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Marketing patterns of rainfed and irrigated systems: Do they differ?

Marketing patterns of rainfed and irrigated systems: Do they differ?

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Acronym

DA	Development agent
FTC	Farmers training centre
GoE	The government of Ethiopia
GTP	Growth and Transformation Plan
LIVES	Livestock and Irrigation Value chain for Ethiopian Smallholders
MVT	Multivariate probit
OLS	Ordinary least squares
PA	Peasant association
SNNPR	Southern Nations Nationalities and People's Region
SUR	Seemingly unrelated regression
TLU	Tropical livestock unit

Acknowledgment

Livestock and Irrigation Value Chain for Smallholder Farmers in Ethiopia (LIVES) project collected baseline survey covering 10 zones in four regions in Ethiopia. The project is financed by the Foreign Affairs, Trade and Development of Canada. The authors are grateful to LIVES project for providing the datasets used in this analysis.

Abstract

This study used nationwide dataset of 5000 households from four regions in Ethiopia to identify important determinants of market orientation, market participation and market outlet choices. The study used ordinary least square and instrumental regression and multivariate probit (MVP) techniques to do just that. Market-orientation was affected by productive capacity, oxen, total land area, irrigated land area, access to irrigation, and access to market information. Market participation is, in turn, affected by market oriented production, productive capacity and the availability of market information. With respect to outlet choices, the important role of market access conditions (mainly roads and storage facilities) and services (extension services and access to micro credit) were found to be important. Expanding the necessary infrastructure for irrigation development or creating the conditions for household adoption of different irrigation technologies is important for market production and participation and outlet choice decisions of households. Provision of adequate and timely marketing information is also another entry point to transform agriculture.

Key words: Production capacity, market information, market access conditions, extension, 2SLS, MVP, Ethiopia

1. Introduction

The government of Ethiopia (GoE) envisages transformation of agriculture into market production from semi-subsistence production. The third pillar of the Growth and Transformation Plan (GTP-I) 2011–2015 of GoE envisaged commercial transformation of farmers through the production of high-value agricultural commodities and integration into the market (FDRE 2010). Based on achievements during GTP-I, the GoE is aggressively working on expanding smallholder irrigation during GTP-II. During GTP-I and GTP-II the projected investments in irrigated smallholder agriculture aim to utilize the vast water resources potential of the country, enhance intensification, raise and sustain productivity and cushion households against droughts and climate variability and change. Irrigation expansion is expected to enhance use of complementary inputs (such as improved varieties, horticultural crops and agrochemicals) and induce behavioural changes of farmers to be market-oriented.

Irrigation enables smallholders to diversify cropping patterns and to switch from low-value subsistence production to high-value crops, which are mainly cash crops. Hagos et al. (2009) indicated that in terms of the land share cereals and pulses are dominant under the rainfed system, while vegetables and fruits are becoming more important under irrigation system.

This shift in cropping pattern is accompanied by marketing challenges. Vegetable and fruit (also called horticultural crops) markets are well developed and are characterized by complex and long chain.

As some writers indicated, commercial strategies linked to high value products, such as production of perishable cash crops and dairy production, are likely to offer the greatest economic potential in the long run (Hagos et al. 1999; Pender et al. 2006). Facilitating market participation of households, as well as developing chain competitiveness and efficiency are valuable preconditions to improve livelihoods (Lundy et al. 2004; Padulosi et al. 2004). It is documented that commercialization has potentially strong and favourable impacts on agricultural productivity, rural poverty reduction, and food and nutrition security (Pender and Alemu 2007). Pender et al. (2006) also argued that promotion of high-value commodities and nonfarm activities can facilitate improved land management.

Areas with high agricultural potential and good market access represent the greatest potential for agricultural development (Hagos et al. 1999; Pender et al. 2006). Pender et al. (2006) indicated that investments in infrastructure and market institutions, a supportive policy environment, and efforts to address pest and disease problems are keys to success in such areas. In areas of high agricultural potential but less favourable market access, less perishable agricultural commodities—such as coffee and cereals—have comparative advantage. Investments in livestock, tree planting, beekeeping and other livelihoods often yield higher returns in areas of lower agricultural potential.

The winners are usually found in central locations in proximity to dynamic markets and among resource-rich rural households that can mobilize additional assets (FAO 2008). Efficient functioning of commodity markets depend on the adequacy of infrastructure, information and institutions (Rashid and Negassa 2012). Rashid and Negassa (2012) document a significant improvement in physical infrastructure in Ethiopia, with implication for growth, poverty reduction, and functioning of markets. In the absence of public interventions, three important determinants of an efficient exchange process are infrastructure, institutions and information. If there are inadequacies or incompleteness in these fundamentals, it will be reflected in the prices (Rashid and Negassa 2012).

When we view marketing of horticultural crops, we need to consider the role of market actors and how producers chose among these chain actors. The actors who actually transact a particular product as it moves through the marketing channel include farmers, traders, processors, transporters, wholesalers, retailers and final consumers (Hellin and Meijer 2006), who are involved in direct ownership of this product and value addition (Gebremedhin et al. 2012). A detailed description of some of the actors in vegetable markets in East Africa is given by Eaton et al. (2007). There have been some changes in the structure of marketing as decreasing role of public food marketing, increasing processing, and increased role of cooperatives (Rashid and Negassa 2012). Although the geographical coverage is still small, cooperatives can play a significant role in promoting smallholders' market participation through improving the economics of scale in collection, storage, transportation, and marketing agricultural products and farm inputs (Rashid and Negassa 2012). Cooperatives can vertically integrate smallholder farmers, eliminating some middle men and thereby reducing the length of value chain and increasing the margins of smallholder farmers (Rashid and Negassa 2012).

There are few empirical studies in Ethiopia that examine the determinants of market-orientation and market participation (Gebremedhin and Jaleta 2010). This particular study provided the methodological guidelines of how to measure market-orientation and market participation and made an important distinction between the two interrelated concepts. The study explores whether market-orientation systematically vary by household productive assets, by access to irrigation, market distance, capital markets and extension support and services, and the study explores whether the same factors affect market participation. The current study is a follow up of an earlier study by Gebremedhin and Jaleta (2010) that explored determinants of market orientation and participation by using a smaller dataset covering the northern part of Ethiopia.

