Market Orientation and Market Participation of Smallholders in Ethiopia: Implications for Commercial Transformation

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Abstract

The literature on commercial transformation of smallholders makes little distinction between market orientation and market participation. This paper analyzes the determinants of market orientation and market participation in Ethiopia separately and examines if market orientation translates into market participation. Results show that subsistence requirements, market access, and production factors affect market orientation, while market access and volume of production affect market participation. Results also show that market orientation translates strongly into market participation. The key implication of this study is that interventions aimed at promoting commercial transformation of subsistence agriculture should follow two-pronged approach: improving market orientation of smallholders at production level, and facilitation of market entry and participation of households in output markets. Focusing on either may not be as effective in achieving the transformation.

Keywords: commercialization, smallholders, market orientation, market participation.

JEL Classification: C21, C24, Q12, Q13

1. Introduction

Commercial transformation of subsistence agriculture is an indispensable pathway towards economic growth and development for many agriculture dependent developing countries (von Braun, 1994; Pingali and Rosegrant, 1995; Timmer, 1997; World Bank, 2008). Sustainable household food security and welfare also requires commercial transformation of subsistence agriculture (Pingali, 1997). Commercial agricultural production is likely to result in welfare gains through the realization of comparative advantages, economies of scale, and from dynamic technological, organizational and institutional change effects that arise from the flow of ideas due to exchange-based interactions (Romer, 1993; 1994). Moreover, commercialization enhances the links between the input and output sides of agricultural markets.

The concept of market orientation has been used widely in the manufacturing sector (eg. the food industry) to refer to the extent to which a producer uses knowledge about the market (esp. customers and prices), as a basis to make decisions on the three basic economic questions of what to produce, how to produce and how to market[1] (Kohli and Jaworski, 1990; Jaworski and Kohli, 1993; 1996). Several studies have also demonstrated that the degree of firm market orientation is a major determinant of competitive advantage (Fritz, 1996; Selnes et al., 1996).

The literature on commercialization of smallholders makes little distinction between market orientation and market participation of smallholders. As a result, most of the analysis of the determinants of smallholder commercialization is based on the analysis of the determinants of output market participation (von Braun et al., 1994; Jaleta, et al., 2009; Otieno et al., 2009). However, analysis of the determinants of market orientation and market participation separately would be useful in guiding the type of interventions needed at production and marketing levels to facilitate commercial transformation. This paper, therefore, makes the distinction between market orientation and market participation and attempts to analyze the determinants of each separately. In addition, the paper attempts to determine if market orientation translates into market participation. By so doing, in addition to informing Ethiopian policy making to facilitate

[1] Kohli and Jakowski (1990) define firm market orientation as "the organization wide generation of market intelligence pertaining to current and future customer needs, dissemination of the intelligence across departments, and organization wide responsiveness to it."

the transformation of subsistence agriculture into commercial orientation, the paper is hoped to contribute to the smallholder commercialization literature

The paper is organized as follows. The next section gives the context of the study in brief. Section three presents the conceptual framework. Section four deals with empirical models, methods and hypotheses. Section five presents results, while section six concludes the paper and draws implications.

2. Context

Ethiopia has adopted commercialization of smallholder agriculture as a strategy for agricultural development. The agricultural services of extension, credit and input supply are expanding significantly to support commercial transformation, although the dominant player in these services still remains to be the public sector. A recent study by Gebremedhin et al. (2009) showed that the expansion of the agricultural services had significant impact on the intensity of input use, agricultural productivity and market participation of Ethiopian smallholders.

Results in this paper are based on household and plot level data collected from annual-crop based farming systems of three Ethiopian districts (Bure, Goma and Mieso), thought to represent the major annual crop production systems in the country in terms of agricultural and market infrastructure characteristics[2]. Annual crops (cereals, pulses, oil crops, and vegetables) cover about 93% of cultivated land in the study areas. Hence, commercialization is analyzed in terms of annual crop production.

