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Market chain analysis of maize (in the case of Silte zone, Snnpr, Ethiopia)

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Abstract

The main goals of this study were to determine the primary maize marketing channels, analyze the market structure, conduct, and performance of maize markets, evaluate maize farmers' market participation decisions, and identify factors impacting marketable maize supply. A multi-stage sample strategy was used to collect primary data from 148 maize growers, and 43 maize dealers were chosen to examine the efficacy of the maize market in the research area using the Structure, Conduct, and Performance (SCP) model. The Hackman selection model was used to estimate the drivers of maize quantity supply and market participation choice. Wholesalers purchased 19.42 percent of maize from producers, rural collectors 21.35 percent, urban assemblers 15.28 percent, cooperatives/unions 6.42 percent, retailers 20.43 percent, and consumers 17.07 percent. The results of the S-C-P investigation Regdina mazoriya market indicated a week oligopoly of maize market in the research region, with four firms' concentration ratios (CR4) of 32.17 percent, while Alemegebaya market showed a competitive market structure with four businesses' concentration ratios (CR4) of 26.69 percent. More of the results suggest price sating by traders in terms of maize market conduct in the study region, computation between maize dealers by giving a better price, fair scaling (measuring) and delivering quality maize, and other measures of conduct by price sating strategy market actors. The maize market's investment possibility suggests that potential new merchants are welcome. The highest total marketing margin (14.6 percent) belongs to channel VI, while the lowest belongs to channel III. Wholesalers had the highest gross marketing margin, accounting for 28% of the total gross marketing margin. As a result, the study indicated that that farmers need better access to flexible credit, increased bargaining power through cooperatives and made information available to them at the right time and place, modern farming technologies, and adult and formal education.

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Introduction

Agriculture is the lifeblood of Ethiopia's development and long-term food security. The donations are substantial, accounting for 9 to 15% of the Ethiopian government's spending. Agriculture accounts for 33.3 percent of GDP and 72.7 percent of total employment in the country. About 80% of export revenues are generated by the sector, which also supplies 70% of the country's raw material requirements for industries. Despite significant advances, securing commercialized production remains one of the biggest difficulties confronting millions of people (William and Robinson, 1990)

Maize is a key component of Ethiopia's food security. When compared to wheat and teff, it is the cheapest source of cereal calories, offering 3/2 times and two times the calories per dollar, respectively. Ethiopia's food production might be pushed to fast eliminate the national food gap and keep up with a growing population if the maize industry is effective (Asrat, 2010)

Maize is the most widely grown grain crop in Ethiopia, with 11.5 million homeowners cultivating it. The overall cultivated land share is 17.68 percent, and 96.4 million quintals are generated from total cereal output. Maize production accounts for 28.75 percent of total cereal production. Wheat is cultivated by 4.5 million homeowners, with a total cultivated land share of 13.91 percent and 53.1 million quintals produced from total cereal output. Wheat production accounts for 15.86 percent of overall cereal production. Teff is cultivated by 7.15 million homeowners, with a total cultivated land share of 24.11 percent and 57.4 million quintals produced from total grain production, with Teff accounting for 17.11 percent. And also 5 million homeowners farm sorghum, which accounts for 14.21% of total cultivated land, and 52.7 million quintals are generated from total cereal production, with sorghum accounting for 15.71 percent (CSA, 2009)

Agriculture is the backbone of the regional economy in the SNNPR, accounting for 43.2 percent of regional GDP and more than 80% of total employment (BoFED, 2020). Cereals were grown on around 1,148,320.13 hectares of land in the region, with an estimated production of 31,021,133.07 million quintals (CSA.2020). According to report by the SNNPR, maize, teff, wheat, sorghum, finger millet, and barley are the most commonly produced cereal crops (Backman and Davidson, 1962).