The literature on market outlet choices has been thin; there are few empirical studies so far in Ethiopia and elsewhere. Kuma et al. (2013) assessed factors affecting milk market outlet choices in Wolaita zone, Ethiopia; while Tefera (2014) identified different marketing channels in value chain of chickpea in Ethiopia, the intermediaries involved therein and their roles in chickpea marketing; and determined factors influencing households' choice of market options. Outside Ethiopia, Meng et al. (2014) assessed the relative importance of modern and traditional food retail outlets and illustrated how the food retail outlet choices might affect consumers' diet and nutrition in Ghana. Lucila et al. (2009) investigated market outlet choice decision-making and identified factors that influence these choices of urban consumers with regards to fresh pork purchases in Vietnam. The current paper aims to contribute to this growing literature by taking the producer's side, identifying market actors under rainfed (mainly cereals and pulses) and irrigation systems (mainly horticultural crops), and examined determinants of outlet choice.

The outline of the paper is as follows: The following section presents a conceptual framework with hypotheses of important variables which is followed by the presentation of empirical methodology and description of the study site. Section 4 presents the main results of this study, disaggregated into summary statistics and regression results. The final part concludes and draws policy implications.

2. Theoretical model and econometric techniques

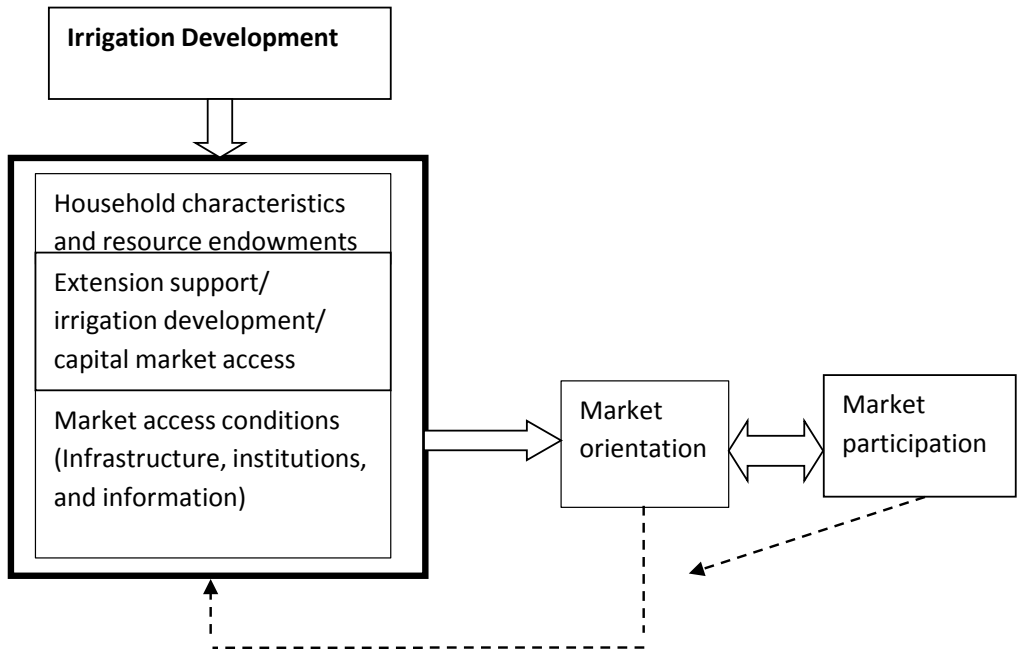
2.1 Conceptual framework and proposed hypothesis for the analysis

We developed conceptual framework (Figure 1) based on the literatures on market orientation (Hendrink and Sterkenburg 1987; Kohli and Jaworski 1990; Immink and Alarcon 1993; Jaworski and Kohli 1993; Fritz 1996) and household market participation (Goetz 1992; Pingali and Rosengrant 1995; Pingali et al. 1997; Lapar et al. 2003; Bellemare and Barett 2006; Rios et al. 2008; Omitti 2009; Gebremedhin and Jaleta 2010).

Market orientation is the degree of allocation of resources (land, labour and capital) to the production of products that are meant for exchange and sale where as market participation is the proportion of crop output sold (Gebremedhin and Jaleta 2010). Irrigation development enables growing cash crops, especially in the dry season, which will be mainly marketed. This will be more possible if the household has all the endowments/assets (labour, land, oxen, other capital goods, etc.), favourable access to market (both in terms of road and transportation service access), production and marketing extension supports, market information, and other infrastructure (storage facilities).

The same household and village level factors may translate market-oriented production into market participation.

Figure 1: Conceptual framework of the determinants of market-orientation and participation.



A related concept to market-orientation and market participation is households' outlet choice decisions. Households, in producing and supplying agricultural product for the market strive to maximize their benefits (revenues) by choosing the right market actor. In other words, households choose outlets (market actors) which shorten the marketing distance to the final consumer, reduce transaction costs (so decrease marketing margin), and increase their net return.

Outlet choice is a function of vector of commodity characteristics, household characteristics, asset holdings, market access conditions (infrastructure and market information), and services (e.g. extension services and access to micro credit). This will be modeled as follows:

$$P(Y_i) = H_i + A_i + X_i + M_j + S_j + \varepsilon_i \quad \text{(Eq.1)}$$

Where $P(Y_i)$ is the probability of each household head i choosing an outlet ($i = 1,...N$), H_i is vectors of household characteristics; X_i, commodity characteristics; M_j market access conditions and S_j services in the kebele (peasant association) j respectively.

2.2 Proposed hypothesis of variables on market orientation and market participation

The determinants of market-orientation and market participation may be the same (Gebremedhin and Jaleta 2010). In this paper we propose that household factors (educational status and household sex), asset holdings (like land and oxen holding) and market access conditions and other services (capital markets, extension, irrigation, and market information) are important determinants of agricultural market orientation. Many of these factors are hypothesized to determine market participation. The following hypotheses are given with the expected signs of these variables(Table 1).

Household head and household characteristics Household characteristics such as age, sex, educational status, and dependency ratio are important determinants of market-oriented production. Household age is expected to negatively influence market production. As household age increases market-oriented production decreases. Female-headed households are expected to be less likely to produce for the market as female-headed households are potentially assessed as resource poor. Higher educational status of the household head is expected to increase market production. Dependency ratio is expected to have negative effect on market orientation and participation because household with more dependents will focus on ensuring their own food self-sufficiency.

