

Full Length Research Paper

The Impacts of Brokerage Institutions in the marketing of horticultural crops in Fogera District, South Gondar, Amhara region of Ethiopia

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Abstract

The main objective of this study was to analyze the economic roles played by the brokerage institutions in smallholder market linkages to market outlets in horticultural marketing and determinants of decisions on whether to use brokerage institutions or not under imperfect market condition in Fogera District, North Western Amhara Region particularly focusing on onion and tomato. Both secondary and primary data were collected for the study. Primary data were collected from a very wide number of respondents at all stages of the market channel where brokers are expected to play role. Two stage sampling techniques were used to select the sampled farmers. Descriptive and econometric statistical models were employed for data analysis using STATA software. The study implemented the Propensity Score Matching (PSM) model. The result of the study showed that the brokerage institutions are characterized as urban, peri-urban and farmer brokers. There was significant brokerage activity only for onion marketing and in the case of tomato marketing the brokers act as rural assemblers. Most of the horticultural trading in the area is undertaken by credit and thrust based and in this arena brokerage institutions are playing most important role by linking smallholder farmers to market outlets. Logistic regression estimation of Propensity Score Matching model revealed that Age, education level, distance of residence from development agent office, distance of residence from Woreta market, distance of residence from main asphalt road, access to cell phone (mobile phone) and number of regular wholesaler customers significantly affected the participation decisions of the smallholders in the brokerage institutions services. The result of the study also revealed that, smallholder farmers using brokerage institutions have got 4393.62 ETB higher net income and 13.55% of greater marketed surplus than those smallholders who do not use. Generally, the brokerage institutions are playing significant and important role in forming market linkages between smallholders and wholesalers under imperfect market conditions with their limitations. Therefore, the study highly recommends the formalization of the brokerage institutions through licensing, training and continuous follow up in the District considering the experience of ECX.

Key words: Fogera, Brokerage institutions, STATA, PSM, ECX

INTRODUCTION

Ethiopia has highly-diversified agro-ecological conditions which are suitable for the production of various types of

fruit and vegetables. Amhara Region is one of the potential areas in the Country. Fogera District is endowed

with diverse natural resource, with the capacity to grow different annual and perennial crops. Two major rivers are of great importance to the Woreda, Gumara and Rib. They are used for irrigation during the dry season for the production of horticultural crops mainly vegetables (Abay, 2007). Efficient coordination in traditional markets is a prerequisite for a successful smallholder commercialization towards rural transformation, poverty reduction and agrarian change in the developing countries. However, it is often staggered by the problem of market imperfection and institutional underdevelopment that increase transaction cost and risk faced by smallholders. There are no producer organizations, such as cooperatives to coordinate horticultural marketing purpose in Fogera on behalf of farmers, against a growing demand for the products in different parts of the country. Because of this, success in horticulture crop production as high value crops is not necessarily translated into a market success in the area. Such institutional bottlenecks against an emerging horticultural market have created a fertile ground for a strong presence of brokers in the horticultural market of Fogera.

Though road infrastructure and use of mobile telephones among farmers for market access and information exchange is reasonable, direct linkage of farmers to the wholesale market (the major market for the horticulture crops produced) is very limited. As a result, the majority of smallholders opt to use brokers to sell their products to wholesalers, who distribute products to different consumer and seasonally deficit producer markets in the country. Given the large volume of horticulture products in the area, combined with seasonal glut and high perishability, efficient market coordination and logistics are necessary to link Fogera horticulture farmers with the wholesale markets and to enable them generate sufficient economic incentives. In rural areas where producer organizations are absent and market institutions are underdeveloped, posing a challenge for smallholder market linkage, brokers could fill the coordination gaps and logistical constraints to facilitate exchange. Fogera provides a useful case in this regard where the brokerage institution, which dominantly exists informally, plays an important role in coordinating the horticultural marketing activities, starting from the farm. According to Amhara Regional Agricultural Research Institute and Amhara Regional Bureau of Agriculture (2008) participatory rural appraisal report, one of the priority research problems in horticultural marketing in the Woreda was the role and functions of informal brokerage activity in the area.