In the Siltie Zone, the Department of Agriculture is the most important economic sector. The performance of peasant agriculture is crucial not only for creating fake effective demand, but also for achieving food security goals, foreign exchange demands, basic needs, and growing employment prospects. Farmers in the zone use a variety of farming methods to enhance productivity per unit area. The most common double cropping systems are intercropping, relay cropping, and rotation. Maize, Teff, wheat, barely, legumes, and Enset (false banana), potatoes, fruits, and vegetables are among the major crops grown in the zone. In 2017/18, the zone's food crop output was predicted to be 24,760,116 quintals, with a total area covered of 196,890 hectares (SFEDSA, 2018)

Maize, which has a total cultivated land share of 32951 hectare and produces 2.4 million quintals, wheat, which has a total cultivated land share of 35,338 hectare and produces 2.02 million quintals, and teff, which has a total cultivated land share of 12,995 hectare and produces 301,393 quintals from the total cereal production, are the major grain crops grown in the Siltie(Abate, 2018)

Researches exist regarding maize in different part of Ethiopia especially in reference to its production and marketing. For example (Hobbs *et al.*, 2000) Market Chain Analysis of Maize (*Zea mays*) in South Omo Zone by utilizing statistical analysis and econometric model (Logit model) were utilized to analyze the data (Erge, 2016) used descriptive statistics and the Tobit model to analyze the value chain of maize in the BakoTibe and GobuSayo districts in central west Ethiopia. Shahidur (Kusse *et al.*, 2019) Maize Value Chain in Ethiopia Using Structure, Conduct, and Performance of Market Structure. The survey

comprises five key maize producing zones in Oromia West Wollega and West Shewa, Amhara West Gojjiam and Awi, and SNNP Seltie (Abate *et al*., 2015).

Other items include (Yarnell, 2008), Analysis of Teff Value Chain in Bacho and Dawo Districts of South West Shewa using descriptive statistics. (Young, 2015) Using descriptive statistics and 2SLS estimation methodologies for estimation, he examined the wheat value chain in the Sinana District, Bale Zone, in Oromia Region. And also (Brunswick, 2016) Market Chain Analysis of Teff the Case of Dejen District, East Gojam Zone, Amhara Regional State, by using descriptive statistics and double hurdle model.

In the instance of the Siltie Zone, (Layton, 2015) study only looks at the Structure, Conduct, and Performance of the maize market structure, rather than factors impacting marketable maize supply, market participation choice, and maize marketing channels in detail. Even if the Zone is one of the SNNPR's potential maize producer Zones, it may not be able to meet the required level of maize market participation. This is related to production and marketing issues, a lack of institutional services, and agricultural input shortages.

The present system in studies of such types of manufacturing and marketing difficulties is said to be market chain analysis. The system will be analyzed in terms of maize market structure, conduct, and performance, with product and geographical specificity in mind, to identify the obstacles and come up with detailed possible remedies. As a result, this study has sought to contribute to filling the knowledge gap by evaluating maize marketing channels, analyzing marketing effectiveness of maize market, factors impacting amount supply maize, and market participation choice in Siltie Zone.

Material and methods

The administration of the Siltie zone is one of the 14 administrative zones found in the SNNPRS, which covers a total size of 2786.09 square kilometers. It is roughly located between 7.43 and 8.10 degrees north latitude and 37.86 and 38.53 degrees longitude. It shares borders with Hadiya Zone in the south, North West-Gurage Zone in the north, East Oromia Region in the east, and Halaba Zone in the south-east. Daloca, Silete, East Silete, Lanfuro, Sankura, West Azrnetberbera, East Azernetberbera, Mito, Hulbaregworedas, Worabe town administration, Tora town administration, and Kibet town administration are among the ten woredas and three town administrations in the zone. Worabe, the zone's capital, is located on the main road between Addis Ababa and Hosanna, and is only 172 kilometers from Addis Ababa (Branson *et al*., 1983).

According to Ethiopia's 2007 Population and Housing Census, the population of the zone in 2010 E.C. was around 1,048, 686, with 49 percent males and 51 percent females. In terms of settlement, 87 percent and 13 percent of the population respectively live in rural and urban regions. The Siltie zone is one of the region's primary zones, featuring huge plains, mountainous areas, and plateaus. In terms of climate, the zone has two distinct agro-climatic conditions: high land (DEGA) and temperate (WEYNA-DEGA), which account for 20.5 percent and 79.5 percent of the total area, respectively. The average temperature is between 12 and 26 degrees Celsius, while the average annual rainfall is between 780 and 1818 millimeters. Agriculture employs approximately 95.5 percent of the population. According to the 2010 E.C. Zonal sector and worades reports, the zone has 29 urban and 183 rural kebales (Dessie *et al*., 2019).

