SUPPLY AND PERFORMANCE OF COFFEE MARKETS IN GOLOLCHA DISTRICT OF OROMIA REGION, ETHIOPIA

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ABSTRACT

The objectives of the study were to identify performance of coffee market and factors affecting market supply of coffee by smallholder farmers. The data was collected through personal interviews from a total of 213 respondents. The result of Focus Group Discussion revealed coffee producers in the study area are exposed to low and volatile price. Based on two stage least squares model, we found that amount of coffee produced, sex of the household heads, educational level, family size, land allocated to coffee production and access to market information had positively and significantly influenced amount of coffee supplied to the market. Therefore, emphasis should be given on controlling illegal traders and enhancing market infrastructure, promotion of cooperatives, increasing level of coffee production and expansion of education facilities in the study area.

Introduction

Agricultural sector has been the priority of Ethiopia since the early 1990s, when the Agricultural Development-Led Industrialization (ADLI) and related policy frameworks were adopted (FAO, 2014). Share of agriculture fell to 34.9 percent in 2017/18 from 36.3 percent during the same period (National Bank of Ethiopia, 2018). Despite its declining contribution to Gross Domestic Product over the years, agriculture remains the leading sector in terms of contribution to the country's overall economy. It is a major source of food for domestic consumption, of raw materials for the domestic manufacturing industries and of primary commodities for export. Moreover, the sector contributes 73% of employment, and supplies 70% of the raw-material requirements of local industries (Admit et al., 2016).

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Ethiopia is mainly characterized by low output rain-fed mixed farming with traditional technologies. The presence of an unproductive class, lack of capital, poor infrastructure, absence of access to markets, a shortage of skilled manpower, land degradation, population pressure, culture, deforestation, tenure regimes and polices, poor land management practices and varied but interrelated natural factors could be mentioned as important factors of rural poverty (Temesgen, 2017). Agricultural production in Ethiopia remains exposed to various risks (disease outbreaks, agricultural output price volatility and uncertainty in input-output price ratios), (IFAD, 2016). The major factor for the short fall in achieving the planned level of agricultural productivity is related to the coverage and quality of implementation of the agricultural extension system (NPC, 2016).

Ethiopia is the birth of *Coffee arabica*. It is grown by over 4 million smallholder farmers and employs 15 million people or roughly 15% of the country's population at different points along the value chain (Francom, 2018). Ethiopia produces and exports one of the best highland coffees in the world (Samuel and Eva, 2008). Total earnings from goods export grew by 3% in 2018 over the same quarter of last year on account of the rise in export earnings from coffee (19.1%), oilseeds (4.9%), leather and leather products (27.7%), fruits and vegetables (16%), meat and meat products (10.1%), flower (8.1%), electricity (23.8%) and other exports (35.1%). The share of coffee in total merchandize export earnings was increased from 27.5% in 2016/17 to 31.8% in 2017/18 (NBE, 2018). The area share of coffee under all crops in the country was increased from 4.94% in 2016/17 *meher* season to 5.09% in 2017/18 *meher* season (CSA, 2018). Coffee plays a vital role in both cultural and social life of Ethiopian community. Among coffee producing countries in the world, Ethiopia is the first in consumption of coffee (Melkamu, 2015; Alemayehu, 2014).

Coffee is backbone of the Ethiopian economy. But, Ethiopia has not yet fully exploited its position as the producer of some of the best coffees in the world. Coffee production in Ethiopia is constrained by lack of competitiveness, poor access to market, lack of infrastructure, inadequate access to services, low value addition, and in adequate technology transfer and research (Jose, 2012). Coffee sector is highly dependent on international prices and affected by the structure and workings of the world coffee market. Ethiopia is one of the countries mostly affected by the crisis in world coffee prices (Nicolas, 2007). Notwithstanding the severe price shocks that have been shacking its value chain, coffee remains a fundamental component of the Ethiopian economy and export. Nevertheless, the prolonged price decline has substantially weakened its production basis and prospects so that appropriate financial services are urgently needed to sustain rural communities (Bastin, Matteucci, 2007).

Oromia is one of the largest region in Ethiopia that shares largest area coverage of the country. It is known for high production of coffee and, 489799.36 ha of land were allocated and 3101927.33 quintals was produced with average yield of 6.33 quintals/ha in 2017/18 *meher* season (CSA, 2018). From top 25 coffee producing districts in Ethiopia, Oromia dominates with 18 coffee producing districts and the remaining top coffee producing districts are located in SNNP. Arsi zone is one of the Oromia region's

zone which has potential of coffee production. In 2016/17 *meher* season, 6606.55 ha of land were allocated for coffee production (CSA, 2017). Gololcha district is found on the 14th from top 18 coffee producing districts in Oromia (James et al., 2015).