However, the brokers at Fogera horticulture market (who play a market coordination role by constituting an important element of the “invisible hand”), are not closely studied, known, and described in terms of their impacts, limitations and constraints to improve their efficiency and impact as an important intermediary in the horticultural supply chain of the area. Perhaps, this is a result of the less recognition the brokerage institution receives. This paper is intended to contribute to filling this knowledge gap in the area by addressing the following objectives.

The general objective of the study was:

- To assess the economic roles played by the brokerage institution and identify determinants of decisions on whether to use brokers or not under imperfect market condition in the study area.

The specific objectives of the study were:

- To identify the determinants of farmers decision whether to use brokerage institutions or not as a means of market linkage to wholesalers; and
- To measure the impact of brokerage institutions on smallholder horticulture producers

RESEARCH METHODOLOGY

Description of the Study Area

Fogera District is one of the 106 Woreda's of the Amhara Regional State and found in South Gondar Zone. It is situated at 110 58 N latitude and 370 41 E longitude. Woreta is the capital of the Woreda and is found 625 km from Addis Ababa and 55 km from the Regional capital, Bahir Dar. The District is divided into 27 rural Peasant Associations and 3 urban kebeles.

Methods of Data Collection and Sampling Procedures

Both primary and secondary data were used for this study. The primary data for the study were collected from market actors starting from production to the end retailers which were conducted through interview and discussion. A semi-structured questionnaire and check-list were used for data collection. Field trips were made to undertake Rapid Market Appraisal (RMA). The questionnaires were pre-tested and its contents were refined. The researcher has made personal observations and informal discussions with farmers, development agents, district agricultural experts of Ministry of Agriculture and Rural Development using checklists. Multi-stage random sampling techniques were employed. The sample has covered farmers, brokers, rural assemblers, wholesalers and retailers on proportionate to size basis and research objectives using sample size determination formula.

Methods of Data Analysis

Descriptive Statistics

For this study descriptive statistics such as percentages, frequencies, standard deviation, independent sample t-test and chi squared test were used.

Propensity Score Matching Model

To measure the impacts of brokerage institutions this study used with and without approach which best suits the purpose of this particular study i.e. brokerage institution participants and non participants comparison using Propensity Score Matching (PSM) model. The first

step in estimating the treatment effect is to estimate the propensity score. To get this propensity scores any standard probability model can be used (for example, logit, probit or multi-nominal logit) (Rajeev *et al.*, 2007). Since the propensity to participate in use of brokerage institution is unknown, the first task in matching is to estimate this propensity. Any resulting estimates of brokerage institution effect rest on the quality of the participation estimate. This can be routinely carried out using a choice model. Which choice model is appropriate depends on the nature of the brokerage institution being evaluated. If it offers a single treatment, the propensity score can be estimated in a standard way using, for example, a probit or logit model, where the dependent variable is 'participation whether to use brokers or not' and the independent variables are the factors thought to influence participation and outcome.

Following Pindyck and Rubinfeld (1981), the cumulative logistic probability function is specified as:

$$P_i = F(Z_i) = F\left[\alpha + \sum_{i=1}^m \beta_i X_i\right] = \left[\frac{1}{1 + e^{-[\alpha + \sum \beta_i X_i]}}\right]$$

(1)

Where; e : represents the base of natural logarithms (2.718...)

X_i : represents the i th explanatory variable

P_i : the probability that a farmer participates in the brokerage institution services

α and β_i : are parameters to be estimated.

Interpretation of coefficients will be easier if the logistic model can be written in terms of the odds and log of odds (Gujarati, 2004). The odds ratio implies the ratio of the probability that an individual will be a participant (P_i) to the probability that he/she will not be a participant ($1-P_i$). The probability that he/she will not be a participant is defined by:

$$[1 - P_i] = \left[\frac{1}{1 + e^{Z_i}}\right]$$

(2)

Using equations (1) and (2), the odds ratio becomes

$$\left[\frac{P_i}{1 - P_i}\right] = \left[\frac{1 + e^{Z_i}}{1 + e^{-Z_i}}\right] = e^{Z_i}$$

(3)

Alternatively,

$$\left[\frac{P_i}{1 - P_i}\right] = \left[\frac{1 + e^{Z_i}}{1 + e^{-Z_i}}\right] = e^{\left[\alpha + \sum_{i=1}^m \beta_i X_i\right]}$$

(4)

Taking the natural logarithms of equation (4) will give the logit model as indicated below.