Asset endowments: Household asset endowments like land, labour, oxen holdings and agricultural productive tools are expected to increase market-oriented production; livestock holdings (in tropical livestock unit (TLU)) are also hypothesized to have positive effect on market orientation because households with more livestock holdings could depose of these assets when there is need to buy farm inputs or consumption goods. Own labour and land holding is expected to increase market orientation because household with more of these assets do have better production capacity. Having larger irrigated land increase the household market orientation as the household have capacity to grow cash crops because of access to irrigation.

Market access and storage facilities: Distance to major market and distance to all weather roads are expected to have a negative effect on market-oriented production. Since the transport services, in the absence of all weather roads, may not be reliable, having more transport equines are expected to increase market orientation and participation. The availability of storage facilities may play a positive role on market orientation and participation.

Services: Extension advice and farmers training is expected to facilitate adoption of modern inputs (like high value crops and agrochemicals) and, thereby, enhance market-oriented production. On the other hand, extension advice may not include market extension and information. The effect on market orientation and participation comes only through increase in production. Credit access may facilitate market orientation and participation as availability of

credit enables the purchase of important farm inputs (like improved seeds/seedlings, agro-chemicals and water lifting technologies, etc.) and cash for payment of transport and storage facilities which are important for market orientation and participation. Finally, irrigation development enabling full irrigation outside the normal rainfall season (also supplementary irrigation in rainy season) enables the use of complementary inputs (such as improved varieties and agrochemicals). This intervention enhances market orientation and participation.

2.3 Proposed hypothesis of variables on farmers market outlet choice

Based on the conceptual framework indicated above [equation 1], the following variables are expected to influence the producer's outlet choice with their expected signs. We disaggregated into cereals and pulses and vegetables and fruits (horticultural crops) of which the former are predominantly rainfed, while the later are irrigated crops respectively. But we didn't differentiate between perishable and nonperishable horticultural crops, for lack of favourable data.

Household characteristics: Household characteristics such as sex of the household head, age, years of education, and dependence ratio are hypothesized to influence the household's outlet choice. The household head being female-headed is hypothesized to be positively associated with the likelihood of choosing farm gate and assembler outlets, but negatively associated with the likelihood of choosing wholesaler and retailer because the latter require volume of production and supply, which female households usually lack. Creating market linkages also involves travelling and a lot of negotiation, which female headed-households are less likely to do. The household head being aged may not do the travelling and the negotiation and may not have the in-house labour endowments to increase the volume of production and supply; the expected signs are the same with the household head being female. If the household head is educated, he/she are more likely to be market-oriented, requiring producing more marketable crops and have the network to supply to the wholesaler, or understand the economics of organization in supplying agricultural products. Thus, educated household heads are more likely to choose assembles, wholesaler and retailers and are less likely to choose farm gate outlet. Producers with more dependents are less likely to choose any of the actors because they produce predominantly for own consumption.

Asset holding: Households with larger number of transport equines are more likely to sell their products to wholesalers and retailers and are less likely to sell their produce on farm gate or to assemblers. Producers with more labour endowment and larger land holding are more likely to choose wholesalers and retailers and less likely to choose farm gate and assemblers. Producers with larger land holding or access to irrigated land are more likely to choose wholesalers and retailers.

Commodity characteristics: Basic economic theory indicates that quantity supplied is positively related to price. But the relationship of quantity sold (in kg) and sales price is determined by actor's role in price determination. At a given point in time, the producer would like to choose market actors who are willing to offer them better prices. This requires better negotiation power and the producers' capacity to transport his/her product long distances and maintain the product quality. The volume of the sold produce (in kg) from each producer is small and it may not require travelling long distances and a lot of negotiation power. If the volume product is large enough, it becomes bulky (the transport cost increases) and maintaining the product quality, especially if is perishable, becomes challenging. The specific effect of these attributes on sale price is ambiguous. Thus the expected sign of the volume of sales produced (in kg) and average price (in ETB/ kg) on outlet choices is unknown a priori.

Market access conditions: Market access conditions of a given household are influenced by the infrastructure conditions (roads and storage facilities), access to market information and the availability of institutional mechanisms for marketing network (like cooperatives). Distance to dry weather roads, all weather roads, market town, and distance to storage facilities negatively influence choosing wholesalers and retailers. Households which are located far and do not have access to market and storage facilities may depend on farm gate actors and assemblers. Being a member of cooperative association (instrumented here by the distance to the cooperative office) may help to establish

connections with wholesalers directly and have access to market information (measured by the distance to mobile and fixed phone providers) enable the producer to choose wholesalers and retailers and depend less on farm gate and assemblers.

Services: The extension program through improved provision of advice and credit services relaxing cash constraints of cash poor households do play important roles in production through introduction of new technologies and practices and marketing those products. Related to extension services, we differentiated training (distance from farmers training centre) and contact with the development agent (DA) (distance to his/her office). The extension services are more likely to be associated with choice of wholesaler and retailer and less likely with choice of farm gate and assembler through its effect on production. Extension services do offer limited market-related advice (what to plant and when) and do not provide valuable market information. Its effect on the producer's decision on market outlet choice may not be clear. The positive effect of credit services on strengthening actors' market capacity is theoretically understandable; choice of wholesaler and retailer are more likely and less likely with choice of farm gate and assembler due to access to credit is something new. We present a summary of the list of these variables with their expected sign in Table 1.

Table 1: Summary of hypothesis of determinants of outlet choices

Variables	Farm gate	Assembler	Wholesale	Retailer
Household characteristics				
Sex of household head	+	+	-	-
Age of the household head	+	+	-	-
Level of education (# years)	-	-	+	+
Dependency ratio	-	-	-	-
Commodity characteristics				
Average price (ETB/kg)	-/+	-/+	-/+	-/+
Quantity sold (in kg)	-/+	-/+	-/+	-/+
Asset holdings				
Labour holding	-	-	+	+
Total land holding	-	-	+	+
Irrigated land	-	-	+	+
Equines	-	-	+	+
Services				
Distance to farmers training centre (FTCs)	-	-	+	+
Distance to development agent's (DA) office	-	-	+	+
Distance to micro credit institute	-	-	+	+
Market access conditions				
Distance to cooperatives	+	+	-	-
Distance to crop market	+	+	-	-
Distance to all weather road	+	+	-	-
Distance to dry weather road	+	+	-	-
Distance to crop store	+	+	-	-
Distance to fixed phone provider	-	-	+	+
Distance to mobile phone provider	-	-	+	+