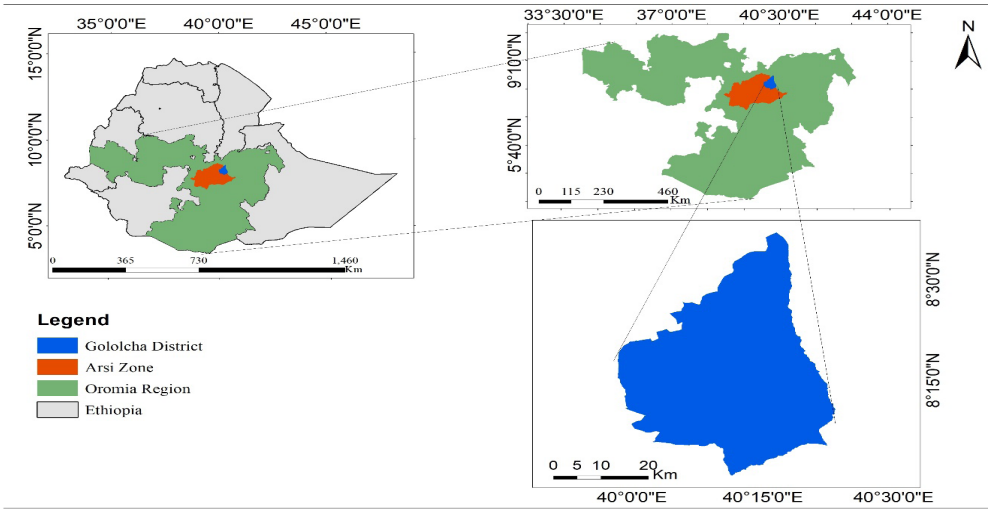
To improve coffee production and productivity in the area, development of well-performing marketing system which satisfies consumer demands with the minimum margin between producers and consumer prices is important. But, no attempt has been made to study performance of coffee marketing and determinants of market supply in the study area. The finding of the study can assist in developing improved market development strategies to benefit all stakeholders who are participating in coffee market in the study area.

Methods

Description of the Study Area

The study was conducted in Gololcha district. It is one of the districts in Arsi zone with potential of coffee production. Gololcha is located at about 281 km from Addis Ababa, the capital city of Ethiopia and 206 km from Asella, which is the capital town of Arsi zone. It is bordered by Aseko district in the north, Amigna district in the south, Shenan Kolu district in the east and Chole district in the west. The district has 23 rural *kebeles* and from this 20 *kebeles* are coffee producers. The altitude of the district ranges from 1400 to 2500 m.a.s.l. Generally, the district has a total area of 178102 hectares and is classified into two agro-ecologies, the midland and the lowland with a share of 25% and 75%, respectively. The average temperature of the district is 35^0c and the average rainfall is 900 mm/year. Total population of the district is about 201,247, of which 102,502 were males and 98,745 were females. The main rainy season of the district is in April, May, June, July, August and September. Major crops produced in the district are coffee, maize, sorghum, *teff* and groundnut (GDOoANR, 2018).

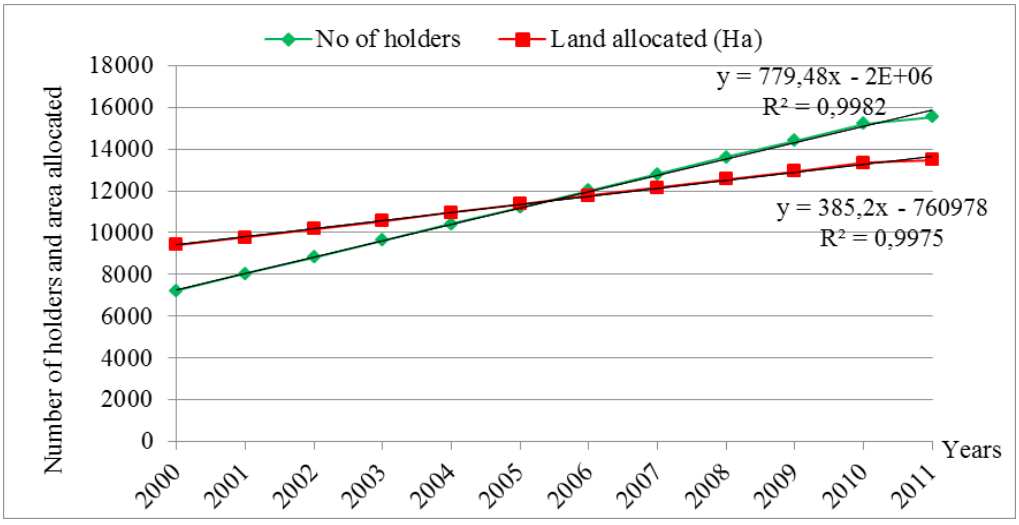
Figure 1. Geographical map of the study area



Source: Own sketch From Ethio-GIS

Trends of number of holders and area allocated: The trends of number of holders and area allocated was estimated in Figure 2 by using twelve years data taken from district coffee and tea marketing authority. The positive value of equations implied that the trend of number of holders and area allocated have increased over the last twelve years. In other words, the high values of R-square indicated that the trend line was best fit to data. Number of holders have increased from 7230 in 2000 E.C. to 15528 in 2011 E.C. This implies that the number of holders have increased by 114.77% in twelve years. Regarding land allocation, it has increased from 9417 hectares in 2000 E.C. to 13466 hectares in 2011 E.C., which indicated it has increased by 43% over the considered years.