$$Z_i = \ln\left[\frac{P_i}{1 - P_i}\right] = \alpha + \beta_1 X_{1i} + \beta_2 X_{2i} + \dots + \beta_m X_{mi}$$

(5)

If we consider a disturbance term, u_i , the Logit model becomes

$$Z_i = \alpha + \sum_{i=1}^m \beta_i X_i + U_i$$

(6)

So the binary Logit will become:

$$\Pr(PBS) = f(X)$$

(7)

Where PBS is participation in broker service, $f(X)$ is the dependent variable project participation and X is a vector of observable covariates of the households;

$$X = [FS, AG, ED, PI, SC, TC, DMM, DMR, AFC, CP, WC, MC, EV, VHP, THP]$$

(8)

After obtaining the predicted probability values conditional on the observable covariates (the propensity scores) from the binary estimation, matching was done using a matching algorithm that is selected based on the data at hand. Then the impact of farmer's participation in the services provided by brokerage institution on a given outcome (outcome in this study is market participation, household's gross income from horticultural crop production, percentage of brokered transaction and marketed surplus) (Y_i) is specified as:

$$\tau = Y_i(D_i = 1) - Y_i(D_i = 0)$$

(9)

Where; τ_i : is treatment effect (effect due to participation in the service of brokers), Y_i : is the outcome on household i , D_i : is whether household i has got the treatment or not (i.e., whether a household participated in the brokers service or not). However, one should note that Y_i ($D_i = 1$) and Y_i ($D_i = 0$) cannot be observed for the same household at the same time. Depending on the position of the household in the treatment (market participation), either Y_i ($D_i = 1$) or Y_i ($D_i = 0$) is unobserved outcome (called counterfactual outcome) (Yemisrach, 2010). Due to this fact, estimating individual treatment effect τ_i is not possible and one has to shift to estimating the average treatment effects of the population than the individual one. Most commonly used average treatment effect estimation is the 'average treatment effect on the treated' (τ_{ATT}), and specified as:

$$\tau_{ATT} = E(\tau|D=1) = E[Y(1)|D=1] - E[Y(0)|D=1]$$

(10)

As the counterfactual mean for those being treated, $E[Y(0)|D=1]$ is not observed, one has to choose a proper substitute for it in order to estimate the average treatment effect (ATT). One may think to use the mean outcome of the untreated individuals, $E[Y(0)|D=0]$ as a

substitute to the counterfactual mean for those being treated, $E[Y(0) | D = 1]$. However, this is not a good idea especially in non-experimental studies. Because, it is most likely that components which determine the treatment decision also determine the outcome variable of interest. In this particular case, variables that determine household's decision to participate in the services developed by the brokers could also affect household's market participation, gross income from horticultural crop production and percentage of brokered transaction and marketed surplus etc. Therefore, the outcomes of individuals from treatment and comparison group would differ even in the absence of treatment leading to a self-selection bias. By rearranging, and subtracting $E[Y(0) | D = 0]$ from both sides, one can get the following specification for ATT.

$$E[Y(1) | D = 1] - E[Y(0) | D = 0] = \tau_{ATT} + E[Y(0) | D = 1] - E[Y(0) | D = 0] \quad (11)$$

Both terms in the left hand side are observables and ATT can be identified, if and only if $E[Y(0) | D = 1] - E[Y(0) | D = 0] = 0$. i.e., when there is no self-selection bias. This condition can be ensured only in social experiments where treatments are assigned to units randomly (i.e., when there is no self-selection bias). In non-experimental studies one has to introduce some identifying assumptions to solve the selection problem. The following are two strong assumptions to solve the selection problem.

Conditional independence assumption: Given a set of observable covariates (X) which are not affected by treatment (in our case, participation in brokerage service), potential outcomes (market participation, household's gross income from horticultural crop production and percentage of brokered transaction and marketed surplus etc) are independent of treatment assignment (independent of how the brokerage service participation decision is made by the household). This assumption implies that the selection is solely based on observable characteristics, and variables that influence treatment assignment (participation in broker service decision is made by the household) and potential outcomes (market participation, household's gross income from horticultural crop production, percentage of brokered transaction and marketed surplus) are simultaneously observed.