2.4 Econometric methods

Under a semi-commercial system, where the household produces the predominant share for home consumption and a smaller share of the produce market sale, the amount sold could be different depending on the difference in resource allocation (land, labour and capital). Marketability of annual crops was computed as a proportion of sale to total production in the various markets (farm gate, within and outside peasant association (PA), district, zonal and regional

markets). A crop specific marketability index (X_i) is computed for each crop by taking the proportion of crop i sold to the total amount produced (Q_i) aggregated over each household in the given PA. The crop marketability index lies between 0 and 1. Once the crop specific marketability index is calculated, the household's market orientation index in land allocation is computed as a ratio of land allocation to each crop (H_i) to the total crop land operated by each household. The higher the proportion the household allocates land to more marketable crops, the more the household is market oriented. Household-level market orientation is modeled as function of household and household head characteristics, household endowment of crop production factors (total land, labour, farm equipment and oxen holding), ownership of livestock (in TLU), access to market and roads, and ownership of transport equine, access to irrigation, access to institutional services (extension and credit) and agro-ecological factors (like altitude) to examine the determinants of market-orientation.

Following Gebremedhin and Jaleta (2010), market participation is measured as a proportion of value crop sale to the total value of crop production. Market participation is modeled as a function of household and household head characteristics, ownership of livestock (in TLU), access to market and roads, and ownership of transport equine, access to irrigation, access to institutional services (extension and credit) and value of annual crop production to examine the determinants of market participation. In order to test whether market-orientation translates into higher market participation, we did also include market-orientation index as a right hand side variable in the market participation model. Because market-orientation index is potentially endogenous, we used instruments (agro-ecology, oxen holding, own labour, livestock, productive farm tools, and total land holding) to account for this problem.

Thus, ordinary least squares (OLS) used to estimate market orientation and market participation is estimated using instrumental variables regressions model (also called two stage least squares) (Wooldridge 2010) using the indices indicated above, as dependent variable and various exogenous independent variables.

The determinants of outlet choice decisions are estimated using simulation method of maximum likelihood estimation of the MVP regression model (Cappellari and Jenkins 2003). This approach was proposed for modeling the multivariate outlet choices because of the interdependence of choices. The MVP recognizes the correlation in the error terms of choice equations and estimates a set of binary probit models (in our case three/four probit models) simultaneously. The model has a structure similar to that of a seemingly unrelated regression (SUR) model, except that the dependent variables are binary indicators (for details see Cappellari and Jenkins 2003). The application of univariate probit or logit models is inefficient when choices are inter-related since univariate models ignore the correlation in the error terms of adoption equations (Dorfman 1996; Khanna 2001; Belderbos et al. 2004).

Considering the M-equation multivariate probit model:

$$y_{im}^{*} = \beta_m' X_{im} + \varepsilon_{im}, \text{ where } m = 1,...,M \qquad \text{(Eq. 2)}$$

$y_{im} = 1$ if $y_{im}^{*} > 0$ 0 otherwise

$\varepsilon_{im},\ m = 1,...,M$ are error terms distributed as multivariate normal, each with a mean of zero, variance-covariance matrix V, where V has values of 1 on the leading diagonal and correlations $\rho_{jk} = \rho_{jk}$ as the off-diagonal elements.

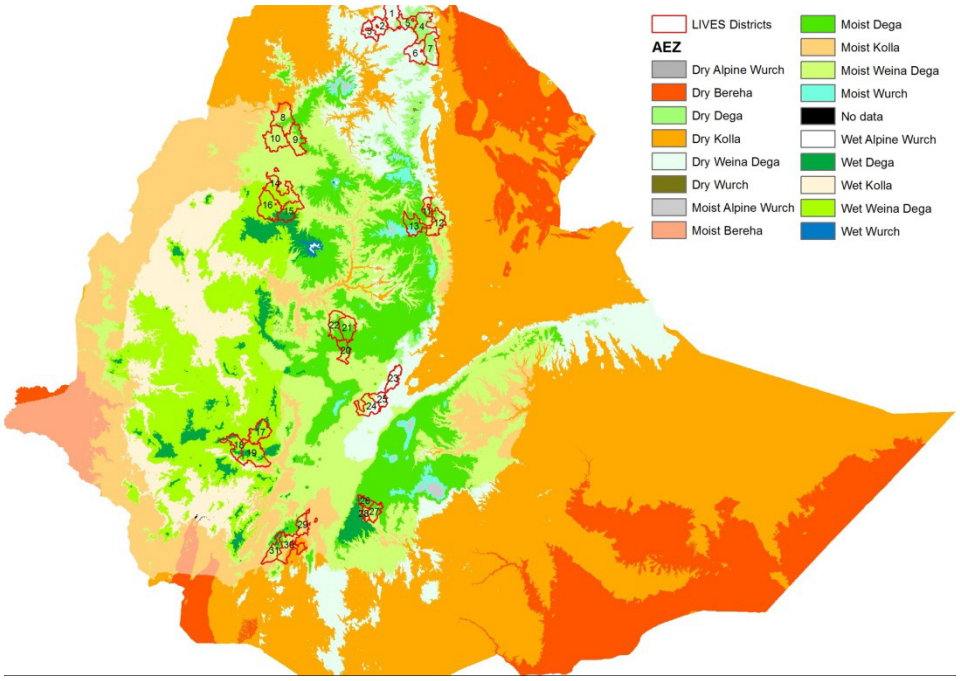
Choice to each outlet is modeled as binary choice where choice to each outlet takes 1 if the household chooses that particular outlet or otherwise zero. All alternative choices are assumed to be dependent; the econometric model, thus, assumes that each alternative is not independent from the other.

2.5 Study site description and data used

The study was conducted in four regional states of Ethiopia: Tigray, Amhara, Oromia and Southern Nations Nationalities and People's Region (SNNPR) where LIVES operates (Figure 2). It covers the three main traditional

agro-ecological zones: *Dega, Weyna-Dega* and *Kola*. As part of establishing the baseline situation for LIVES, the project selected 5000 farm households and surveyed targeting production year of 2013/2014. The variables included in the survey and used for this study include household characteristics, demographic factors, asset holdings (like labour, land, farming tools, oxen holding, etc.), infrastructure conditions, market access conditions, production, extension and rural credit services and so on.

Figure 2: Study sites and underlying traditional agro-ecology.



3. Results and discussion

3.1 Statistical summary

In this section, we report the summary statistics of important variables before we report on the results of the systematic analysis of the determinants of farmers' market-orientation, market participation and outlet choice decisions in the next section.