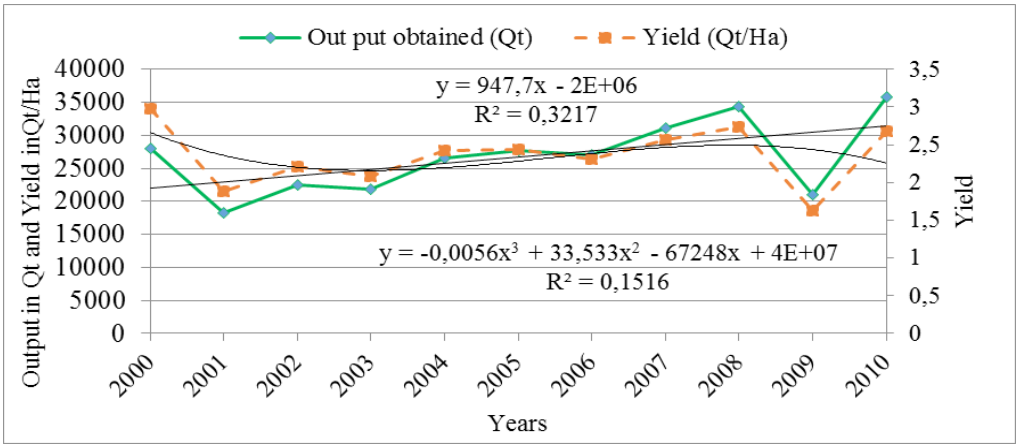
Figure 2. Trend of number of holders and area allocated in Gololcha district



Source: own computation from district data

Total output and yield of coffee in the study area: Trends of total output obtained and yield in quintal per hectare of coffee clean been (green been) were estimated in Figure 3. The positive value of trend of output indicated that output has increased over the last eleven years and the negative value of trend of yield implied that yield has declined over the considered eleven years. The low value of r-square implies that the trend line of yield and output did not fit the data or there was high variation of output and yield over the past eleven years. Figure 3 also indicated that yield per hectare was 2.68 quintal in 2018 which is below national average. The national average reported by CSA (2018) was 6.19 quintals per hectare.

Figure 3. Trend of number of output and yield obtained in Gololcha district



Source: Own computation from district data

Sources and Methods of Data Collection

The study has used both primary and secondary data sources. Primary data was collected from sample respondents by using a structured interview schedule. Before data collection, the questionnaire was tested on some farmers to evaluate the appropriateness of the design, clarity and interpretation of the questions, relevance of the questions, to make sure important issues have not been left out and to estimate time required for an interview. Training was given for enumerators regarding the objectives of the study and particularly on the detailed contents of the questionnaire.

Secondary data on population size of the study areas, lists of coffee producers and traders, and agro-climatic condition of the study area were taken from unpublished documents of district agricultural and natural resource office, and coffee and tea development and marketing authority.

Sample Size and Sampling Procedures

Two stage random sampling technique was used to select coffee producing *Kebeles* and sample farm households. In the first stage, 4 coffee producing *Kebeles* were selected purposively from 20 coffee producing *kebeles*. In the second stage, from the total coffee producers, 154 household heads were selected randomly based on probability proportional to population size.

In addition to farm households, 17 wholesalers, 5 agent middle-men, 11 coffee boilers and 26 consumers were selected purposively. Wholesalers were selected based on their total amount purchase per year by depending on the data taken from the district and from total 22 licensed wholesalers in the district, the largest 17 traders were interviewed. Agent middlemen were selected depending on their availability to obtain information related to them.

Method of Data Analysis

Both descriptive statistics and econometric analysis were used

Descriptive Statistical Analysis

Descriptive statistics such as mean, maximum, minimum, standard deviation, frequencies, percentages, graphs and Garrett's ranking technique were used.

Ranking of constraints (Garrett's ranking)

Production and marketing constraints of producers, and marketing constraints of traders in selling and buying were prioritized by using Garrett's ranking technique. Following Nirmala and Suhasini (2013), percent position can be specified as the follows;

$$\text{Percent position} = \frac{100\left(R_{ij} - 0.5\right)}{N_j} \quad (1)$$

Where; R_{ij} = is the rank given by i^{th} item by j^{th} individual.

N_j = is the number of items ranked by j^{th} individual.

By using Garrett's table, percent position of each rank was converted into scores. Then, for each constraint, scores of individual respondents were added together and divided by total number of respondents.