3. Conceptual framework

Our overall conceptual framework given in Figure 1 is based on the literature on firm and farm market orientation (Hinderink and Sterkenburg, 1987; Kohli and Jaworski, 1990; Immink and Aarcon, 1993; Jaworski and Kohli, 1993; Fritz, 1996; Selnes et al.,

[2] Bure is located in North Western Ethiopia in the Amhara region, at about 400 km north of the capital, Addis Ababa and receives adequate rainfall (about 1600 mm per year) and has relatively well developed road and market networks. Goma is located in South Western Ethiopia, in the Oromia region, at about 400 km south of the capital, and receives abundant rainfall (about 1860 mm per year and lasting for about 8 months in a year), with less developed road networks and markets. Mieso is located in Eastern Ethiopia in the Oromia region, at about 300 km east of the capital and is characterized as drought prone with rainfall (about 800 mm per year) as the most important constraint of crop production, but with well developed road networks and market places.

1996; Jaworski and Kohli 1996), and household market participation (Goetz, 1992; Pingali and Rosegrant, 1995; Pingali, 1997; Lapar et al., 2003; Bellemare and Barrett, 2006; Rios et al., 2008; Omiti, 2009).

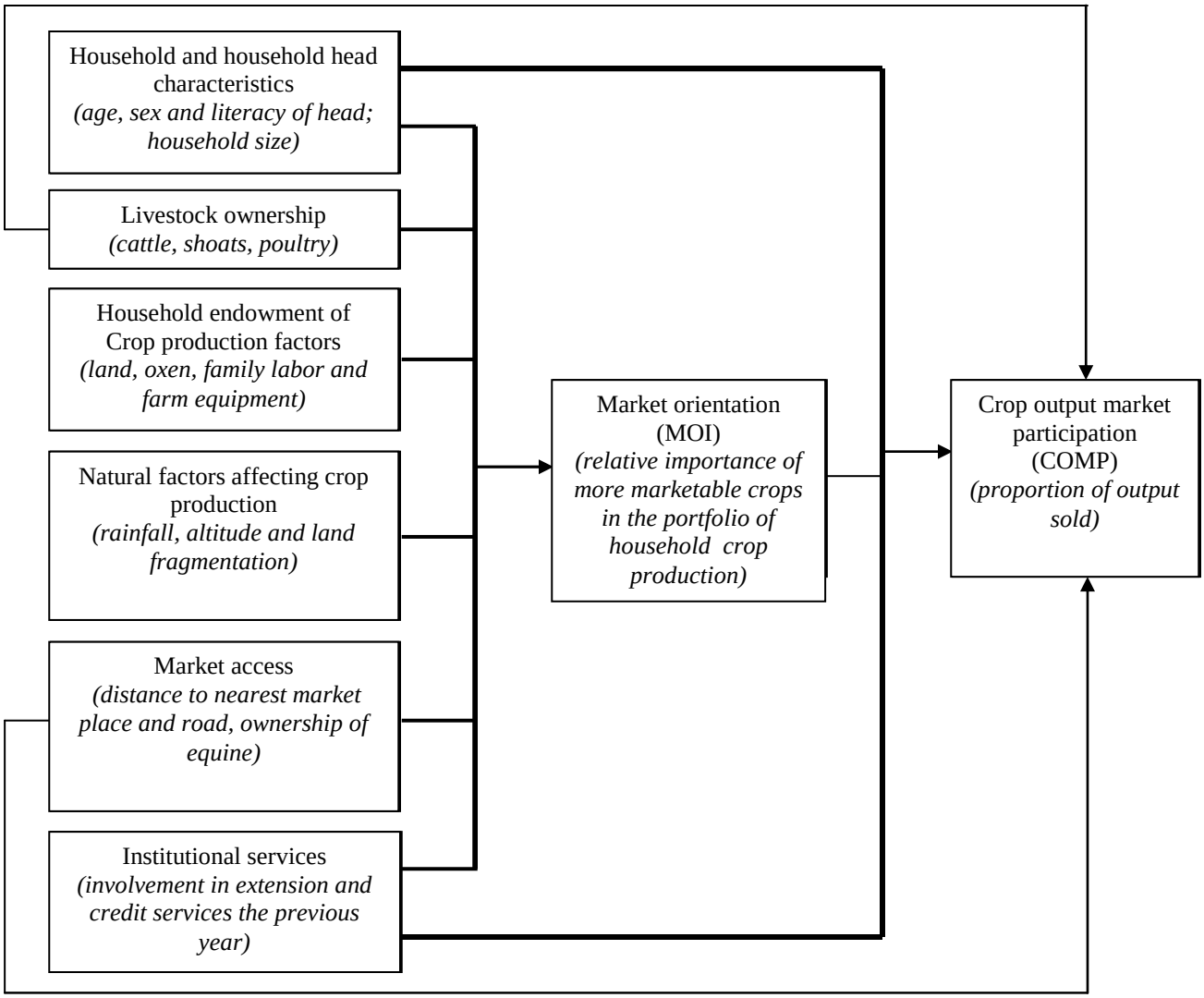

Figure 1. Conceptual framework of the determinants of household level market orientation, and crop input and output market participation.