The summary statistics presents, first, a comparison tests between households that use rainfall to produce crops only (commonly called rainfed agriculture) and household with access to irrigation facilities (commonly called irrigated agriculture) besides rainfed agriculture (see Table 1). Production (in terms of value) per *timad* (pair of oxen used for cultivation) was significantly higher under irrigation systems compare to rainfed systems. All farm inputs like purchased seeds/seedlings, agro-chemicals (fertilizers, herbicides and pesticides) used under irrigation was significantly higher than the rainfed. Moreover, the value of output sold is significantly higher under irrigation compared to rainfed systems. This can be accounted for by the fact that irrigated crops include high value crops such as vegetables and fruits which need intensive agricultural practices compared to cereals. Only own improved seeds were statistically higher under rainfed systems, while the differences in purchase improved seeds was not significant. These summary results are indicators of the presence of market orientation and participation, but systematic analysis will be undertaken later.

Table 2: Summary statistics (n= 3837)

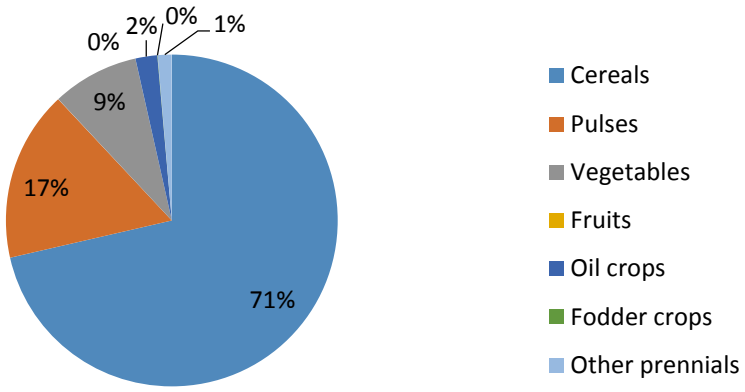
Variables	Rainfed	Irrigate	**Std. Err.**
Value of output per *timad* (in ETB)	6414.52	26,7911.50	82,150.33***
Value of sold output per *timad* (in ETB)	3066.51	75,419.30	43,884.26*
Own seed used per *timad* (in kg)	15.35	24.11	1.86***
Purchased seeds per *timad* (in kg)	4.68	28.63	2.63***
Own improved seeds per *timad* (in kg)	1.023	0.466	0.232**
Own improved cuttings/seedlings per *timad* (in no.)	0.673	136.74	25.93***
Purchased improved seeds per *timad* (in kg)	3.92	29.66	17.88
Purchased improved bulbs/cuttings/seedlings per *timad* (in no.)	2.078	59.31	31.71*
DAP application per *timad* (in kg)	16.20	20.03	1.48**
Urea application per *timad* (in kg)	13.42	24.33	1.517***
Herbicide application per *timad* (in litre)	0.052	0.033	0.010*
Pesticide application per *timad* (in litre)	0.072	0.469	0.112***

± timad is ~ 0.25 hectare. *, **, *** significant at 10, 5, 1 % respectively

Source: Baseline survey 2014.

Irrigation development causes a shift of crop categories as indicated in Figures 3 and 4 and 2. Under rainfed systems, cereals are the most dominant crops (71%) followed by pulses (17%) and vegetables (9%). Other crop categories hold 2% or less according to their importance.

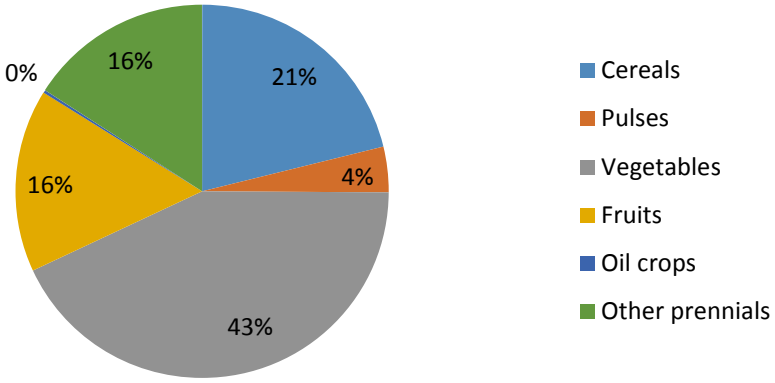
Figure 3: Crop category under rainfed system.



Source: Baseline survey 2014.

Under irrigated systems, on the other hand, vegetables are the most dominant (43%) followed by cereals (21%) and fruits (16%). This poses a livelihood change and challenges to marketing. Vegetables and fruits are bulky and perishable; having huge requirements on transport, storage and implication on the sales price.

Figure 4: Crop category under irrigated system.



Source: Baseline survey 2014.

The high proportion of the agricultural crops (commodities) was sold in the season between January and April, followed by May and August. There were no systematic differences between rainfed crops and irrigated crops in terms of when they are sold. A smaller percentage of the crops was sold between Septembers and December.

In terms of market places, district markets were very important followed by PA markets for both rainfed and irrigated crops. About 17% of the irrigated crops were sold at farm gate and close to and more than 20% were transacted within the PA and neighbouring PA respectively. More than 20% of rainfed crops were transacted within the PA and neighbouring PA. Zonal and regional markets are not very important, however (Table 4).

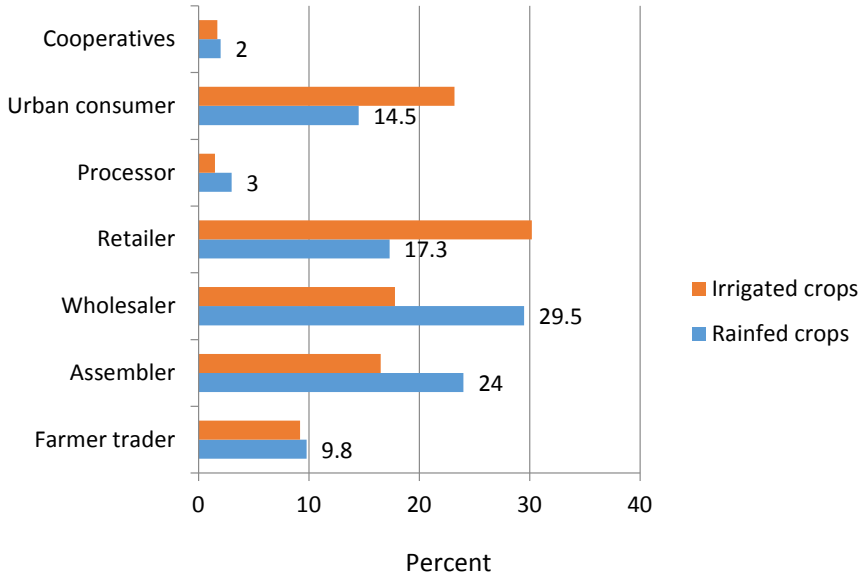
Table 3: Proportion sold when

Sold when	Rainfed crops	Irrigated crops
September to December	23.50	15.40
January to April	44.90	48.35
May to August	31.60	36.30

Source: Baseline survey 2014.