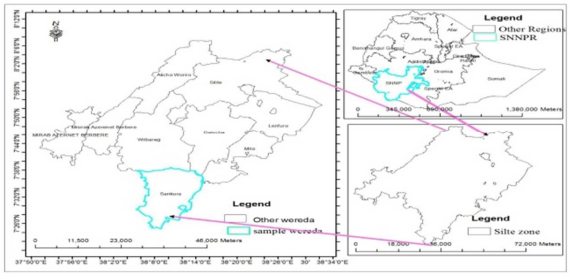

Fig. 1. Study area map

Sampling of maize producers

A multi-stage sampling technique would be used in the research. Sankuraworeda selected specifically based on the zone's maize production potential in the first step. In the second stage, four participant kebeles

(Getemziko, Menzoseyato, Getemgurbaya, and Jejebichoseyato) make purposeful selections based on the woreda's secondary data and consultation with woreda office experts. Secondary data is gathered from the agriculture offices of the Zone and Woreda, as well as the commerce and industry office. The number of sample households is calculated based on the fraction of total households living in each Kebele.

Finally, according to population size, the (Kotler, 2005) algorithm was used to choose appropriate numbers of sample farmers from four kebeles. The required sample size at 95 percent confidence level with a 5 percent degree of variability is in order to obtain a sample size that represents a true population.

$$n = \frac{N}{1 + N(e^2)}$$

Where, n = sample size, N= Population size and e = level of precision assumed 5%.

$$n = \frac{1958}{1 + 1958(0.05^2)}$$

$$n = \frac{1958}{13.5312} = 144.7 \cong 148$$

Questioner and interviews are conducted by socioeconomics examiners to collect data on household socioeconomics and demographic characteristics, farm information, production, marketing, and market access, information service, market structure, conduct, and performance, market actors, price determination, maize production and marketing, marketing channels, challenges and opportunities of maize production and marketing, production and marketing of maize. Descriptive statistics and econometric analysis are used to analyze the data.

Data analysis

The Structure, Conduct, and Performance (SCP) model is a model that investigates the underlying links between market structure, conduct, and performance (FAO, 2011) This model was used to assess Teff (Kusse *et al.*, 2005), and assess the maize market. This model was also used to assess the Teff and wheat markets. The SCP model would also use to examine the maize market in this study.

One method of assessing market performance is to use marketing margin. The market margin is the difference between the price customers pay and the price producers receive. Margins can be determined at each point along the market chain, and each margin represents the value added at that point. The ultimate price of the produce paid by end customers less farmers' price divided by consumers' price is the total gross marketing margin (TGMM), which is stated as a percentage (Begna, 2015)

TGMM = (Pc-Pp)/Pc*100% ---------- (1)

TGMM stands for total gross marketing margin. Pc stands for consumer (or ultimate) price, while Pp stands for producer price.

It's a good idea to teach the concept of the "farmer's part," or "Producer's Gross Margin," which is the portion of the consumer's price that goes to the producer. The margin of the producer is computed as follows:

GMp = (pc-TGMM)/PC* 100% ---------- (2)

Where, GMp is the producer's share in consumer price

After marketing expenditures are removed, the Net Marketing Margin (NMM) is the proportion of the final price generated by the intermediaries as net income. Marketing costs should be closer to transfer costs in an effective marketing system, and the net margin should be close to normal or tolerable profit.