In developing our conceptual framework, first we make the distinction between market orientation and market participation. Market orientation in smallholder agriculture is basically a production decision issue of what to produce since individual farm

households are minor players in the market. Hence, we define market orientation in agriculture as the degree of allocation of resources (land, labor and capital) to the production of agricultural produce that are meant for exchange or sale (Hinderink and Sterkenburg, 1987; Immink and Aarcon, 1993). On the other hand, market participation refers to the extent by which a household participates in the market as seller.

The determinants of market orientation and market participation may not be the same because a household may produce marketable commodities but use them for home consumption if the household specific endogenous prices lie between the mark-up selling and buying prices. This situation is more common when there are high transaction costs and the price band is wide (Key et al., 2000). A household could also have high market participation because of surplus production due to various reasons, including favorable weather conditions, although it may not be market oriented. Hence, production possibilities, comparative advantages and expected profitability are expected to be major determinants of market orientation. Realized output, profitability and market orientation are then expected to be major determinants of market participation.

Hence, we hypothesize that while market orientation is influenced by factors related to household and household head characteristics, ownership of livestock as alternative source of cash income, production and market access factors, and institutional support services, household market participation in crop output markets is determined by household market orientation, the realized level of crop production, household and household head characteristics, ownership of livestock, and market access and institutional services, and. Production related factors affect market participation in no way other than through their effect on crop production.

4. Empirical Model, Methods and Hypotheses

4.1 Empirical Model

Our specification of empirical model is based on our conceptual framework described earlier and is divided into two parts, (1) the determinants of market orientation of households in crop choices, and (2) the determinants of household participation in crop output as seller.

1. Market orientation

Household level market orientation index (*MOI*) is modeled as a function of household and household head characteristics *(HH)* (age, sex, literacy of household head, and household size); household endowment of crop production factors *(HR)* (labor supply, land, oxen, and farm equipment); ownership of livestock (*LVSTK*); market access *(MKTac)* (distance to nearest market and nearest all-weather road, and ownership of equine); access to institutional services (extension *(EXT)*, credit *(CRD));* natural factors affecting production (rainfall *(RF),* altitude *(ALT))* and land fragmentation *(SI)* (Eq. 1).

$$MOI_i = f(HH, HR, LVSTK, MKTac, EXT, CRD, RF, ALT, SI, u_{MOI_i}) \quad (1)$$

Where u_{MOI_i} is an error term assumed to be independently and identically distributed with zero mean and constant variance.

2. Crop output market participation (COMP)

Crop output market participation (*COMP*) is modeled as a function of household and household head characteristics *(HH)*; ownership of livestock (*LVSTK*); market access *(MKTac);* access to institutional services (extension *(EXT)*, credit *(CRD));* and value of annual crop production (*CRVP*). In order to test whether market orientation translates into higher market participation, we also include market orientation index (*MOI*) as a right hand side variable in the crop output market participation model (Eq. 2).[3]

$$COMP_i = f(HH, LVSTK, MKTac, EXT, CRD, CRVP, MOI, u_{COMP_i}) \quad (2)$$

Where u_{COMP_i} is an error term assumed to be independently and identically distributed with zero mean and constant variance.

[3] We were not able to include crop price as right hand side variable, because the dependent variable is the summation of all annual crop values and it was difficult to come up with a representative price at household level.

Market orientation decision can be endogenous variable in this specification, if the realized level of market participation was envisioned during production decision. To account for this possible specification problem, we have used the physical and natural crop production factors to test for possible endogeneity of MOI in the model for crop output market participation. An F-test confirmed that these variables are significant correlates with MOI but not with COMP, once we control for value of crop production.

4.2 Methods

4.2.1 Data sources

Results are based on a survey of 168 households and all plots operated by the households, and 53 communities (peasant associations (PAs)) in the three districts in 2007/08. Farming systems were stratified into PAs and households in each PA were selected randomly based on proportional to size sampling. Village level data on rainfall, altitude, distance to nearest market and all-weather road were collected at community level. Indices of land fragmentation, market orientation, and crop output market participation in annual crops were computed using the household, plot and community level data. Below, we briefly present the computation of these indices.