The dominant actor in buying rainfed crops was the wholesaler (30% of the proportion sold), while the retailer was very dominant (30% of the proportion sold) with regard to irrigated crops. The second most dominant actor with regard to rainfed crops was the assembler (24% of the proportion sold), while the urban consumer was dominant (24% of the proportion sold) with regard to irrigated crops. The third most important actor for irrigated crops was the wholesaler (18% of the proportion sold), while yje retailer was important (17% of the proportion sold) for rainfed agriculture. Urban consumer was the fourth important actor (15% of the proportion sold) with regard to rainfed crops. Farmer traders took up a similar proportion (9% of the proportion sold) of rainfed and irrigated crops. Processors and cooperatives did not take up a higher proportion of the purchases, less than 2%, of rainfed and irrigated crops.

Figure 5: Proportion purchase by each market actor.



Source: Baseline survey 2014.

The summary results indicate that the value chain functions are primarily aggregation and retailing, but little in processing. The current value chain in Ethiopia hardily focuses on value addition. The determinants of market orientation, market output participation and outlet choice are systematically analysed and reported in the subsequent sections.

3.2 Determinants of market orientation

The result of the determinants of market-orientation is given in Table 5. Households with more than the average oxen holding (average 1.91) were market oriented, households with more total land holding (average 6.17 *timad*) are not market oriented, but households with more irrigated land (average 0.12 *timad*) are market oriented. This implies that households with more irrigated land produce cash crops than households which have larger land area per se. Thus, access to irrigation was significant in market production as indicated by the result. The production capacity such as agro-ecology (altitude), total land holding, irrigated land, oxen, and access to irrigation are important determinants of market orientation. Households located at a higher altitude (average 2091 metres above sea level) were found to be market oriented even if they own marginal lands but look for better means of income.

Access to market condition may not matter as such for the household to be market oriented. Having more equines for transport, distance to crop store facilities, distance to fixed phone provider are negatively associated with market-orientation. The former was not expected, while the latter two variables did have the expected sign.

Table 4: Determinant of market orientation

Dependent variable: market-orientation	Coef.	S. Error
Female-headed household head (reference male)	-139.20	111.89
Age of the household head (in yrs)	8.71	5.217*
Level of education of household head (in yrs)	-15.19	27.21
Dependent ratio	96.07	42.47**
Altitude	0.212	0.115*
Total land owned	-21.35	10.25**
Irrigated land	478.56	180.92***
No access to irrigation (reference yes)	-285.92	110.46***
Productive farm tools	-70.36	55.98
Own labour	-3.16	1.91*
Hired labour	-0.261	5.14
Equines	-165.97	58.74***
Oxen	95.14	44.10**
Livestock holding in TLU less equines and oxen	-23.94	30.90
Distance to crop store facilities	0 .56	0.22**
Distance to fixed telephone service provider	-1.67	0.87*
Distance to mobile telephone service provider	1.32	0.84
Distance to market town	1.33	0.72*
Distance to dry weather roads	1.29	1.29
Distance to all weather roads	0.32	0.45
Distance to FTC	0 .26	9.27
Distance to DA's office	-8.52	9.54
Distance to cooperative office	-0.55	1.54
Distance to microcredit office	1.1	0.68*
Intercept	-589.37	350.55
Number of obs = 103 F(24, 42) = 87.26 Prob > F = 0.0000 R-squared = 0.4552 Root MSE = 320.11		

Source: Baseline survey 2014.

Household characteristics such as household's age and dependency ratio were significant in explaining market orientation. But both had, unexpectedly, a positive sign. The former explains the farm experience and is important, while the latter explains the households with more dependents, probably have larger family size, having larger labour endowment to be market-oriented. Own labour was negatively related with market orientation, however.

3.3 Participation in crop output market

With regard to market participation in crop output, the market orientation index and the value of crop produced were significant, indicating that market orientation is translated into market participation and higher value of produce is an important determinant of market participation. Market information (e.g. distance to mobile telephone service provider) does negatively influence market participation underlying the importance of market information. However, distance to market town did have a positive influence (10% level of significance) on market participation, unexpectedly.

Oxen holding didn't positively influence market participation primarily because it determines production as it provides the draught power necessary for production but not necessarily market participation, thus the negative sign. Finally, households with more dependents do not participate in the crop market. Households with more dependants primarily strive to be food self-sufficient before they produce for the market.

Table 5: Determinants of market participation (two SLS regression)

Variables	Coefficient	Adjusted St. Error
Female-headed household head (reference male)	19.49	19.71
Age of the household head (in yrs)	-0.78	0.94
Level of education of household head (in yrs)	7.19	4.20
Dependent ratio	-5.05	8.97*
Value of the produced	0.003	0.002*
Predicted market orientation index	0.18	0.07***
Irrigated land	-0.88	10.46
No access to irrigation (reference yes)	22.65	27.11
Own labour	31.43	82.19
Equine	-10.26	12.79
Oxen	-14.39	8.06*
Livestock holding in TLU less equines and oxen	12.72	6.49**
Distance to microcredit office	0.08	0 .15
Distance to coop office	0.023	0.27
Distance to FTC	0.18	0.45
Distance to crop store facilities	-0.09	0.07
Distance to market town	0.43	0.23*
Distance to all weather roads	-0.12	0.08
Distance to mobile telephone service provider	-0.35	0.123***
Distance to fixed telphone service provider	0.17	0.17
_cons	38.14	58.41
Number of obs = 117 F(19, 97) = 2.61 Prob > F = 0.0011 R-squared = 0.0432		

Source: Baseline survey 2014.

3.4 Determinants of outlet choices

The likelihood ratio test indicated that the covariance and variance matrix across the error terms in the four equations are not independent (p-value > 0.0000). This implies that the choices are dependent and the use of MVP is appropriate.