Econometric Models

Factors affecting market supply: One of the assumptions of classical liner regression model is the exogeniety of the independent variables, i.e., $\mathrm{E}\left[\varepsilon^{i} / x_{j1}, x_{j2}, \cdots x_{jk}\right] = 0.$ This states that the expected value of the disturbance at observation i in the sample is not a function of the independent variables observed at any observation. This means that the independent variables will not carry useful information for prediction of ε^{i} (Greene, 2008). In this condition, the classical OLS method may not be applied because the estimators thus obtained are not consistent, that is, they do not converge to their true population values no matter how large the sample size (Gujarati, 2003). The method of instrumental variables (IV) provides a general solution to the problem of an endogenous explanatory variable (Wooldridge, 2002). To use IVLS, we must find an instrumental variable, namely, a random variable z ; that is statistically independent of the error term (Dunning, 2008). Number of coffee mother trees owned and level of fertilizer applied were used as instrumental variables. Following Wooldridge (2010), as the name indicates, the method involves two successive applications of OLS and specified as the following;

Stage 1: Obtain the fitted values $\hat{X}k$ from the regression

$$x_k = \alpha_o + \alpha_1 x_{1i} + \alpha_2 x_{2i} + \ldots + \alpha_{k-1} x_{k-1i} + \gamma_1 z_{1i} + \gamma_2 z_{2i} + u_i \quad (2)$$

Where; x_k = is level of output produced (endogenous variable)

α_o = is constant
X = is a vector of explanatory variables
Z = is a vector of instrumental variables (level of fertilizers and number of mother coffee trees owned).
U = is known as a random, or stochastic, error term and

The subscript i denotes i^{th} observation.

Stage 2: Run the OLS regression

$$Y_i = \alpha_o + \alpha_1 x_{1i} + \alpha_2 x_{2i} + \ldots + \alpha_{k-1} x_{k-1i} + \hat{K} + u_i \quad (3)$$

Where; Y_i = is amount of coffee sold (ln)

α_o = is constant
X = is a vector of explanatory variables (SEXHH, EDHH, AREACOFE, QUANP, FARMEX, DMRKT, FEXCONT, TROWR, NONFRM and INFO).

$\hat{X}k$ = is level of outputhat,
U = is known as a random, or stochastic, error term and

The subscript i denotes i^{th} observation.

Results and discussion

Performance of Coffee Market in the Study Area

To determine market performance, marketing margin and associated marketing costs has been used and discussed as below.

Production cost of coffee in ETB/ha in the study area: Production cost and output obtained has been estimated by averaging production cost and output harvested by sampled households. As it is illustrated from Table 1, total annual production cost of households was 20012.03 ETB per hectare. Opportunity cost of land was estimated by annual market price (rental value) of one hectare in the area and it accounted for 59.96% of total production cost followed by harvesting cost (14.99%), cultivation cost (12.45%) and fertilizer cost (9.99%). Fertilizer cost was estimated by market price for inorganic, and cost of preparation and application for organic fertilizers.

Table 1. Estimated dry coffee cherries production cost (ETB per hectare) and output obtained (Kg per hectare) in 2017/18 production year in the district

No	Activities	Cost (ETB)	%Share of total cost
1	Cultivation cost (ha)	2492.32	12.45
3	Fertilizers cost (ha)	2000.00	9.99
4	Harvesting cost (ha)	3000.00	14.99
6	Tax (ha) (annual tax)	219.71	1.10
7	Opportunity cost of land (ha)/year	12000.00	59.96
Total estimated annual production cost in ETB/ha		20012.03	100.00
8	Average output in kg/ha (with husk)	912.6	
9	Total revenue (output * average price)/ha	35646.16	
10	Profit/ha in ETB	15634.13	

Source: Own survey

Marketing cost and profit: Marketing costs per kilogram in moving coffee bean from farm to the final market for different coffee marketing actors was estimated in the Table 2. Highest marketing cost was incurred by wholesalers. This was because, wholesalers were supplying coffee to the auction (ECX) market. The highest cost incurred by wholesalers was payment at ECX which was 43.55% of total cost. Wholesalers paid 16500 ETB per trip or per 51 quintals on average which includes tax payment to ECX (2%) from total sale, payment to commission men (1.75%) from total sale and 0.4 ETB per quintal per day for storage. All these costs accounted for 16500 ETB per 51 quintals on average. Transportation cost accounted for 26.34% of total marketing cost next to total payment at ECX market. It costs 10000 ETB per 51 quintals from Gololcha to Dire Dawa market. The other costs were cost of hulling (0.4 ETB per kg of dry cherries), sisal sack cost (0.5 ETB per kg of dry cherries) and load unload, filling cost, storage rent (opportunity cost if owned), broker cost and other costs accounted for 0.06, 0.03, 0.01, 0.01 and 0.08 ETB per kg of dry cherries, respectively. Municipality tax is tax paid at district and was 350 ETB birr per 51 quintals of green bean. Other costs include the estimate of personal payments made at different points in shifting the product from farmers to EXC market. High marketing cost for producers was transportation cost which was 35.71%, followed by sack cost (24.29%), load/unload cost (24.29%), and cost of drying and filling (10%). Similar to farmers, high proportion of marketing cost for agent middle-men was transportation cost which was 40.85% (Table 2)

Table 2. Marketing cost in birr per kg of dry coffee cherries for coffee market actors in the study area

No	**List of costs per kg**	**Farmers**	**Wholesalers**	**Brokers**	**Cooperatives**
1	Production cost	21.93	-	-	
2	Sack	0.17	0.5	-	0.5
3	Load/unload	0.17	0.06	0.16	0.06
4	Filling cost	0.07	0.03	0.06	0.03