NMM = (TGMM-MC)/Pc*100%---------- (3)

Where, NMM is net marketing margin MC is marketing cost

TGMM = (Retelling price-Farm gate price)/ (retiling or consuming price)

GMM_i = (selling price of $_i$- purchasing price of $_i$)/ (retiling or consumer price)

$NMM_i = GMM_i - TMC$

We have a sample of size n from this population, according to (Koha, 1985), but there's a problem: it wasn't chosen randomly, and hence is unlikely to be representative of the population. The Heckman selection model was employed in order to organize the selectivity bias and endogeneity problem; and obtain consistent and unbiased parameter estimates. The result from the Table 2 shows that market

participation decision and quantity supplies of maize was highly correlated (rho is positive and greater than 0.65). The result confirms that the two processes are highly interdependent such that, market participation decision and quantity supplies of maize are interrelated and estimating them separately gives biased estimation results. The hypothesized variables that were assumed to influence marketable supply were: Sex of the household head, level of education, family size, age of household head, credit used for maize production, number of oxen owned, frequency of extension contact, lagged price, distance to nearest market, yield, non-farm income, land allocated for maize, and fertilizer used for maize.

The usual measure of Multicollinarity among continuous and dummy variables is Variance Inflation Factor (VIF). Depending on the results of variance inflation factor multicollinarity was not problem among the hypothesized continuous and dummy variables. Hence, multicollinearity and heteroscedasticity detection test were performed using appropriate test statistics.

As stated in the aims section above, this study has four goals. Heckman two-stage selection models are used to achieve the two goals. The model allowed the researchers to look into the factors that influence maize market supplies, as well as compare market participation versus non-participation. This "Ordinary Least Square" method is used to determine the intensity of use. The probit model is employed in the Hackman. In the probit model, households are expected to make decisions with the goal of maximizing utility. Separate models are constructed for each decision for a particular decision. The underlying utility function is determined by household-specific parameters X (e.g., household head's age, sex, education, participation in an agricultural association, credit availability, etc.) and a disturbance term with a zero means:

$U_{1i}(X) = \beta_1 X_i + e_{i1}$ for participant (4)

And $U_{oi}(X) = \beta_o X_i + e_{io}$ for non- participant (5)

Because utility is a random variable, the i^{th} family chose the alternative "maize market participant" if and only if U1i > Uoi. As a result, the likelihood of a maize market participant for household I is given by:

$P(1) = p(\varepsilon_{1i} > \varepsilon_{oi})$ (6)

$P(1) = P(\beta_1 X_i + \varepsilon_{i1} > \beta_o X_i + \varepsilon_{io})$ (7)

$P(1) = P(\varepsilon_{io} - e_{i1} < \beta_1 X_i - \beta_o X_i)$ (8)

$P(1) = P(\varepsilon_i < \beta X_i)$ (9)

$P(1) = \Phi(\beta X_i)$ (10)

Where Φ is the cumulative distribution function of the standard normal distribution. The parameters β are estimated by maximum likelihood x′ are a vector of exogenous variables that explains market participation of maize. In the case of normal distribution function, the model to estimate the probability of observing farmer market participation of maize can be stated as:

$$P(Y_i = 1/x) = \Phi(x'\beta) = \int_{-\infty}^{x'\beta} \frac{1}{\sqrt{2\pi}} \exp\left(\frac{-z2}{2}\right) dz \quad (11)$$

Where

P is the probability that the i^{th} household used the market participation of maize and 0, otherwise.

Y_i Farmer market participation decision which takes the value of 1 if he is market participant of maize and 0, otherwise

On both market participant and non-market participant of maize, the chance of being a market participant of maize is calculated using a probit maximum likelihood function. The following selection model is used to model the i^{th} household's choice of maize market participant:

$Y^* = x'\beta + \varepsilon$ (12)

Where Y^* is an unobserved latent variable determining a household's decision to use market participant of maize, β is a vector of farm households' asset endowments, household characteristics and location variable hypothesized to affect the market participant of maize decision, and ε is the random disturbance term distributed with mean 0 and variance 1. The observed binary variable will be:

Y = 1 if $Y* > 0$, (for market participant of maize)

Y = 0 if $Y* \leq 0$, (for non- market participant of maize) (13)

From the Probit equation the inverse of the Mill's ratio, LAMBDA (λ), which is the ratio of the ordinate of a standard normal to the tail area of the distribution, can be computed (Heckman, 1980). The Mill's ratio reflects the probability that an observation belongs to the selected sample and is obtained as follows:

$$\hat{\lambda}=\frac{\varphi(Xi\hat{\alpha})}{\Phi(Xi\hat{\alpha})} \quad (14)$$

Where: φis the density function of a standard normal variable, Φis the cumulative distribution function of a standard normal distribution and λ is the Mills ratio term.