The result of the determinants of outlet choice for rainfed agriculture is reported in Table 7. In this analysis,we focused on four major market actors; namely farm gate, assembler, wholesaler and retailer. With respect to cereals and pulses, households with more dependents are less likely to choose retailers. The coefficients in other equations do have consistently negative sign, although are statistically insignificant.

Households with bigger labour and land holding are less likely to sell on farm indicating that households with larger labour and land holdings can sell their produce directly to wholesalers or retailers. This implies that households with bigger labour and land holding can produce a larger volume making the choice of wholesalers and retailers more economically meaningful.

Quantity sold (in kg) and average prices are significant and consistently negative to the outlet choice in all equations, implying probably that producers have limited role in price determination (requiring, among others, better negotiation power and the producers' capacity to transport his product long distances and maintain the product quality) and

producers required to sell the given volume (in kg) at the expense of travelling long distances (the transport cost becomes larger) and maintaining the product quality.

Table 6: Determinants of outlet choice in rainfed (cereals and pulses)

Variables	Farm gate	Assembler	Wholesaler	Retailer
Female-headed household (reference male)	-0.002 (0.128)	-0.007 (0.115)	-0.118 (0.105)	0.035 (0.063)
Age of the household head	0.005 (0.005)	0.004 (0.004)	0.003 (0.004)	0.003 (0.002)
Education level of household head (yrs)	-0.004 (0.020) (0.049)	0.024 (0.017)	0.025 (0.023)	0.017 (0.047)
Dependency ratio	-0.012 (0.058)	-0.041 (0.046)	0.023 (0.055)	-0.095 (0.046)**)
Own labour	-0.007 (.003*)	-0.004 (0.004)	-0.002 (0.004)	-0.004 (0.002)
Total land holding (in *timad*±)	-0.039 (0.018**)	-0.013 (0.020)	0.020 (0.023)	-0.019 (0.020)
Quantity sold (in kg)	-0.002 (0.0014***)	-0.004 (0.001***)	--0.002 (0.0003***)	-0.002 (0.0004***)
Average price (ETB/kg)	-0.069 (0.012***)	-0.075 (0.011***)	-0.067 (0.011***)	-0.051 (0.0112***)
No. of equines	-0.057 (0.053)	-0.033 (0.069)	-0.053 (0.057)	-0.096 (0.023)
Distance to crop market	-0.004 (0.004)	0.002 (0.004)	0.009 (0.004**)	-0.007 (0.004*)
Distance to dry weather roads	-0.009 (0.002***)	-0.005 (0.002***)	-0.008 (0.002***)	-0.008 (0.002***)
Distance to all weather roads	-0.001 (0.001 **)	0.001 (0.0004688	-0.002 (0.0005)***)	-0.002 (0.0005***)
Distance to market town	0.001 (0.001))	-0.0003 (0.001)	-0.0002 (0.001)	-0.070 (0.059)
Distance to crop store facility	0.0003 (0.0003)	0.0002 (0.0003))	0.001 (0.0003*)	0.001 (0.0003***)
Distance to fixed telephone provider	0.0001 (0.001)	-0.001 (0.0004 **)	-0.001 (0.0004)	0.146 (0.065**)
Distance to mobile telephone provider	0.0003 (0.0004))	-0.0002 (0.0005))	0.0002 (0.0005)	0.031 (0.048)
Distance to microfinance institution	0.001 (0.001)	0.001 (0.001*)	0.001 (0.0006**)	-0.050 (0.048)
Distance to cooperative office	-0.001 (0.001)	-0.0001 (0.001)	-0.001 (0.001)	0.001 (0.001)
Distance to FTC	-0.014 (0.010**)	-.0104614 .008448)	-0.003 (0.006)	-0.017 (0.007**)
Distance toDA's office	0.014 (0.008*)	0.011 (0.008)	0.007 (0.007)	0.0216 (0.008)
intercept	1.913 (0.385 ***)	1.814 (0.287***)	1.590 (0.313 ***)	1.705 (0.293***)
Number of obs = 1957 Wald chi2(76) = 1267.51 Log pseudolikelihood = -1827.6777 Prob > chi2 = 0.0000				

± timad is ~ 0.25 hectare. *, **, *** significant at 10, 5, 1 % respectively

Source: Baseline survey 2014.

Households which are far from the market (measured by distance to dry and all weather roads) are less likely to choose any of the outlets because they hardly produce for the market. The availability of storage facilities makes the choice of wholesalers and retailers more likely. Distance to fixed phone providers makes the choice of assemblers and wholesalers less likely, farmers who didn't have access to market information prefer selling to retailers.

Access to micro credit makes the outlet choice of assemblers by wholesalers more likely. Distance to a farmers training centre (FTC) make the outlet choice of farm gate actor and wholesaler less likely, while distance to the DA's office make the choice more likely.

With respect to horticultural crops, we focused on three market actors[†]; namely, farm gate, assembler, and wholesaler. The likelihood ratio test in the second equation also indicated that the covariance and variance matrix across the error terms in the three equations are not independent (p-value > 0.0000) indicating that the outlet choices are not independent, thus indicating the appropriateness of using MVP model.

† In this equation we used only three equations, as the all observations of dependence variable in the forth equation had no variation. All observations took value 1.

Table 7: Determinants of outlet choice in irrigated agriculture (vegetables and fruits)