Land fragmentation:

Land fragmentation can be measured either in single dimension or in integrated indicators. Among the integrated indicators, Simpson index (SI) and Januszewski index (K) are the most common (Blarel et al., 1992; Wu et al., 2005). We use the Simpson index to measure the degree of land fragmentation of households as defined below (Eq. 3).

$$SI_i = 1 - \frac{\sum_{j=1}^{J} a_{ij}^2}{A_i^2}, \qquad 0 \leq \text{SI} \leq 1 \tag{3}$$

Where a_{ij} is area of the jth plot and A_i is the total area of annual crop land operated by a household. We chose the Simpson index because the Januszewski index does not take farm size into account[4]. Zero value of *SI* indicates complete land consolidation (one parcel only), while the value closer to one indicates numerous parcels of equal size.

Market orientation index (MOI):

We define that a smallholder is market oriented if its production plan follows market signals and produce commodities that are more marketable. Under a semi-commercial system, where both market and home consumption are playing a central role in production decision, all crops produced by a household may not be marketable in the same proportion. Thus, households could differ in their market orientation depending on their resource allocation (land, labor and capital) to the more marketable commodities. Marketability of annual crops was computed at the district level since districts are the closest representatives of the farming systems included in the study. Hence, based on the proportion of total amount sold to total production at district level, a crop specific marketability index (α_k) is computed for each crop produced as follows (Eq. 4):

$$\alpha_k = \frac{\sum_{i=1}^{N} S_{ki}}{\sum_{i=1}^{N} Q_{ki}} \quad ; \quad Q_{ki} \geq S_{ki} \quad \text{and} \quad 0 \leq \alpha_k \leq 1 \tag{4}$$

Where α_k is the proportion of crop *k* sold (S_{ki}) to the total amount produced (Q_{ki}) aggregated over the total sample households in a district. α_k takes a value between 0 and 1, inclusive. Crops mainly produced for markets usually have α_k values closer to 1.

Once the crop specific marketability index is computed, household's market orientation index in land allocation (MOI_i) is computed from the land allocation pattern

[4] Januszewski index $K = \frac{\sqrt{\sum_{a=1}^{n} a_i}}{\sum_{a=1}^{n} \sqrt{a_i}}$, where *n* is the number of plots, and a_i is the area of each plot.

of the household weighted by the marketability index of each crop (α_k) derived from Eq. 4 as follows (Eq. 5).

$$MOI_i = \frac{\sum_{k=1}^{K} \alpha_k L_{ik}}{L_i^T} \quad ; \quad L_i^T > 0 \quad \text{and} \quad 0 < MOI_i \leq 1 \tag{5}$$

Where MOI_i is market orientation index of household *i*, L_{ik} is amount of land allocated to crop *k*, and L_i^T is the total crop land operated by household i. The higher proportion of land a household allocates to the more marketable crops, the more the household is market oriented.

Crop output market participation:

Following von Braun et al (1994), we computed household crop output market participation in annual crops as the proportion of the value of crop sales to total value of crop production, which we refer to in this paper as crop-output market participation (*COMP*) index, computed as follows (Eq. 6):

$$COMP_i = \frac{\sum_{k=1}^{K} \overline{P}_k S_{ik}}{\sum_{k=1}^{K} \overline{P}_k Q_{ik}} \tag{6}$$

where S_{ik} is quantity of output k sold by household i evaluated at an average community level price ($\overline{P}_k$), Q_{ik} is total quantity of output k produced by household i.

4.2.2 Econometric approach

The dependent variables analyzed in this paper are market orientation and crop output market participation of households in annual crop production. The econometric model used depends on the nature of the dependent variable. For the determinants of household market orientation we use ordinary least squares (OLS) model, since the

dependent variable is continuous. For household participation in crop output market as seller we use Tobit model, since this variable is lower censored at zero. Summary of descriptive statistics of variables used in the regression models are given in Table 1. All coefficients and standard errors are adjusted for sampling weights, clustering, and stratification using the SVY command (STATACorp, 2008).