In the second step, λ is included as an additional variable in the outcome equation for market participation of maize - using households. This technique eliminates the potential sample selection bias. If λ is not statistically significant, then sample selection bias is not a problem (Equation *et al.*, 1979). The regression equation for the market participation of maize is given by

$$Yi=\beta_1+\beta_2 w+\beta_3\hat{\lambda}+\xi_i \quad (15)$$

Where: Y is defined as the market participation of maize, W is a vector of farm households' asset endowments, household characteristics and location variable affecting of market participation of maize, ξ is the new residual with the property that E(ξ) = 0

As mentioned earlier, OLS is used for the objective that deals with intensity of market supplies of maize. The model for the intensity of market supplies of maize is given bellow.

Y=f (sexhh, educ, famsz, cred, noxw, frqexct, dsnmar, agehh, Yield, laprmz, nfainc, lalfrmz, feusmz, ei)--(16)

To identify factors affecting maize supply to the market and the sales income from market supplies of maize that actors involved in the marketing of the crop, the following variables were assumed to affect dependent variables and used for this study.

Quantity of maize supplied to the market (mzspmr)

It is dependent variable which represents the amount of maize actually supplied to the market by household in the year 2019/20 which is measured in quintals.

Market participation (maprt)

It is dummy dependent variable which represents the participation of households in maize marketing in the analysis year. 1=if the household is participated and 0= if not participated

Sex of the household head (sexhh)

It is a dummy variable taking 1 for male and 0 for female maize farmers. Male-headed households have access to productive assets such as land, labor and capital which increases their production capabilities and hence, expected to have a positive relationship with quantity supplies. (Mahamud, 2016) found sex of household head positively affected Teff market supplies. The result showed that being male household head increases the probability of market participation of the sample participant due to the reason that men contribute more labor input in the production of crops.

Level of education (educ)

Is a categorical variable, which represents education level of households, expected to have a positive relationship with marketable supply. The finding of (Abbot *et al.*, 1981) showed that education level of household head affected marketed surplus of honey positively. This is because producers who have higher education level have better attitudes towards the new production technologies, input utilization, to actively being beneficiaries of services provided to them. Additionally, it is due to the fact that as the educational level of farmers increased, farmers" ability to get, process and use information for their market supply also increases.

Family size (famsiz)

It is a continuous variable, measured in numbers of the household members. When the number of household members increased more part of wheat produce will be allocated for household consumption. There is also another argument which is man equivalent; households with higher family labor supply are more likely to grow output. Because of the above grounds family size is expected to have negative or positive impact on maize market participation and quantity supply of maize.

Age of household head (agehh)

It is a continuous variable and measured in years. This may be the fact that age is an alternative measure of farming experience of household. Aged households are believed to be wise in resource use, and it is expected to have a positive effect on marketable supply.

Credit used for maize production (cred)

It is a dummy variable which represents the 1for Yes households were borrow from credit institutions for maize production and 0 for No households were not borrow from credit institutions for maize production. For small-scale farmers, access to credit is believed to play important role in increasing the market participation and quantity supply. Consistent with this, (Taffesse etal, 2011) found the amount of credit to have positive and significant influence on volume of wheat marketed.

Number of oxen owned (noxw)

Is a continuous independent variable indicating total oxen holding of the household? According to (NBE, 2019), number of oxen owned by household head influenced the farmers" decision to participate in quantity of grain supply positively. This is because of the facts that as farmers have more and more number of oxen; they can easily cultivate the maize land intensively/extensively, which increases the production of maize there by increasing the market participation decision and quantity of maize sold.