Common support: This assumption rules out perfect predictability of D given X . That is: $0 < P(D = 1 | X) < 1$. This assumption ensures that persons with the same X values have a positive probability of being both participants and non-participants in broker's service. Given the above two assumptions, the PSM estimator of ATT can be written as:

$$\tau_{ATT}^{PSM} = E_{P(X|D=1)} \{E[Y(1) | D = 1, P(X)] - E[Y(0) | D = 0, P(X)]\} \quad (12)$$

Where; $P(X)$ is the propensity score computed on the covariates X . Equation (12) is explained as; the PSM estimator is the mean difference in outcomes over the common support, appropriately weighted by the propensity score distribution of participants.

RESULTS AND DISCUSSIONS

Demographic and Socio-economic Characteristics of Sampled Households

This study is based on the information collected from 143 sampled farm households in Fogera District. Family size ranges from 2 to 14. The sample is composed of 63 male headed and 4 female headed non participant households and 67 male headed and 9 female headed participant households. As indicated in Table 1 below, there is significant difference between participant and non participant farmers with respect to sex. This indicates female headed households tend to participate in the brokerage institutions to sell the horticulture product. Because, direct linkage to the wholesalers needs high communication ability, networked interaction, labor intensive and mobility from place to place but females in the area cannot undertake this because they are very busy undertaking house works and also social taboos hinder them.

There is a significant difference in age. This is because aged people are weak in communication and interaction which needs moving from place to place and labor intensive. Thus, they tend to participate in the brokerage institutions. The level of education of the household heads is statistically different for the two groups and non participants were better-off in their level of education. Educated people have greater communication and negotiation ability in addition they have no problem of calculating the transaction and profit. Thus, educated households tend to do not participate in the brokerage institutions in order to remove the *commission payment* and maximize their profit. There was significant difference on irrigable land holding between the non-participant and participant households. This might be due to the reason that households who have higher irrigable land size have the opportunity to produce more which in turn gives an incentive for them to attract wholesalers because wholesalers think of the reduced transaction cost in which they can have full of the car at a time from one producer. The livestock ownership was not significantly different between participant and non-participant households. The minimum amount owned by a household is 0 while the maximum was 17.68 TLU which indicates that there is a high degree of disparity in the ownership of livestock between the sample households.

Institutional and Social Capital Aspects

All of the households have access to formal credit sources such as Amhara Credit and Saving Institutions (ACSI). Only 13.2% of households are member of

Table1: Descriptive statistics of sample households on pre-intervention characteristics

Pre-intervention Variables	Sampled Households (143)		Participant (N=76)		Non participant (N=67)		Difference means		in T-Value
	Mean	Std.Er	Mean	Std.Er	Mean	Std.Er	Mean	Std.Er	
Age	39.60	0.99	42.54	1.64	37.01	1.09	-5.52	1.93	-2.86***
Sex	1.91	0.02	1.87	0.04	1.95	0.03	0.08	0.05	1.70**
Marital Status	0.96	0.02	0.95	0.03	0.96	0.02	0.01	0.03	0.16
Education Level	2.53	0.29	1.52	0.36	3.42	0.41	1.9	0.56	3.42***
Family Size ¹	3.31	0.11	3.36	0.15	3.26	0.15	-0.10	0.22	-0.47
Family Size	6.13	0.21	5.94	0.29	6.29	0.30	0.35	0.42	0.83
TLU	5.67	0.25	5.97	0.38	5.40	0.34	-0.57	0.51	-1.11
Land Size	1.57	0.09	1.43	0.08	1.69	0.16	0.27	0.19	1.43
Irrigable Land	0.97	0.09	0.77	0.06	1.16	0.15	0.39	0.18	2.2**
Experience in production	8.97	0.32	9.18	0.48	8.79	0.42	-0.39	0.64	-0.61
Distance to Extension	3.49	0.30	4.41	0.55	2.69	0.26	-1.71	0.59	-2.92***
Cell phone	0.43	0.04	0.18	0.05	0.64	0.06	0.47	0.07	6.32***
Distance to District (Woreta)	12.43	0.63	14.64	1.1	10.49	0.63	-4.15	1.22	-3.40***
Distance to Asphalt road	2.49	0.22	3.76	0.36	1.37	0.18	-2.39	0.39	-6.16***
Number of customers	1.52	0.20	0.85	0.19	2.12	0.32	1.27	0.38	3.29***
Number of Trading contacts	8.07	0.59	7.95	0.74	8.17	0.92	0.22	1.20	0.18