Market orientation can potentially be endogenous variable in the model for crop output market participation. Since standard Tobit model is more efficient than IV Tobit when the explanatory variables are exogenous (Wooldridge, 2003), we first tested for endogeneity of MOI in the COMP model. We use the physical and natural production factors as instruments, since we do not expect these variables to affect market participation once we control for value of crop production. The Wald test failed to provide sufficient information to reject the null hypothesis of exogeneity (see appendix 1 for the IV test of endogeneity). High mutlicollinearity among the dependent variables inflates standard errors and may render important determinants insignificant. We checked for multicolliearity and found no evidence of serious multicololinearity problem as all variance inflation factors were below 10.

4.3 Hypotheses

In setting our hypotheses, our main interests are in analyzing the determinants of households market orientation and crop output market participation, and in testing whether market orientation translates into higher crop output market participation. We present our key hypotheses about the effect of explanatory variables below.

Household characteristics

Literate households are expected to have better skills, and better access to information and ability to process information, and thus may be positively associated with market orientation and market participation. Household size increases domestic consumption requirements and may render households more risk averse. Hence,

controlling for labor supply, larger households are expected to have lower market orientation and market participation.

Household endowment of crop production factors

When agricultural factor markets are imperfect, ownership of the factors matters for efficiency and productivity (Sadulet and de Janvry, 1995). For example, when land markets are imperfect, households with larger farm holdings may be more likely to be more market oriented and have higher market participation (via higher outputs) (von Braun and Immik, 1994). Hence, household endowments of labor, land, oxen and farm equipment are expected to be positively associated with market orientation.

Ownership of livestock

The effect of ownership of livestock (other than oxen) on market orientation and market participation is ambiguous. It could be that ownership of livestock is negatively associated with crop output market orientation and market participation by offering alternative cash income sources. On the other hand, cash income obtained from livestock can be used to acquire crop production resources.

Market access

The role of marketing costs in completely hindering or limiting the level of smallholder market participation has been examined by several authors (de Janvry et al., 1991; Sadoulet and de Janvry, 1995; Key et al., 2000; Gabre-Madhin, 2001; Barrett, 2007; Pender and Alemu, 2007; Alene et al., 2008). Nearness to markets and roads, and ownership of transport equine are expected to reduce marketing costs, thus encourage market orientation and market participation.

Institutional Services

Agricultural services (extension, credit) are expected to enhance farmer skills and knowledge, link farmers with modern technology and markets, and ease liquidity and input supply constraints (Lerman, 2004), thus are expected to induce market orientation and market participation.

Rainfall and altitude

Rainfall may increase farm productivity, thus encouraging market orientation by improving profitability, thereby favoring market orientation and participation. Altitude determines the type of crops grown. High altitude areas are expected to have wider crop choice than low altitude areas, because of the more varied and more favourable climatic conditions. Hence, we expect altitude to be positively associated with market orientation and market participation.

Market orientation

We defined market orientation in terms of the relative importance of more marketable crops in the crop mix of the household. Underlying market orientation is the profit motive of households (Pingali and Rosegrant, 1995; Pingali, 2001). The realization of profit depends on market revenues. Hence, we expect that market orientation will be positively associated with household participation in crop output market as seller.

Land fragmentation

Household level land fragmentation is defined as the practice of operating a number of spatially separated plots (McPherson, 1982). Land fragmentation has advantages and disadvantages. The most frequently cited advantages of land fragmentation is the ability of farmers to disperse production risk by growing variety of crops in different agricultural environments related to soil, weather, pest and other production conditions, and overcoming seasonal labor bottlenecks (Melmed-Sanjak, et al., 1998; Blarel, et al., 1992). The most widely mentioned disadvantages of land fragmentation include higher production costs related to labor, transport, and operational costs (Simons, 1987). Hence, the effect of land fragmentation on market orientation and market participation is indeterminate.

5. Results

5.1 Descriptive information

Descriptive statistics of variables used in the regression analysis are given in Table 1. The average market orientation index is about 29%, indicating moderate market orientation of smallholders in the study area, while the average crop output market participation is 25% , also indicating moderate market participation.

About 11% of households in the sample are female headed. The average household size is about 6.44, with family labour supply of 3.4 persons per household, figures which are close to the national average. Livestock owned excluding oxen and transport equine averages 4.25 TLU. A household on average operates about 1.33 ha, a result also quite close to the national average. Households own on average a pair of oxen used for traction. Annual crop production per household was valued at Birr 3851.

Almost 50% of household heads are literate, a figure which has shown significant rise in recent years. The average population density in the study area is about 347 persons/ km^2. Households in the study area are on average about 5 km away from nearest market center, and about 7 km away from nearest all weather road. The extension services reached out to almost half of the farm households, while the credit service extended credit to about 60%.