Frequency of extension contact (frqexc)

It is a continuous variable measured in number. It is expected that extension service extends the household's knowledge with regard to the use of improved maize production technologies and has positive impact on maize market participation decision. (Temesgen *et al.*, 2017) found frequency of extension contact positively influenced participation decision of framers in marketed supply of mango. (Negash, 2010) extension contact positively influenced participation decision of framers in marketed supply of Teff. This suggests that access to extension service avails information regarding technology which improves production that affects market participation decision of households. Therefore, an extension service was expected to be associated with higher market participation and quantity supply positively. Yarnell (2008) indicated that access to extension service was positively and significantly related to the quantity of maize supplied to the market.

Distance to nearest market (dsnmr)

It is a continuous variable and is measured in kilometers. (Young, 2015) the distances from the main market influence households in buying inputs and selling outputs. The closer the market place to farm gate, the lesser would be the transportation costs, transaction costs, time, and more access to market information. Therefore, the time taken to market negatively affected quantity supplies and market participation.

Yield (q/ha)

It is a continuous variable measured in quintal per hectare and expects to affect maize market participation and quantity supply positively. Farmers who produce higher output per hectare expected to supply more to the market than those with the lower output per hectare of land. According to (IFPRI, 2011), productivity of maize affected intensity of maize marketed positively and significantly and (Rahnama, 2013) productivity of teff affected intensity of teff marketed positively and significantly. It indicates that households who produce more quantity of teff had also supplied more to the market.

Lagged price of maize (laprmz) (2019/20)

It is a continuous variable measured in Ethiopian birr per quintal. It is expects to affect maize market participation positively, because prices stimulate volume of maize marketed. If the current market prices are low producers will not interested to sell maize then intensity of maize participation will decrease until the price rises. According to (Holloway, 2002) Producers are sensitive to market price. When the selling price increased from the prevailing market price, they are encouraged to supply more to the market.

Non-farm income (nfainc)

It is a dummy variable measured 1 for Yes the households' haves non-farm income and 0 for No the households not have non-farm income. It is expects to affect maize market participation and market supply negatively, because prices stimulate volume of maize markets. The findings of (Awoke and Molla, 2019) showed that non-farm income negatively affected the supply of maize to the market. This may be due to the fact that households who generate more income from nonfarm activities, tends to sell less and increase family food consumption.

Land allocated for maize (lalfrmz)

It is a continuous variable measured in hectares. It is expects to affect maize market participation and market supply positively. The more the allocation of land for maize, the more increase in production (Nitsuh, 2019). This in turn increased the volume of marketable supply**.** The result showed that the more the land is allocated for maize, the higher the production that in turn increased marketed supply of maize.

Amount fertilizer used for maize (feusmz)

It is a continuous variable measured in kilograms per hectares. It is expects to affect intensity of maize market participation and market supply positively. According to (Mendoza, 1995) the rate of fertilizers used for maize production has significant and positive effect on the yield. The result showed that use of fertilizers had significant and positive effect on marketed supply of maize.

Results and discussion

In this parte factors affecting quantity supplied of maize to market and market participation decision of producers are obtainable and discussed.

Determinants of maize quantity Supply to the market

Factors that determine supply of maize to the market was estimated using Heckman selection model (Table 1).

Table 1. Heckman two steps selection model result determinants of quantity supplies of maize

Variables	Coefficients	Std. Err	z	p > |z|
mzspmr	quantity supplies of maize			
Sex of the household	-0.5159163	0.5530717	-0.93	0.351
Level of education	0.2718526	0.3044335	0.89	0.372
Family size	-0.0526533	0.0940358	-0.56	0.576
Age of household	-0.0155936	0.0156663	-1.00	0.320
Credit used for maize production	0.0905048	0.4843496	0.19	0.852
Number of oxen owned	0.3954163	0.294985	1.34	0.180
Frequency of extension contact	0.0260253	0.1777051	0.15	0.884
Distance to nearest market	-0.7212353***	0.1411512	-5.11	0.000
Yield	0.0816031*	0.0493453	1.65	0.098
Lagged price of maize	-0.0004321	0.0012166	-0.36	0.722
Non-farm income	-1.419148***	0.515064	-2.76	0.006
Land allocation for maize	2.016531***	0.4879603	4.13	0.000
Amount fertilizer used for maize	0.0722728***	0.0097648	7.40	0.000

***, ** and * significant at less than 1%, 5% and 10% significance level respectively
Source: survey data result

Distance to nearest market

It is a continuous variable measured in kilometer. It affects quantity of maize supplied to market negatively and significantly at 1% levels of significance. As distance to nearest market increased by one kilometer the amount of maize supplied to market is decreased by 0.72 quintal. Raymon (2003) found that distance to nearest market of maize affected intensity of maize marketed supply negatively and significantly.

