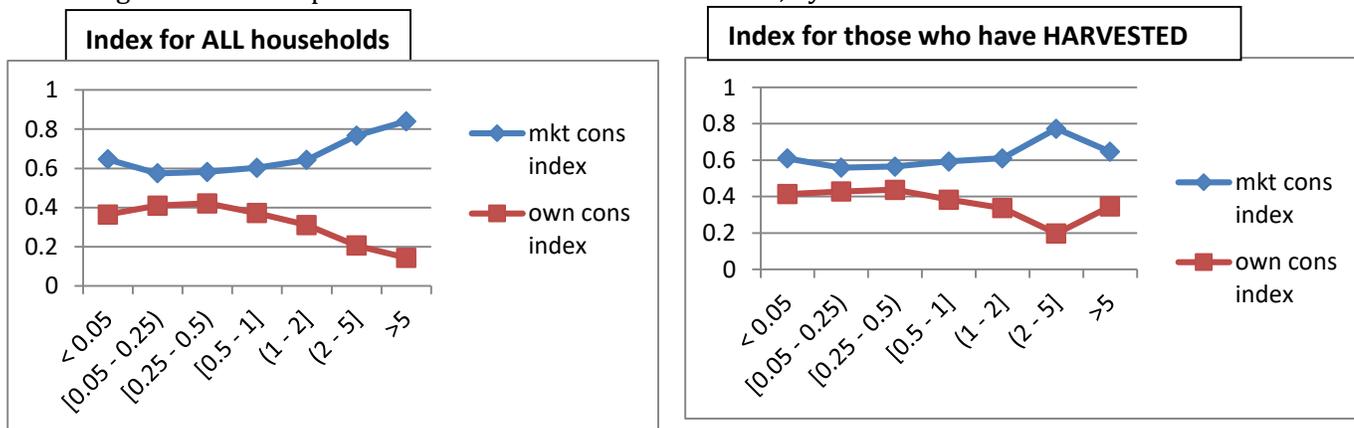
Figure 1: Consumption index by land size



Source: Author’s computation based on CSA-LSMS-ISA data, 2017

Furthermore, consumption index results have been disaggregated by crop harvest and land size of household head. Results showed that market consumption index for all households increases after 0.25hars, while own production index does the opposite, implying that households become more market oriented in line to the size of their land. This situation has investigated by relating consumption with production by introducing whether these consumers were harvesting or not. As a result, as land size increases, consumption index for those farmers who were harvesting declined after certain size. That is, market consumption index for those who have HARVESTED declined for the lowest (<0.25hars) and highest (>2hars) land sizes; while the reverse is true for consumption from own production. This indicates that as land size increases, while consumption of those do not harvesting farmers depend on market (by reducing own consumption), consumption of those harvesting depend on their own production (by reducing market consumption).

Figure 2: Consumption commercialization index of HHS, by harvest



Source: Author’s computation based on CSA-LSMS-ISA data, 2017

Econometric results

Based on the reasons discussed in the 'method of data analysis' above, the study employ generalized linear model for the fractional consumption commercialization variable. Consequently, the results for determinants of consumption commercialization of smallholders has presented in table 3. Moreover, OLS and Tobit models have also been compared with glm, while only significant variable were presented. Results indicated that the three models were similar in their result regarding the sign and significance of variables to affect consumption commercialization, except for credit that was significant in glm only.

Applying the econometric method of glm, all the 17 included variables, except market information (dummy for mobile or fixed phones) were significantly influencing the level of market based consumption of small farmers in Ethiopia. As indicated in the table, female households have an advantage to have significantly (@1%) higher (by .3103) market based consumption than male households. This may be due to the cultural fact that most consumption related market transactions are conducted by females to care their family than males. Education level had significant impact on increasing the level consumption commercialization. That is, households with education levels of primary and secondary & above were having significantly (@5&1% respectively) higher (by .1001 & .2486 respectively) consumption commercialization than those who can't read and write. As age increases, the level of market based consumption significantly (@ 5%) declines, implying that young heads were more market oriented consumers. As family size increases, consumption from the market significantly (@5%) declined. This is consistent with the descriptive analysis of the index which was minimum for married and maximum for never married households, may be to reflect shortage of expenditure need for market based consumption. Region wise, Oromia and SNNP have significantly (@1%) lower (by .2738 & .2097 respectively) market based consumption than Tigray regional state. Households residing in small towns have significantly (@1%) higher (by 1.355) consumption commercialization than their rural counterpart. Those widowed households were having significantly (@5%) lower (by .4003) consumption commercialization than those never married, while there is no significant evidence that married & divorce households have different market orientation in consumption than those never married. Religion wise, there was significant (@1%) evidence that only those Muslim households have lower (by .1533) consumption commercialization than orthodox.