No	List of costs per kg	Farmers	Wholesalers	Brokers	Cooperatives
5	Transportation cost	0.25	0.98	0.29	0.98
6	Storage rent		0.01		0.01
7	Broker		0.01		0.01
8	Municipality tax		0.03		
9	Hulling cost		0.4		0.4
10	ECX		1.62		
14	Other costs	0.05	0.08	0.2	0.16
15	Marketing cost	0.7	3.72	0.71	2.15
16	Average buying price per kg	-	39	37	40
17	Average selling price per kg	39.06	47	39	48
18	Total cost per kg	22.63	42.72	37.71	42.15
19	Market profit per kg	16.43	4.28	1.29	5.85

Source: Own survey

Production Constraints of Coffee in the Study Area

Data taken from District Coffee and Tea Development and Marketing Authority indicated that yield per hectare of clean bean was 2.68 quintals which is below national average. The yield per hectare of green bean reported by CSA (2018) was 6.19 quintals per hectare. The result from Table 3 depicted the problem of coffee production listed and prioritized by focus group discussion at four *kebeles*. According to the result, drought, diseases, lack of improved coffee varieties, lack of extension and technical support, lack of scientific research on appropriate shade, insect infestation and lack of post-harvest materials were major problems of coffee production in the study area.

Drought: Drought was a great challenge of coffee production in the study area. According to the result from focus group discussion, the new transplanted coffee seedlings are not surviving because of drought and the existing coffee mother trees on farm field are old. Additionally, coffee yield declines because of changing of climate. In the same manner, Moat *et al*. (2017) reported that challenge of coffee production in Ethiopia is the variability of weather pattern such as rainfall variability on the onset of the wet season, extension of dry season and more extreme (drier and hotter).

Diseases: Coffee berry diseases (*Colletotrichum kahawae),* branch die back (physiological disorder), coffee wilt diseases *(Fusarium xylarioides)* and coffee leaf rust *(Hemileia vastatrix)* were also other constraints of coffee production listed by focus group discussion. Coffee berry diseases can cause significant yield losses of up to 75% when not properly controlled and coffee leaf rust can cause yield losses in excess of 75% where outbreaks are severe (Mike and Phiri, 2006). According to Michiel *et al. (*2004) Dieback is caused by poor management, excessive crops as a result of light exposure without sufficient fertilization, heavy temperature fluctuations, nutrient deficiencies, or severe moisture stress and all these issues can be handled with proper management in the field. This implied that there is a poor management of coffee in the study area.

Lack of improved coffee varieties: The respondent also raised that there were no improved coffee varieties recommended by research for the study area. They were cultivating indigenous coffee landraces which are susceptible to diseases and pest. Their yielding conditions were also not consistent and highly vary from year to year. Similarly, Jose (2012) reported that coffee production in Ethiopia is constrained by lack of adequate technology transfer and research.

Lack of extension and technical support: Low government support on coffee production in the area was also another problem of coffee production. There was low support in terms of seedling dissemination and training provision on coffee production and management. Moreover, the respondents also added, the skill of experts and developmental agents were low in answering the problems coffee producers faced such as diseases. When the farmers ask how to manage diseases and other problems, developmental agents could not properly address the problems.

No appropriate permanent shade: Shade available in the area was simply locally available tree and their suitability has not been checked. The permanent shades available in the area were *Cordia africana, Acacia albida, Acacia seiberiana, Milletia ferruginia, Erthrina abyssinica, Ficus sycomorus, Ficus vasta and Croton macrostachyus* which were affecting coffee production. According to Jean (2004), one of the three major principles of sustainable coffee production is shade-grown coffee. The other two are organic coffee growing and fair-trade. Coffee shades have manifold ecological benefits by serving as windbreaks and shelterbelts, for aesthetic value in residential areas, and more importantly to protect the coffee plants from excessive sun and high temperatures (Molla 2015).

Insect-pest: The other problems reported by focus group discussion were insect-pest such as termite and stem borer. Termite and stem borer pose affect coffee production by feeding on the bark or skin of the tree and also by making tunnel or passageway of another fungal and bacterial diseases and causes yield loss.

Lack of post-harvest handling materials: Post-harvest handling materials such as lack of drying bed, high price of sisal sack (85 ETB per unit) and storage were also found to be other constraints of coffee production in the study area.

Table 3. Production constraints of coffee in the study area

No	Factors	Mean core	Rank
1	Drought	67.75	1
2	Lack of improved coffee varieties	57.75	3
3	Lack of extension and technical support	52	4
4	No appropriate shade	40.5	5
5	Insect (termite and stem borer)	41	6
6	Diseases (CBD, BDB and CWD)	64	2
7	Lack of post-harvest handling materials	27	7

Source: Own survey

Marketing Constraints of Coffee Producers in the Study Area

Table 4 revealed the problems of coffee marketing listed and prioritized by interviewed focus group discussion and discussed one by one as the follows.