Source: Author's Survey, 2012

*** and **means significant at the 1 and 5% probability levels, respectively.

1. Labor supply conversion factor (person day equivalent)

Table 2: Descriptive statistics of sample households (for dummy variables)

Pre-intervention Variables	Category	Participant (N=76)		Non participant (N=67)		Total		χ ²
		N	%	N	%	N	%	
Sex	Female	10	13.16	3	4.48	13	9.09	2.88*
	Male	56	86.84	64	95.52	130	90.91	
Cell phone	No	62	81.58	43	64.18	105	73.43	31.56***
	Yes	14	18.42	24	35.52	38	26.57	

Source: Author's Survey, 2012

*** and *means significant at the 1 and 10% probability levels, respectively.

cooperatives. In all of the kebeles of the District there are development agents. However, there is significant difference in distance from residence to development agents between participant and non participant households. Telecommunication facility is the most important service in marketing of horticultural products by providing recent information and reducing the transaction cost of trading. There was significant difference between the participant and non participant households with respect to cell phone ownership. Higher percentage of mobile phone ownership helps the non participant households to easily call and find the wholesalers for selling their horticulture product. There are two main asphalt roads from Bahir Dar to Gondar and from Woreta to Debre Tabour. There is significant difference between participant and nonparticipant households with respect to distance of residence to Woreta (District) market and main asphalt road. The reason is that when the households are far away from the main asphalt road and Woreta town, the transaction cost of finding market information and wholesalers is very high. Thus, the households tend to

use brokerage institutions in order to reduce the transaction cost.

Social capital plays very significant role in transaction. There is significant difference between the participant and non participant households with respect to the number of regular wholesaler customers and number of trading contacts to main (Woreta) market in marketing of horticultural products. Social capital reduces the transaction cost by reducing the negotiation and information searching costs. High social capital means less probability of participation in the brokerage institutions. Since, non participant households have higher social capital which reduces the transaction cost they tend to directly contact to wholesalers to sell their product than using brokerage institutions.

Characteristics of Brokers and their Economic Role

Brokers in the study area are characterized as farmer, peri-urban and urban brokers including farmers, youth brokers (school dropout and high school complete

youngsters) and traders of cereals like rice. The brokerage institutions have strong chain in the Woreda and most of the transactions are undertaken by them and are playing role by searching different market outlets to almost all parts of Ethiopia. Since brokerage institutions are well informed by buyers and producers, are residents of the Woreda, educated and youngsters, they have easy information access and play significant role by providing market information, linking smallholders to wholesalers, creating economies of scale from many smallholders, easily bargain both smallholders and wholesalers and act as a collateral for both of actors which helps the smallholders and wholesalers to reduce transaction cost under market imperfections and trust based transaction.

Propensity Score Matching Model

As indicated in [table 3](#) below, only six of the fifteen explanatory variables which are theoretically supported to influence the decision to participate in the brokerage institutions for linkage in the logit model have significant effect on the participation decision of the household.

The interest of the matching procedure is to get a household from non-participants in brokerage institutions service with similar probability of participation or using brokerage institutions given the explanatory variables. Age of the household head significantly and positively affected the probability of participation in using brokerage institutions service of the household. It coincides with the hypothesis that as the age of the household head increases, the household decides better to participate in brokerage institutions. This is due to the fact that aged people have weak communication and information searching ability in order to directly contact to traders/wholesalers to sale the onion. In other words, the younger the household head is, and the more likely will be the probability of not participating in the brokerage institutions for linkage in the marketing of onion.

Education level of the household has a negative significant effect on the participation decision of the household in brokerage institutions. People with higher education level are good at communication, information searching, negotiation and undertaking transaction which leads to direct contact to traders to sell their product. This indicates that educated people have less probability of using brokerage institutions for linkage to wholesalers than uneducated people (illiterate and adult education). In Fogera Woreda the most determining factor for direct linkage of farmers to wholesalers is the thrust between them during transaction. The transaction can be undertaken if there is strong thrust between them in weighing and payment. If the household head is uneducated he has no knowledge about weighing and preferred to use brokerage institutions for market linkage than direct linkage to wholesalers as he is more familiar with the broker who lives in the residence and trustful on the broker. Payment place is also the most important

issue for farmers and wholesalers. Farmers prefer to receive their payment at the farm while wholesalers prefer to pay at Woreta town this disagreement made uneducated farmers to sale their product using brokerage institutions while educated farmers have no problem of payment place rather the price itself. Thus, there will be easy agreement between farmers and wholesalers and they tend to directly contact to wholesalers to sell their product without using brokerage institutions.