5.2 Results of econometric analysis

Market Orientation

*H*ousehold size, labor supply of household, ownership of equine, involvement in extension the previous year, rainfall, and altitude, are significant correlates with market orientation, all with expected signs (Table 2). Household size detracts from household market orientation due to its effect on increasing household domestic consumption needs, as expected. Household labor supply is associated positively with market orientation. Factor markets in rural Ethiopia are far from perfect and so ownership of resources matters for efficiency (thus profitability) of agricultural production, all else equal.

Ownership of equines encourages market orientation due to their effect of reducing marketing costs, thus improving profitability. The Ethiopian agricultural extension service appears effective in inducing market orientation. While higher rainfall is associated with higher market orientation (perhaps due to its effect on productivity and thus profitability), higher altitude appears to detract from it. It may be that the higher altitude areas of Ethiopia are more subsistence oriented due to higher population pressure and higher risk due to land degradation.

Crop output market participation

Distance to nearest market place, value of crop production, and market orientation of households are significant correlates with household participation in crop markets as seller, all with expected signs (Table 3). Of the significant variables, market orientation has the highest explanatory power, both statistically and numerically.

Households further away from market places have lower market participation as expected. Households with higher crop value produced sell higher proportion of their produce, implying that building the capacity of households to produce surplus production is critical to improve market participation in the Ethiopian context, consistent with several prior findings in other places (Omitti et al., 2009; Rios et al. 2008; Barrett, 2007). Market orientation translates strongly into market participation indicating the strong need

to intervene on improving household market orientation at the production level in order to promote commercial transformation of subsistence agriculture.

Comparisons between the determinants of market orientation and household market participation in crop output markets shows that production related factors affect market participation only through their effect on market orientation and crop production, implying that analysis of commercial transformation of households should also address determinants of market orientation, and not be limited to the analysis of market participation only. The extension service, while effective in promoting market orientation, failed to have significant effect on market participation, indicating the weak component of marketing extension in the extension service.

6. Conclusions and Implications

Commercial transformation of smallholder agriculture entails production decisions based on market signals (market orientation) and significant participation in input and output markets (market participation). However, the literature on commercialization of smallholders rarely makes the distinction between market orientation and market participation. This study is an attempt to fill this gap of knowledge in the commercialization literature.

Market orientation of smallholders in the study area is found to be moderate, with an average market orientation index of 29%. Only about 25% of the Birr 3874 annual crop value produce is sold. We find that the significant correlates with market orientation are factors related to household characteristics, market access, technical support by the extension service, and soil moisture. Consistent with the findings of Heltberg and Tarp (2001), Lapar et al. (2003) and Edmeades (2006), on the negative effect of household size on market participation, we find household size to be negatively correlated with market orientation. This result implies that interventions aimed at promoting family planning amongst farm communities can contribute to commercial transformation of subsistence agriculture.

Household labor supply is positively associated with market orientation, consistent with the findings of Barrett (2007) on the positive association between

household human capital and market participation. Market transportation cost considerations are important deterrents from market orientation of households, implying that improving market and transport infrastructure can be important for commercial transformation.

The fact that market orientation translates strongly into market participation implies that interventions aimed at promoting market orientation of households at production level is likely to have significant effect on commercial transformation of households. Moreover, improving market access and household capacity to produce surplus production stand out as critical to improve household participation in output markets, consistent with several findings in other places ((Omitti et al., 2009; Rios et al. 2008; Barrett, 2007).

Availability of adequate soil moisture improves market orientation of households, perhaps due to its effect on crop productivity, consistent with the findings of Barrett (2007) on the positive association between favourable agro-ecological factors and surplus production for sale. This implies that improved availability of soil moisture through various means help farmers choose market oriented crops. The development of small-scale irrigation at household or community level offers an option to improve soil moisture.

The extension service in the study area appears effective in promoting market orientation, although it failed to have significant effect on market participation. Agricultural extension services are instrumental in promoting improved technologies, and improving farmer skills. Agricultural extension services are also expected to facilitate market entry through facilitation of collective marketing, farmer linkages with buyers and the supply of market information. The insignificant effect of extension service on market participation implies that a successful commercial transformation of small holder agriculture in Ethiopia will need the strengthening of marketing extension service in the country.