Low and volatile price: The result from focus group discussion showed low and volatile price was ranked first from other coffee marketing constraints**.** Coffee producers in the study area are exposed to low price which could not even cover their cost of production. In the same way, Jose (2012) and Tesfu (2012) reported low price and low benefit shares of farmers are problems of coffee marketing in Ethiopia. Coffee producers are exposed to large fluctuation in market price (Berhanu, 2017; Alemayehu, 2014). Many farmers in sub-Saharan Africa face significant difficulty when trying to bring their products to market. They also complain about the low level of profit that they are able to earn from their products (Anne, Delmas, 2009).

Agreement of traders on market price: It is not allowed to farmers to sell coffee out of the district. But, within the district, they can sell their coffee to wholesalers, cooperatives and agent middle-men. The great problem of cooperatives was lack of capital (money cash) to purchase coffee all time and hence they did not purchase constantly but, temporarily. Traders were mostly the residents of the district and knew each other very well, and had agreement on market price and purchase by the same price. The participants on group discussion also added that traders had an agreement with agricultural office so that they kept silent when farmers appeal about the price. Traders kept their advantage only and are the owners of car within short period while farmers are poor.

High transportation cost: The area had low infrastructural (road) facility and there were transportation problem. Farmers supplied their coffee to market by donkey and human labor

Lack of information on coffee price: Survey result showed that around 44.8% of the respondent had access to market information while the rest had no access to information. Even for those who had access, the initial sources were traders. The result from focus group discussion also indicated lack of market information as the fourth in constraining coffee marketing.

Lack of fairness on the price paid for qualified and not qualified sundry coffee: The payment made for coffee was not as per quality. Traders have mixed qualified and not qualified coffee and the difference in price did not cover the cost of qualifying.

Presence of illegal traders, mixing of coffee with other coffee and unfair weight: Illegal traders purchase coffee cherries that did not dry very well and mix with others. They disseminate false information about price and thereby affect coffee producers. The result from group discussion also indicated government control on illegal traders is very low. Mixing of Gololcha's coffee with Bale and Chole which could drop market price was also another problem of coffee marketing. Traders were also cheating on weight by putting their legs or stones on weight.

Table 4. Marketing constraints of coffee producers

No	Marketing constraints	Mean score	Rank
1	High transportation cost	56.75	3
2	Low price	68.5	1
3	Lack of information on coffee price	53	4
4	Traders agreement on price	64.75	2
5	No significant price difference between qualified and not qualified coffee	48.25	5
6	Presence of illegal traders	43.25	6
7	Mixing of coffee with other coffee	32.75	7
8	Unfair weight	29.75	8

Source: Own survey

Marketing Constraints for Traders

Constraints in buying: Table 5 portrayed, quality issue was the first factor in buying coffee. Poor quality of coffee such as being wet had affected traders in purchasing of coffee from farmers. Similar to farmers, traders also added that presence of unlicensed traders had declined quality of coffee in the area. Mixing of coffee (qualified and not qualified, Golocha's coffee with other coffee such as Bale and Chole) aggravated with low control of government especially starting from the last five years, had declined quality of coffee in the study area. In line with the expansion of drought and alternative bearing of coffee, the supply of coffee was inconsistent and characterized by high fluctuation. Table 5 further indicated that capital and price fluctuation were also constraints of traders in purchasing coffee. Because of price fluctuation, traders faced difficulty in determining purchase price.

Table 5. Marketing constraints in buying

No	Factors	Mean score	Rank
1	Inconsistency in supply of coffee (low supply)	12.95	3
2	Coffee quality	50.45	1
3	Presence of unlicensed traders	15	2
4	Price fluctuation	3.41	5
5	Capital	6.14	4

Source: Own survey

Constraints in selling of coffee: Price fluctuation was found to be the first challenge in selling of coffee for traders. Grading system given by ECX and price attached was unfair. For example, if a kg of 2nd grade is sold at 97 ETB, a kg of 4th grade is sold at 94 ETB. But, the cost of supplying 2nd grade coffee is greater than the difference. They paid 2% tax of total sell at ECX and perceived it unfair. In addition to tax, traders paid for commission men from 0.5% to 2% of total sell and 40 cents per quintal per day for storage. In general, they paid 16500 ETB per trip or per 51 quintals on average.

Sampled traders also added that Sisal sack or "*jonia*" was not returned after they sell coffee. The price of one sisal sack was 85 ETB and at one trip, they supplied 60 sisal sack (net contents of 85 kg) to Dire Dawa city. Therefore, they lost 60 "*joinia*" or sisal sack or 5100 ETB at one trip only. Transportation cost was also another problem in selling coffee which was 10000 ETB per trip from wholesalers' store to Dire Dawa city. The end ranked problems of coffee selling was shortening of selling days at ECX market. Traders should sell their coffee within 20 days after they enter ECX market. If not, traders were penalized and re-enter to market as new and sell within 7 days only.