Distance of residence of the household to development agent's office has a positive significant effect on the participation decision of the household in the brokerage institutions. Households which are far from the development agent office have higher probability to use brokerage institutions for linkage to the market outlet than households which are near to development agents. The reason for this fact is that when distance of the household's residence to the development agents increase, the household cannot have easy access for extension services related with product marketing techniques, market information and market linkages which lead the household to participate in brokerage institutions service for linkage than direct contact to the wholesalers. The two most important factors which affects households decisions whether to use brokerage institutions or not in Fogera Woreda are transaction costs and the issue of obtaining secure market outlet for the product. Having Cell phone (Mobile phone) or not has a negative significant effect on the participation decision of the households whether to use brokerage institutions or not for linkage to the traders/wholesalers. Households who have mobile phone have a higher probability of not using brokerage institutions for market linkage than those who do not have. Mobile phone makes communication and information searching very easy as a result it reduces the transaction cost of finding wholesalers. Therefore, it facilitates the direct contact of households to the traders.

Distance of residence of the household to the main asphalt road has a positive and significant effect on the participation decision of the households in the brokerage institutions. Households which are far from the main asphalt road have higher probability to use brokerage institutions for linkage to the market outlet than households which are near to the main asphalt road. The reason for this fact is that when distance of the household's residence to the main asphalt road increases, the household cannot access information about the wholesalers and there will not be thrust between the wholesalers and the farmers in the transaction processes (payment become very difficult for the wholesalers at the farm which is distant from the asphalt road, the wholesaler do not thrust the farmer whether he has quality onion or not in the area and if there is no quality onion there will be high transaction cost for wholesaler to come out of the farm to the main road. On the other side, the farmer also do not have

Table 3: Logit results of households' brokerage institution participation

Variables	Coefficients	Std.Er	Z value
Age	.056**	.028	2.03
Sex	-.157	.996	-0.16
Marital Status	-.308	1.410	-0.22
Education Level	-.163*	.086	-1.90
Family Size ¹	-.052	.282	-0.19
TLU	.109	.098	1.11
Land Size	.183	.586	0.31
Irrigable Land	-.022	.574	-0.04
Experience in production	-.021	.065	-0.33
Distance to Extension	.156*	.087	1.81
Cell Phone	-1.710***	.554	-3.09
Distance to District	.006	.038	0.16
Distance to Asphalt	.631***	.172	3.67
Regular Customer	-.331**	.164	-2.02
Trading Contacts	-.027	.042	-0.65
Constant	-2.479	2.458	-1.01
Sample size (N)	143		
LR chi2(15)	84.88		
Prob > chi2	0.00		
Pseudo R ²	0.42		
Log likelihood	-56.394		

Source: Own estimation result

***, ** and *means significant at the 1%, 5% and 10% probability levels, respectively.

1. Labor supply conversion factor (person day equivalent)

thrust on the wholesaler in order to receive the payment for his product from the wholesaler in the Woreta town) which leads to higher probability of using brokerage institutions for market linkages in which the brokerage institutions are known and the transaction is safe from any default.

Number of regular customers (wholesalers) of the households has a negative and significant effect on the participation decision of the household in brokerage institutions service. Households having large number of regular wholesalers have lower probability of participating in the brokerage institutions for market linkage than those who have lesser number of regular customers this is due to the fact that households prefer direct market contact to the wholesalers as they have larger number of regular customers who can purchase the product. Thus, there is no information problem and higher transaction cost to access them. In addition direct contact removes the *FERQ* which is advantageous for both producers and wholesalers. However, if the household have less number of regular wholesaler customers, this wholesalers cannot purchase all of his product because they are few

which needs searching another market outlet or wholesaler this in turn leads to higher transaction cost of searching information and wholesalers. As a result the household prefer to use brokerage institutions for market linkage under this condition.