Table 3: Determinants of consumption commercialization: using glm

Variables	Generalized linear models, glm		
	Coefficient	(robust s.e.)	z-value
sex_fem	.3102643***	(.0856768)	3.62
age	-.0036738**	(.0014663)	-2.51
educ_1 st	.1001204**	(.0422409)	2.37
educ_2 nd	.2485968***	(.086748)	2.87
famsize	-.0238309**	(.0093762)	-2.54
region_oro	-.2737667***	(.0728367)	-3.76
region_snnp	-.2096862***	(.079647)	-2.63
rural_smal	1.355311***	(.1185383)	11.43

marital_wid	-4.003234**	(.1891932)	-2.12
religion_mus	.1533097***	(.0489186)	3.13
lntlu	.0141766***	(.0049478)	2.87
lnoutput	-.1071812***	(.0170657)	-6.28
overallindex	.8457635*	(.1255948)	6.73
landsiz_0.5-2	.0837444*	(.0477831)	1.75
landsiz_>2	-.1412552***	(.0534687)	-2.64
extensio~1	-.1365322***	(.0393933)	-3.47
credit_1	-.075751**	(.0445705)	-1.70
dist_market	-.002466***	(.0003892)	-6.33
agroecol_cool	-.4968211***	(.0797026)	-6.23
_cons	2.300977***	(.2272631)	10.12
No. of obs	2070		
Residual df	2044		
Deviance	345.0216421		
	Pearson	309.9072697	
Log pseudolikelihood	-929.57924		
AIC	.923265		
BIC	-15261.54		

NB: *, **, & *** are significant at 10%, 5% & 1% levels of significance respectively
Values in parenthesis are standard errors.

As prior expectation, while increase in livestock production increases market based consumption (as it is source of additional income to spend), increase in own production reduced market based consumption (implying that they have enough to consume at home). Both variables were significant at 1% level of significance. Moreover, the effect of land holding size on consumption commercialization was mixed that while commercialization index was higher for those with holding size of [0.5 to 2] hectares, it was lower for those with holding greater than 2 hectares in comparison to those holding less than 0.5 hectares.

Empirical studies show that commercialization has increased household incomes in most cases (Pender and Alemu, 2007), which could led to increased food consumption (Bouis, 1994) and improved nutrition (Kennedy, 1994). Similarly, in this study, production commercialization (overallindex) has positive and statistically significant (@1%) impact on market based food consumption. Therefore, as production commercialization increases by one unit, market based food consumption increases by 0.1676 units, ceteris paribus.

Regarding the institutional factors as participation in agricultural extension programs (which may require some expenditure to introduce technologies as fertilizer, irrigation materials, & other new technologies) and credit services have negative impact on commercialization of smallholders' consumption. This is because of the expenditure requirement of these services, which reduce income for marketed based consumption. As prior expectation, distance to the weekly market has affected consumption from market negatively and significantly (@1%). On the other hand, those living in agro-ecology of tropical cold were significantly (@ 1%) disadvantageous in having market based

consumptions than those living in tropical warm agro-ecology. Finally, the OLS model has been checked for diagnosed tests of heteroskedasticity (robust), multicollinearity, and variable omission and specification problems; and was no evidence that there are any of these problems.

Conclusion

As indicated in the study results, on average, about two-third (65%) of smallholders consume their entire food item from market purchases, while around one third (35%) of the sample households do not consume from the market. This implies that most smallholders were market oriented in their consumption. The econometric (glm) results on the determinants of food consumption commercialization indicate that all of the included variables, except market information were significantly influencing the level of market based consumption of smallholders in Ethiopia. These covariates include household and head characteristics (sex, education, age, family size, marital status), farm and livestock endowment (livestock in TLU, produced output, land size), institutional factors (extension and credit services), access to markets (distance to the weekly market), and other variables as agro-ecology, and regional, religion, rural-urban dummies). That is, while sex (female), education, religion, TLU, production index, agro-ecology (cool), land 0.5 to 2 hectares affect consumption commercialization positively and significantly; Age, family size, regional states, marital status, output, extension, credit, distance to market, land above 2 hectares affect negatively and significantly, calling for remedies to improve commercialization.

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