Yield

It is a continuous variable measured in quintal per hectare in 2019/20 production season in the study area. Accordingly the result indicated that quantity of maize produced per hectare affects market supply positively and significantly at 10% probability level. Maize produced per hectare increased by one quintal the amount of maize supplied to market is increased by 0.08 quintal. Similar study of (Scott, 1995) productivity of maize affected intensity of maize marketed positively and significantly.

Non-farm income

It is a dummy variable measured 1 for the households' haves non-farm income and 0 for the households not have non-farm income. Accordingly the result indicated that non-farm income affects market supply negatively and significantly at 1% significant level. A household having non-farm income decrease quantity supplies of maize by 1.4 quintal. Similar, to other study showed that non-farm income negatively affected the supply of maize to the market. This is due to the fact that households, who generate more income from nonfarm activities, use these incomes to purchase inputs, to pay tax and other expanses tends to sell less maize and increase family food consumption.

Land allocation for maize

It is continues variable measured in hectares. Accordingly the result indicated that land allocation for maize affects market supply positively and significantly at 1% significant level. Land allocation for maize increased by one hectare the amount of maize supplied to market is increased by 2.01 quintal. Related, to other study of the more the allocation of land for maize, the more increase in production and more quantity supplies to the market. This is due to the fact that, the result showed that the more the land is allocated for maize, the higher the production that in turn increased marketed supply of maize

Amount fertilizer used for maize

It is a continues variable measured in kilogram. Accordingly the result indicated that the amount fertilizer used for production of maize affects market supply positively and significantly at 1% significant level. Amount fertilizer used for maize increased by one kilogram the amount of maize supplied to market is increased by 0.07 quintal. This is due to the fact that, the result showed that the more the amount fertilizer used for maize, the higher the production that in turn increased marketed supply of maize.

Table 2. Heckman two step**s** selection model determinants of maize market participation

Variables	Coefficients	Std.Err	Marginal effect	p > |z|
maprt	market participation			
Level of education	1.25433**	0.518043	.0604837	0.015
Family size	0.1166467	0.1073782	.0056247	0.277
Age of household	0.001807	0.0184288	.0000871	0.922
Credit used for maize production	-0.916944	0.5861004	-.0801474	0.118
Number of oxen owned	-0.1273027	0.2739682	-.0061385	0.642
Frequency of extension contact	-0.1152577	0.1886966	-.0055577	0.541
Distance to nearest market	-0.1274433	0.1561749	-.0061453	0.414
Yield	0.1066966	0.0655494	.0051449	0.104
Lagged price of maize	0.0011032	0.001567	.0000532	0.481
Non-farm income	-1.06691***	0.3712489	.0967781	0.004
Land allocation for maize	0.2360321	0.5616902	.0113815	0.674
Amount fertilizer used for maize	0.025708**	0.0122036	.0012396	0.035
Constant	-5.226564	2.622952		0.046
Mills lambda	1.636532*	0.9006152		0.069
rho	0.86922	Number of observation	148	
sigma	1.8827512	Censored observation	23	
Wald chi2(13)	1573.43	Uncensored observation	125	
Prob> chi2	0.0000			

Factors affecting market participation of maize in study area

The model analysis output of maize market participation decision result has been summarized in the Table 2 below. In the first stage, households decide whether they would sell the commodities in to market or not. Based on the Hackman's selection assumption Out of thirteen explanatory variables, three of them were found to determine the participation decision in maize market. These are level of education, amount fertilizer used for maize, and non-farm income. The summarized results of the model are given below.