Common Support Condition and Matching Using Matching Algorithms

The next step in propensity score matching technique is the common support condition. Only observations in the common support region matched with the other group considered and others should be out of further consideration. The predicted probability for those who are participating in the brokerage service ranges from 0.060 to 0.999 with the mean probability of participation being 0.725. On the other hand, the probability of not participating of the non participant households in the brokerage institutions service ranges from 0.003to 0.895 with mean of 0.242. From the result, observations with the predicted probability between 0.060 and 0.895 are in the common support region with the possibility of getting

good match from the other group. Observations with predicted probability less than 0.060 and greater than 0.895 have been disregarded out from further analysis.

In an impact assessment study, households should have their good match from the control group. This will be maintained through balancing the covariates of the participant group to the covariates of the non-participant group. Against the unmatched sample, matched samples using kernel with band width of 0.25 satisfy the property of balanced matching for all of the covariates. The three criteria were implemented to each matching algorithm to identify the best matching technique. Kernel matching algorithm with a band width of 0.25 was found to be the best estimator by balancing all the observable covariates, ends with low pseudo- R^2 and large number of observations in the common support. Accordingly, the research used it for measuring the impact.

Impacts of the Brokerage Institutions

The study describes the impacts of brokerage institutions in linking smallholder horticultural crop (onion) producers with market outlets (wholesalers) in terms of net return, percentage of marketed surplus, land allocated to onion production, amount of onion produced and sensitivity of the impacts.

Table 4: Impact of Brokerage institutions

Outcomes	ATT	Std.Err ¹	T-value
NRO	4393.62	1781.51	2.53**
PMS	13.55	13.84	2.86**
AOP	-5.084	36.72	-0.25
LAOP	-0.053	0.22	-0.24

1. The bootstrapped SE is obtained after 100 replications

**, significant at 5% probability levels

Source: Own estimation result

Impact on Net Return from Onion Production (NRO)

Brokerage institutions in Fogera Woreda create linkage between farmers and the market outlet (wholesalers). Thus, farmers using brokerage institutions have easy access to wholesalers which reduces the transaction cost of searching traders, market information, loss due to perishability and transportation cost which in turn reduces the overall marketing cost. As net return is revenue reduced the total cost, a reduction in marketing cost means a reduction in total cost which leads to high net return. Smallholder farmers using brokerage institutions have got 4393.62 ETB higher net incomes from onion production than those farmers who do not use brokerage institutions for linkage to the market outlet. This indicates that brokerage institutions are playing a significant and

positive role in linking smallholder farmers to the market outlets.

Impact on Percentage of Marketed Surplus (PMS)

Smallholder's use of brokerage institutions is highly associated with the issue of obtaining secure market for their product in all the production years. According to Woreda Experts and Development Agents there is significant fluctuation either increasing or decreasing in horticultural production every year following the increase or decrease in price of the previous year respectively. In 2011 production year, It was very good year for horticultural production and onion production was high in the area following the high price incentive in 2010. Thus, in 2011 the price of onion has reached to 0.25 ETB for Kg of onion because the supply was much more than the demand and even most of the farmers specially farmers who do not use brokerage institutions do not sell much of their product, following this the farmers reduced allocation of more land to onion production and the supply in 2012 become very low relative to demand. Based on the monitoring of the study area for about four months (January, February, March and April) the price score for a Kg of onion was between 4.00-7.00 ETB.

In 2011, due to the high supply of onion, lower demand compared to production and perishable nature of the product brokerage institutions played great role in linking their smallholder customer farmers (broker users) to the market outlets and the percentage of non marketed onion from total production was lower than 27.27% while farmers who do not have the experience of using brokerage institutions specially those their residence is far from the main asphalt road were unable to sell their product and the non marketed onion from total production has reached to up to 79%. This is due to the fact that brokers have much higher regular wholesaler customers than farmers who do not use brokers, more information and very high communication capacity which leads them to control most of the wholesalers coming to the area. In addition, in the time of much supply brokerage institutions provide service first for their very experienced farmer customers that is based on experience in transaction. The result of the study revealed that smallholder farmers who participated in brokerage institutions for linkage have 13.55% of greater marketed surplus than those smallholders who do not participate. This implies that brokerage institutions have significant and positive impact on marketed surplus in Fogera District.

Impact on Amount of Onion Produced (AOP) and Land Allocated to Onion Production (LOAP)

The result of the study indicated that brokers have no significant and positive impact on the amount of onion produced and land allocated to onion production. The

Table 5: Result of sensitivity analysis using Rosenbaum bounding approach.