Variables	Farm gate	Assembler	Wholesaler
Female-headed household (reference male)	0.061 (0 .189))	0.175 (0.172)	-0.088 (0.167)
Age of the household head	-0.001 (0.008)	-0.015 (0.008*)	-0.006 (0.007)
Education level of household head (yrs)	0.018 (0.036)	0.013 (0.035)	0.004 (0.036)
Dependency ratio	-0.213 (0.078***)	-0.217 (0.082***)	-0.068 (0.088)
Own labour	-0.023 (0.005***)	-0.007 (0.004**)	-0.004 (0.005
Total land holding (in *timad*±)	0 .002(0.033)	0.005 (0.035)	-0.109 (0.041***)
Irrigated land (in *timad*±)	0.831 (0.300***)	0.845 (0.285***)	0.230 (0.335)
Quantity sold (in kg)	-0.003 (.033***)	-0.002 (0.0003***)	-0.002 (0.0004***)
Average price (ETB/kg)	-0.004 (0.005)	-0.002 (0.006)	-0.014 (0.006**)
No. of equines	0.255 (0.087***)	0.175 (0.084**)	0.136 (0.114)
Distance to coop office	0.001 (0.002)	0.002 (0.002)	0.002 (0.002)
Distance to dry weather roads	-0.003 (0.005)	-0.003 (0.005))	-0.012 (0.005**)
Distance to all weather roads	-0.002 (0.001**)	0.003 (0.001**)	-0.002 (0.001***)
Distance to market town	-0.003 (0.001***)	-0.004 (0.001***)	-0.003 (0.001***)
Distance to crop store facility	0.001 (0.001**)	-0.0004 (0.001)	0.001 (0.001))
Distance to fixed phone provider	0.003 (0.001**)	0.002 (0.001)	0.001 (0.001)
Distance to mobile phone provider	-0.001 (0.001)	0.0003 (0.001)	0.0001 (0.001)
Distance to microfinance institution	0.001 (0.001)	0.001 (0.001)	-0.0002 (0.002)
Distance to farmers training centre	-0.011 (0.013)	-0.029 (0.012**)	-0.045 (0.012***)
Distance to DA's office	0.024 (0.013*)	0.039 (0.013***)	0.059 (0.015***)
intercept	0.045 (0.578)	0.630 (0.533)	1.138 (0.485**)
Number of obs = 582 Wald chi2(60) = 3945.38 Log pseudolikelihood = -590.2925 Prob > chi2 = 0.0000			

± timad is ~ 0.25 hectare. *, **, *** significant at 10, 5, 1 % respectively

Source: Baseline survey 2014.

With respect to the determinant of outlet choice of vegetables and fruits (Table 8), various variables related to household characteristics, asset holdings, commodity characteristics, market access conditions and services turned out to be significant. Older household heads are less likely to choose assemblers and households with more dependents are consistently negative in the choice of any outlet, more significantly so farm gate and assembler, probably indicating that households with more dependents are less likely to sell.

Quantity sold (in kg) and average prices are significant and consistently negative to the outlet choice in all equations (although average price insignificant in assembler choice), implying probably, as explained above, that producers have limited role in price determination and producers required to sell a given volume (in kg) at the expense of travelling far and maintaining the product quality. The opportunity costs of not selling at the right moment is quite high; producers choose to sell their produce at whatever price regardless of which actor they are facing.

Distance to dry weather roads negatively influences the outlet choice in farm gate equation. Distance to all weather roads negatively related to farm gate and wholesaler choices, but it is positively related to the assembler choice. The former result is more meaningful, while the later is not. Distance to market town is significantly and negatively related in all equations. Distance to crop store facilities are positively related to the likelihood of choosing with regards to the farm gate actor. Number of transport equines is significantly positively related to the choice of farm gate and assembler outlets, which is unexpected.

Finally, distance to FTC make the outlet choice of assembler and wholesaler less likely, while distance to the DA's office makes the choice of farm gate, assembler and wholesaler more likely.

4. Conclusions and policy implications

The latest government plans in Ethiopia aim to enhance market-oriented growth and market participation, through irrigation development, among other policy measures, to effect the structural transformation of agriculture. This study aims to identify determinants of market-orientated production, market participation and market outlet choice. The study used nationwide dataset of 5000 households from Amhara, Oromia, SNNP and Tigray states, applying appropriate econometric techniques for each of the objectives. Households with more than the average oxen holding were market oriented. Households with a greater total land holding are not market oriented, but households with more irrigated land are market oriented. This implies that households with more irrigated land produce cash crops than households which have larger land area per se. The result indicated that access to irrigation is significant in market production.

With regard to market participation, the market orientation index and value crop produced were significant, indicating that market orientation is translated into market participation and higher value of the produce is an important determinant of market participation. Market information (proxied by distance to mobile telephone service provider) does negatively influence market participation underlying the importance of market information.

The government focus on irrigation development is correct, but the strategies should focus on increasing households' productive capacity (oxen, total land area, irrigated land area). Probably, increased access to improved seeds/seedlings could increase the productive capacity of the different factors of production like oxen, land and labour. Expanding the necessary infrastructure for irrigation development or creating the conditions for household adoption of different irrigation technologies is important for market production and participation and structural transformation of agriculture. Although the evidence on the need for developing rural infrastructures (like roads and storage facilities) is not convincingly adequate in this study, provision of adequate and timely marketing information is also another entry point to transform smallholder agriculture and to gain the best out of the program.

Identifying determinants of outlet choices is relevant as it provides scientific evidence that can help policy measures to improve marketing performance and introduce institutional changes, if found necessary, to enhance the network of smallholder farmers and major actors to boost market efficiency and competitiveness. This will have important implications on the improvement of value chain of agricultural commodities and improvement of the livelihoods of farmers. The results of the current study indicate that there is a shift in crop categories from low value crops (predominantly cereals) to high value crops (vegetables and fruits) because of irrigation development. The study also found out that four major market actors are involved in the marketing of agricultural crops, both rainfed and irrigated, with limited roles of cooperatives and processors indicating that the market functions are primarily aggregation and retailing, but little in processing and value addition.

With respect to outlet choices, households with more labour and land holding are less likely to sell on farm indicating that households with larger labour and land holdings can sell their produce directly to wholesalers or retailers. Increasing land and labour is not an important policy instrument in Ethiopia, but through demonstration and production interventions, we can enhance the amount and type of outputs, which are marketable and of high value. These will be the entry points for policy intervention.

Market access conditions like distance to dry and all weather roads negatively influence the outlet choice almost in all channels considered, in both rainfed and irrigated crops. The implication of the study is that households which are far from the market are less likely to choose any of the outlets because they hardly produce for the market. The availability of storage facilities makes the choice of wholesalers and retailers more likely in rainfed crops. Distance to crop store facilities are positively related to the likelihood of choosing farm gate actor in irrigated crops. Distance to market town is significantly and negatively related to the outlet choice in all channels considered with respect to vegetables and fruits. The results show that development of road infrastructure and storage facilities could play an important role in enhancing market participation. The policy emphasis on developing rural infrastructure in Ethiopia is also in the right direction, though the focus now is on rural roads with limited emphasis on developing storage facilities. Distance to FTC make the outlet choice of assembler and wholesaler less likely underlying the importance of developing training centres closeby. Finally, access to micro credit makes the outlet choice of assemblers and wholesalers more likely. This underlines the importance of expanding micro credit services in Ethiopia.

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