Educational level

Educational levels of the household head have a significant and positive effect on the participation of maize market at 5% level of significance. The marginal effect of this variable revealed that literacy increased headed household would increase the

likelihood of maize market participation by 6.04%.Formal education determines the readiness to accept new ideas and innovations, and easy to get supply, demand and price information and this enhances farmers‟ decision to produce more and increase volume of sales. The result is in line with the finding of (Thomas and Gupta, 2005) showed that education level of household head affected marketed surplus of honey positively.

Amount fertilizer used for production of maize

Amount fertilizer used has a significant and positive effect on the participation of maize market at 5% level of significance. The marginal effect of this variable revealed that one kilogram the amount of fertilizer used would increase the likelihood of maize market participation by 1.22%.The result is in link with the finding of (Mango *et al*., 2018) the rate of fertilizers used for maize production has significant and positive effect on the yield and market participation.

Non-farm income

Having non-farm income has a significant and negative effect on the participation of maize market at 1% level of significance. The marginal effect of this variable revealed that the household head have non-frame income would decrease the likelihood of maize market participation by 37.1%. Similar to the study (Brunswick, 2016) showed that non-farm income negatively affected the supply of maize to the market.

Mills (lambda)

It is additional variable of selection equation of market participation at the *p*-value of 0.069 significant at less than 10% levels of significance these shows that market participation decision and quantity supple of maize are sample selection problem, to solve these problems Heckman two step modal is appropriate. According to Heckman If λ is not statistically significant, then sample selection bias is not a problem (IFPRI, 2012).

Conclusion

Maize market performance in study was analyzed using the structure-conduct-performance approach. The structure of maize market in Alemegebaya and Regdinamazoriya market were measured using top four largest traders concentration ratio and the result indicated that the structure of maize in CR4 32.17 for Regdinamazoriya market were week oligopoly and CR4 25.69 for Alemegebaya competitive market .

Factors affecting market participation of maize the result shows that educational levels of the household head have a significant and positive effect on the participation of maize market at 5% .level of significance, amount fertilizer used has a significant and positive effect on the participation of maize market at 5% level of significance, having non-farm income has a significant and negative effect on the participation of maize market at 1% level of significance and Mills (lambda) also at the p-value of 0.069 significant at less than 10% levels of significance. The structure of maize market in the Alemegebaya CR4 shows competitive but briers to entry and Regdinamazoriya market is week oligopolistic and the conduct of the market deviated from competitive market norms. As the result the market performance in the study area is inefficient. Hence, there is a need to enhance maize producers bargaining power through establishment of cooperatives and resolve the barriers to entry to market so as to enable potential traders to enter into the maize market, which improve the competitiveness of the market. There is also a need of government or other stakeholder's intervention to strengthen the linkage of maize market actors through training and financial supports strengthening media's contribution on production and marketing of agricultural products. The results indicated distance to nearest market affects quantity supplies maize negatively and significantly. This may be due to the households far from the market the manse of information gating about the price not available not to supplies to the market. Therefore, there is a great need to make information available to farmers at the right time and place in response to this challenge; it is also good to develop an integrated agricultural marketing information system that will be linked to Woreda information center, and to link them to governments program.

Also improving road infrastructures can improve the delivery of maize to market place because mostly more traders were found at market places rather than in villages. Yield of maize positively and significantly affected level of maize market supplies significant. As a result, there is a need to encourage innovations such as land use increase of yield by agricultural inputs like improved maize varieties recommended fertilizer rates and pesticides appropriate agronomic recommendations can improve production and productivity of maize in the study area. And also government and non-governmental organizations supplies modern farming technologies like tractors to increase productivity of maize. Accordingly the amount fertilizer used for production of maize affects market supply and market participation positively and significantly at 1% significant level. In order to strengthen farmer's production potential, making available fertilizer at low cost credit to farmers for fertilizer purchase also needs attention. To solve shortage of fertilizer, improving farmers' knowledge in amount of fertilizer used per hectare production through training is important. Educational levels of the household head have a significant and positive effect on the participation of maize market at 5% level of significance. Formal education determines the readiness to accept new ideas and innovations, and easy to get supply, demand and price information and this enhances farmer's decision to produce more and increase volume of sales. To increases the productivity of maize and quantity supplies to the market gives adult and formal education for farmers to enhance the educational levels of the household.

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