Outcomes	$e^v=1$	$e^v=1.25$	$e^v=1.5$	$e^v=1.75$	$e^v=2$	$e^v=2.25$	$e^v=2.5$	$e^v=2.75$	$e^v=3$
NIO	5.0e-12	6.4e-09	6.9e-07	.000018	.000192	.001141	.004497	.013149	.030763
PMSU	P<0.000	P<0.000	P<0.000	1.1e-16	8.0e-15	2.3e-13	3.3e-12	2.9e-11	1.8e-10
AOP	P<0.000	P<0.000	P<0.000	P<0.000	P<0.000	P<0.000	P<0.000	P<0.000	P<0.000
LAOP	P<0.000	P<0.000	P<0.000	P<0.000	P<0.000	P<0.000	P<0.000	P<0.000	P<0.000

Source: Own estimation

e^v (Gamma)=log odds of differential due to unobserved factors where Wilcoxon significance level for each significant outcome variable is calculated

reason is that higher land allocation and high production is affected by other factors like previous year price.

Sensitivity Analysis

Rosenbaum (2002) proposes using Rosenbaum bounding approach in order to check the sensitivity of the estimated ATT with respect to deviation from the CIA (Conditional Independence Assumption). The basic question to be answered here is whether inference about treatment effects may be altered by unobserved factors or not.

The first column of table 5 showed those outcome variables which bears statistical difference between treated and control households in our impact estimate above. The rest of the values which corresponds to each row of the significant outcome variables are p-critical at different critical value of e^v . Result showed that the inference for the effect of the brokerage institutions is not changing though the participants and non participant households in the brokerage institutions has been allowed to differ in their odds of being treated up to 200% ($e^v=3$) in terms of unobserved covariates. That means for all outcome variables estimated, at various level of critical value of e^v , the p- critical values are significant which further indicate that the study have considered important covariates that affected both participation and outcome variables. The study couldn't get the critical value e^v where the estimated ATT is questioned even if the research have set largely up to 3, which is larger value compared to the value set in different literatures which is usually $e^v=2$ (100%). Thus, it is possible to conclude that the research impact estimates (ATT) are insensitive to unobserved selection bias and are a pure effect of brokerage institutions in the area.

CONCLUSION AND RECOMMENDATIONS

The overall analysis of the study can be concluded that brokerage institutions are characterized as farmer, peri-urban and urban brokers including farmers, youth brokers (school dropout and high school complete youngsters) and traders of cereals like rice. The brokerage institutions have strong chain in the Woreda and most of the transactions are undertaken by them and are playing role by searching different market outlets to almost all parts of Ethiopia. Since brokerage institutions are well informed

by buyers and producers, are residents of the Woreda, educated and youngsters, they have easy information access and play significant role by providing market information, linking smallholders to wholesalers, creating economies of scale from many smallholders, easily bargain both smallholders and wholesalers and act as a collateral for both of actors which helps the smallholders and wholesalers to reduce transaction cost under market imperfections. If brokerage institutions were not there, it was very difficult for wholesalers coming from the area to find smallholder producers. Therefore, empirically the idea that brokerage institutions are not important along the value chain is highly challenged here and brokerage institutions are the most important actors in the marketing of perishable products like onion which implies that greater attention should be given for them in order to sustain production and market linkages.

Brokerage institutions are source of secure market for smallholder producers because they have many regular wholesaler customers coming from the different areas of the country. Thus, if a farmer have regular customer of broker and plan to produce onion he is secured for the market because of brokers. This in turn implies that brokerage institutions form market outlets for the smallholders. Finally, the study recommends that a formalized and upgraded brokerage institution is commendable only as a *third pillar* for a better market coordination in the area. That is to say, in the best circumstances, even a formalized and upgraded brokerage institution should be considered only as a complement to, rather than as a substitute for, improved market institutions and effective producer organizations. The formalization activity can be adopted from the Ethiopian Commodity Exchange (ECX) experience. The study also recommends the ECX to include the horticultural crops such as onion in its commodity crop services. In addition, the study recommends training to farmers on marketing and weighing, standardization of weighing and provision of market information for the farmers in order to increase the benefit and income of farmers which helps them to come out of poverty.

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