Table 6. Major constraints in selling of coffee

No	Factors	Mean score	Rank
1	Price fluctuation	40.32	1
2	High tax by ECX	6.36	5
3	Unfair grade at ECX	20.91	2
4	Sisal sack or "*jonia*" will not be returned	16.23	3
5	Shortening of selling day	3.50	6
6	High transportation cost	8.82	4

Source: Own survey

Opportunities of Coffee Production in the Study Area

Even though coffee has production constraints discussed above, it has the following opportunities. Mechara Agricultural Research Center has sown 60000 improved coffee seedlings in the district which will be disseminated in the coming summer season. In addition, the center is conducting a research on Arsi coffee landraces to release recommended coffee varieties for the area. The establishment of Coffee and Tea Development and Marketing Authority at country and district level can also be other opportunities for coffee production in the study area.

Econometric Model Results

Factors Affecting Amount of Coffee Supplied to the Market in the Study Area

Before interpreting output from OLS model, Tests for heteroscedasticity, omitted variables and multicollinearity were conducted.

Presence of heteroscedasticity was tested using Brush pagan test and the result indicated that there was heteroscedasticity problem. According to Gujarati (2011), sometimes, instead of estimating regression we can regress the logarithm of the dependent variable on the regressors which may be linear or in log form. The reason for this is that the log transformation compresses the scales in which the variables are measured, thereby reducing a tenfold difference between two values to a twofold difference. To overcome the problem of heteroscedasticity, functional transformation (ln amount of coffee sold) was used and then after, no heteroscedasticity problem existed. The presence of multicollinearity problem was tested using variance inflation factor (VIF). The results of all VIF values range between 1.1 and 2.21 with a mean of 1.38 which indicates that

there is no serious multicollinearity problem among independent variables. Ramsey RESET test was used to test omitted variable and the result showed there were no omitted variables.

Durbin score and Wu-Hausman test were used to test endogeneity problem by using estat endog STATA command after ivregress 2sls and the result indicated that we are 95% confident that the model had endogeinity problem. The value of minimum eigenvalue statistic which is 49.34, is greater than any value of 2SLS size of nominal 5% Wald test and LIML size of nominal 5% Wald test. This implied that the null hypothesis which states that the instrumental variables are weak is rejected.

Table 7. Tests for multi-collinearity, heteroscedasticity and omitted varaibles

estat hettest		
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity		
Ho: Constant variance		
Variables: fitted values of log of amount of coffee sold		
chi2(1) = 1.04		
Prob > chi2 = 0.3080		
estat ovtest		
Ramsey RESET test using powers of the fitted values of log of amount of coffee sold		
Ho: model has no omitted variables		
F(3, 139) = 0.30		
Prob > F = 0.8263		
estat vif		
Variable	VIF	1/VIF
Level of output	2.21	0.45
Level of education	1.74	0.58
Land allocated to coffee	1.55	0.65
Family size	1.44	0.69
Sex	1.32	0.76
Farming experience	1.3	0.77
Means of transport ownership	1.14	0.88
Distance to the nearest market	1.14	0.88
Access to information	1.11	0.9
Frequency of extension contact	1.1	0.91
Access to non-farm income	1.1	0.91
Mean VIF	1.38	

Source: Own survey

Therefore, two stage least squares was used to identify determinants of amount of coffee market supply. The P-value of F for the overall significance of the model which is (Prob> F=0.0000) indicates that the model (included explanatory variables) are jointly significant at 1% or in other words, the null hypothesis which states that all

regressors have zero impact on amount of coffee sold is rejected. It indicated that there is at least one regressor that is significantly different from zero. The value of coefficient of variation indicates that 49.1% of variation in ln of amount of coffee sold in 2017/18 is explained by included explanatory variables (Table 8). From eleven hypothesized explanatory variables, six were found to be significant and discussed as below.

Amount of coffee produced (QUANP): It was hypothesized that amount of coffee produced has positive and significant effect on quantity supplied to the market. Similarly, the result from the model indicated that the quantity of coffee produced affects amount of coffee bean supply to the market positively and significantly at 1% probability level. The result from Table 8 indicated the amount of coffee supplied to the market increases by 3.01% for every one additional quintal of coffee produced, other explanatory variables kept constant. The rationale behind this was that coffee is market-oriented crops and the more produced, the more supplied to the market. Similarly, the study conducted by Samuel (2016), Tadele *et al.* (2016) and Mohammed (2011) indicated the amount of coffee, *teff* and wheat produced had positively and significantly affected market supply, respectively.

Sex of the household heads (SEXHH): It was hypothesized that male headed households are more likely to supply more than females headed households. The result of the study also confirms this and showed that it has positive and significant influence on amount of coffee supplied at 1% level of significance. It also showed being male household head increases the amount of coffee supplied to the market by 47.2% as compared to female household head, controlling for other independent variables. From the survey result, male headed households have sold around 598.8 kilograms of dry coffee cherries while female headed households sold around 253.2 kilograms on average in 2017/18. The reason could be of that female headed households are busy in home and stay at home for child care. The result of the study is not consistent with Nasir (2016) who reported that sex of household heads (being male), had negatively and significantly affected amount of sundry coffee supplied to the market. But, it is consistent with Tadele *et al*. (2016) who identified that sex of the household heads had influenced quantity of *teff* marketable surplus positively.