The key implication of this study is that policy, technological, organizational and institutional interventions aimed at promoting commercial transformation of subsistence agriculture should follow two-pronged approach: improving market orientation of smallholders at production level, and facilitation of market entry and participation of

households in output and input markets. Focusing on either may not be as effective in achieving the transformation.

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Table 1: Descriptive statistics for variables used in econometric analysis

Variables	N	Mean	Std. Dev.	Min	Max
Market orientation index	168	0.29	0.09	0.07	0.59
Crop output market participation index	167	25.29	19.88	0	86.60
Land fragmentation index (Simpson index)	168	0.49	0.31	0	0.90
Age of household head *(year)*	168	43.32	11.88	20.00	78.00
Sex of household head *(yes=1, no=0)*	168	0.89	0.31	0	1.00
Education of household head *(literate=1, illiterate=0)*	168	0.49	0.50	0	1.00
Family size *(no.)*	168	6.44	2.43	2.00	14.00
Other livestock owned *(TLU)*	168	2.52	2.39	0	16.80
Available family labour *(persons)*	168	3.38	1.40	1.00	7.00
Farmland size owned *(ha)*	168	1.33	0.72	0.06	4.00
Oxen owned *(no.)*	168	1.89	1.41	0	6.00
Value of farm equipment *(Birr)*	168	217.48	166.68	0	1150.00
Rainfall *(mm)*	168	1518.49	388.33	757.00	1956.00
Altitude *(m above sea level)*	168	1945.67	369.15	1207.00	2414.00
Distance from settlement center to nearest market place *(km)*	168	5.04	3.30	0.02	18.00
Distance from settlement center to nearest all weather road *(km)*	168	6.75	7.07	0	21.00
Equine owned *(no.)*	168	0.57	1.08	0	11.00
Involvement in extension program *(2005/06) (yes=1, no=0)*	168	0.49	0.50	0	1.00
Access to credit *(2005/06) (yes=1, no=0)*	168	0.61	0.49	0	1.00
Value of annual crop produced *(Birr)*	168	3851.06	3840.23	0	25600.00

Table 2: Estimation results for market orientation index (MOI) (OLS)

Explanatory Variables	Coef.	Std. Err.
Household and household head characteristics		
Age of household head *(year)*	-0.000047	0.000688
Sex of household head *(yes=1, no=0)*	-0.000668	0.031057
Education of household head *(literate=1, illiterate=0)*	0.018513	0.016021
Family size *(no.)*	-0.012686***	0.003896
Ownership of livestock		
Other livestock owned *(TLU)*	-0.000397	0.003388
Ownership of crop production factors		
Available family labour *(persons)*	0.019547***	0.006569
Farmland size owned *(ha)*	0.003840	0.012890
Oxen owned *(no.)*	0.004158	0.006288
Value of farm equipment *(Birr)*	-0.000004	0.000044
Natural factors affecting crop production		
Rainfall *(mm)*	0.000189***	0.000037
Altitude *(m above sea level)*	-0.000184***	0.000039
Land fragmentation index (Simpson index)	-0.027573	0.028794
Market access		
Distance from settlement center to nearest market place *(km)*	0.001085	0.002357
Distance from settlement center to nearest all weather road *(km)*	-0.001792	0.001232
Equine owned *(no.)*	0.017839***	0.006023
Institutional service		
Involvement in extension program *(2005/06) (yes=1, no=0)*	0.034089**	0.014347
Access to credit *(2005/06) (yes=1, no=0)*	-0.001400	0.020920
Constant	0.356452***	0.081830
Number of strata	4	
Number of observations	168	
Population size	45162.56	
Design df	164	
F(17, 148)	4.59	
Prob > F	0.0000	
R-squared	0.3632	

***, **, and * are significant at 1%, 5%, and 10% significant levels, respectively.

Table 3: Tobit estimation results for crop output market participation (COMP)