Educational level (EDHH): Level of education influenced market supply at 5% level of significance. For each additional year of education, coffee market supply increases by 3.42%, keeping other variables constant. Educated farmers might be better in adoption of technology, coffee production management and application of fertilizers such as farmyard manure. This might help them to increase production and thereby quantity supply. The result is in line with Jemberu (2017), and Wogayehu and Tewodros (2015) who identified that educational level affects significantly and positively the amount of chickpea and haricot bean supplied, respectively.

Family size (FAMSZ): It was hypothesized that family size affects coffee market supply either positively or negatively. But, the result of the study indicated that family size affects the amount of coffee supplied to the market positively at 1% level of

significance. It implies that, for every additional family member (in men equivalent), the amount of coffee sold increases by 6.27%, other variables kept constant. The rationale behind is that those households who have more family members had more total labor available which in turn could help to increase amount of coffee bean available for sale. Moreover, households with large family size might need to expend more for children schooling and other expenses. The study is consistent with Nasir (2016) who found family size had positively and significantly affects amount of sundry coffee supply. But, it is inconsistent with Agegnehu (2016) and Sultan (2016). According to them, high family member results in high proportion of rice and wheat consumption and low market supply respectively.

Land allocated to coffee production (AREACOFE): Land allocated had influenced positively and significantly the amount of sundry coffee bean sold at 5% level of significance. The positive coefficient under land allocated to coffee production showed that for each additional hectare of land, amount of coffee supplied to the market increases by 12.1%, controlling for other variables. Similarly, Bekele *et al.* (2017), Adisu (2016) and Jemberu (2017) reported that land allocated had positively and significantly affected the amount of sales of potato, onion and chickpea, respectively.

Access to market information (INFO): The result of the model indicated that access to market information had positively and significantly affected the amount of coffee supply. The positive and significant value of coefficient under access to market information implied that access to market information increases the quantity of supply by 22.2%, keeping other variables constant. The rationale behind this could be access to market information might enable farmers to receive accurate price level and encourage to sell more. The result of the study is in line with Wendmagegn (2014) who found that access to market information had significantly and positively influenced coffee market supply.

Table 8. Determinants of amount of coffee bean (with dry husk) supplied to the market

Variables	Coefficient	Robust Std. Err.	t-value
Level of output	0.0301***	0.00966	3.11
sex	0.472***	0.124	3.81
Educational level	0.0342**	0.0164	2.09
Family size	0.0627***	0.0218	2.87
Farming experience	-0.00389	0.00544	-0.72
Land allocated to coffee production	0.121**	0.0491	2.45
Access to non-farm income	-0.0410	0.139	-0.30
Means of transport ownership	-0.00803	0.0892	-0.90
Frequency of extension contact	0.0154	0.0277	0.56
Access to market information	0.222**	0.0924	2.40
Distance to the nearest market	-0.00623	0.0116	-0.54
Constant	0.256	0.182	1.41
Observations		154	

Variables	Coefficient	Robust Std. Err.	t-value
F(11, 142)		21.340	
Prob > F		.0000***	
R-squared		.491	

Note: *** p<0.01, ** p<0.05 and * p<0.1, and dependent variable is amount of coffee supplied (ln) 2017/18

Source: Own survey

Conclusions and Recommendations

In this article, we assessed performance of coffee market and analyzed factors affecting market supply of coffee by smallholder farmers. The data was collected through personal interviews form a total of 213 respondents.

The study identified drought, diseases outbreak, lack of improved coffee verities, lack of extension and technical support, inappropriate shade, insect manifestation and lack of post-harvest materials were among the major constraints of coffee production. Therefore, strengthening coffee research to improve farm productivity, reducing risk, improving shade tree practices by using improved recommended shade tree species, Practice stumping old coffee tree for recycling its life or re-plant and using of improved coffee variety are found to be important for the study area. Low and volatile price, agreement of traders on market price, lack of fairness on price paid for qualified and not qualified sundry coffee, presence of illegal traders, high transportation cost, mixing of coffee with other coffee and unfair weight were also found to be major marketing constraints of producers in the study area. Thus, controlling of illegal traders and enhancing of market infrastructure is found to be important.

Sampled traders reported that coffee supplied by the farmers had no quality. Hence, improving harvesting techniques by only harvesting red cherry at the farm level, improving drying techniques through drying coffee on plastic sheet, improving packaging materials (use only sisal sack) and store coffee after it well dried in appropriate warehouse only for a short period are also important. Grading system, price attached to each grade and tax paid at ECX market were reported to be unfair by sampled traders. Therefore, further research should be conducted on coffee market condition at ECX level.

The result of two stage least squares showed that amount of coffee produced, sex of the household heads, educational level, family size, land allocated to coffee production and access to market information had positively influenced amount of coffee supplied to the market. Therefore, enhancing information access, increasing level of coffee production (through extension of improved varieties, fertilizer application, irrigation, pruning and other agronomic management) and expansion of education facilities were other crucial issues to increase coffee market supply.

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Conflict of interests

The authors declare no conflict of interest.

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