Explanatory Variables	Coef.	Std. Err.
Household and household head characteristics		
Age of household head *(year)*	0.093397	0.147651
Sex of household head *(yes=1, no=0)*	-7.831571	6.778989
Education of household head *(literate=1, illiterate=0)*	5.068704	3.734701
Family size *(no.)*	0.029731	0.929591
Ownership of livestock		
Other livestock owned *(TLU)*	0.135571	0.730926
Market access		
Distance from settlement center to nearest market place *(km)*	-1.309654***	0.457385
Distance from settlement center to nearest all weather road *(km)*	-0.237029	0.248684
Equine owned *(no.)*	-0.159586	0.872255
Institutional service		
Involvement in extension program *(2005/06) (yes=1, no=0)*	-1.535830	4.362558
Access to credit *(2005/06) (yes=1, no=0)*	5.068451	3.830619
Realized input and market orientation		
Value of annual crop produced *(Birr)*	0.001072***	0.000413
Market orientation index	127.892700***	19.517950
Constant	-11.662250	10.262850
Number of strata	4	
Number of observations	157	
Population size	42124.809	
Design df	153	
F(12, 142)	8.99	
Prob > F	0.0000	

***, **, and * are significant at 1%, 5%, and 10% significance levels, respectively.

Annex 1: IV Tobit estimation results testing endogeneity of MOI

First-stage regression

Source	SS	df	MS		
Model	.43569677	17	.025629222	Number of obs	= 157
Residual	.670492048	139	.004823684	F(17, 139)	= 5.31
				Prob > F	= 0.0000
Total	1.10618882	156	.007090954	R-squared	= 0.3939
				Adj R-squared	= 0.3197
				Root MSE	= .06945

moi_iw	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
labsuply	.0160225	.0061417	2.61	0.010	.0038793	.0281657
landown	.0015605	.0103417	0.15	0.880	-.0188869	.0220079
oxen	.0035005	.0059832	0.59	0.559	-.0083293	.0153303
farmequiptv	.000039	.0000414	0.94	0.347	-.0000428	.0001208
rainfall	.000158	.0000294	5.37	0.000	.0000998	.0002162
altitude	-.0001839	.0000263	-7.00	0.000	-.0002358	-.0001319
sindexf	.0198704	.0265404	0.75	0.455	-.0326046	.0723454
hhage	-.0003177	.0006157	-0.52	0.607	-.0015351	.0008996
hhsex	.0005994	.0222654	0.03	0.979	-.0434232	.044622
literate	.0119314	.0132428	0.90	0.369	-.0142519	.0381147
hhsize	-.0086157	.0038971	-2.21	0.029	-.016321	-.0009105
tluothliv	-.0034628	.0034186	-1.01	0.313	-.010222	.0032964
dscnmpkm	-.0011019	.0019646	-0.56	0.576	-.0049863	.0027824
dscnawrkm	-.000453	.0011937	-0.38	0.705	-.0028131	.0019072
equine	.0128431	.006005	2.14	0.034	.0009702	.0247161
hhiepy	.0200486	.0135609	1.48	0.142	-.0067638	.0468609
dhhacrpy	-.0084588	.0165122	-0.51	0.609	-.0411065	.0241888
_cons	.3942041	.0511569	7.71	0.000	.2930579	.4953504

Two-step tobit with endogenous regressors

Number of obs = 157
Wald chi2(11) = 42.81
Prob > chi2 = 0.0000

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
moi_iw	105.8828	30.8878	3.43	0.001	45.34377	166.4217
hhage	.0565611	.1510498	0.37	0.708	-.2394911	.3526133
hhsex	-6.212038	5.818201	-1.07	0.286	-17.6155	5.191426
literate	3.88701	3.509155	1.11	0.268	-2.990808	10.76483
hhsize	-.2415093	.7750723	-0.31	0.755	-1.760623	1.277605
tluothliv	.2357427	.7198272	0.33	0.743	-1.175093	1.646578
dscnmpkm	-1.376074	.5073634	-2.71	0.007	-2.370488	-.3816603
dscnawrkm	-.1161251	.2333295	-0.50	0.619	-.5734426	.3411924
equine	.2822065	1.502905	0.19	0.851	-2.663434	3.227847
hhiepy	-.830713	3.46075	-0.24	0.810	-7.613658	5.952232
dhhacrpy	7.925577	3.810798	2.08	0.038	.4565506	15.3946
_cons	-1.827777	13.25792	-0.14	0.890	-27.81283	24.15727

Instrumented: moi_iw
Instruments: hhage hhsex literate hhsize tluothliv dscnmpkm dscnawrkm equine hhiepy dhhacrpy labsuply landown oxen farmequiptv rainfall altitude sindexf

Wald test of exogeneity: chi2(1) = 0.69 Prob > chi2 = 0.4062

Obs. summary: 27 left-censored observations at coc100o<=0
130 uncensored observations
0 right-censored observations