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Review Article

A Study on Supply Chain Analysis of Coffee in Ethiopia

M. Krishna Naidu

Assistant Professor
Department of Agricultural Economics,
Ambo University, Ethiopia, Eastern Africa.

Abstract *- This study is initiated to analyze the coffee Supply chain in Yubdo District, Western Wollega ZoneOromia Regional state of Ethiopia. It focused on identifying determinants of volume coffee supply of Households; and factors affecting market outlet choice decisions of coffee producers. Data for the study are collected from both primary and secondary sources. The primary data are collected from randomly selected coffee producer household surveys by using a pre-tested structured questionnaire. The data are collected from 132 farmers and 20 traders and analyzed using STATA software. Coffee supply Chain actors identified in the study include input suppliers, producers, rural collectors, Primary cooperatives, wholesalers, processors, and Exporters. Eight market channels were identified for coffee marketing in the study districts. Policy implications drawn from the study findings include: improving farmers' knowledge and experience on coffee production, encouraging adult education through extension service, improving cooperation of coffee farmers strengthening the linkage/interaction among Coffee Supply chain actors, expanding the accessibility of market infrastructure. Further study needed on coffee supply chain analysis starting from producers to the Exporters would be a considerable issue to improve the whole coffee supply chain in the study area.*

Keywords *- Supply chain analysis; Coffee, multiple linear regression regressions; Multivariate probit;*

I. BACKGROUND OF THE STUDY

In the realm of economic growth, markets may provide the incentives to profit-maximizing participants to develop new technologies, products, resources of supply, new markets, and methods of exploiting them. Agricultural marketing acts as an agent of rural development. In Ethiopia Agriculture dominates the national economy that accounts for 36.7% of overall GDP and 70% of foreign exchange earnings. The sector provides employment for 72.7% of the population and is a means of generating livelihood for about 83% of the rural population (ATA, 2017). Ethiopia practices various agricultural activities; among these, coffee production is one of the cash crop's that is dominantly produced in Oromia and Southern Nation and Nationalities People regional states.

A. Statement of the Problem

According to ECX (2011), agricultural markets in Ethiopia before 2008 had been characterized by high costs and high risks of transacting, with only one-third of output reaching the market, and besides, small-scale farmers, who produce 95 percent of Ethiopia's output, came to market with little information and are at the mercy of merchants in the nearest market they know, and they are unable to negotiate better prices or reduce their market risk.

Problems in the coffee Supply chain hinder the potential gains that could have been attained from the existing opportunities. In this regard, coffee supply chain analysis is an interesting process that has not been investigated in the study area. Both buyers and sellers, in the study area, usually do not play collective roles towards one another. Under such circumstances, a study that focuses on production problems, coffee market Channels problems, and roles and responsibilities of actors can play a significant role in the improvement of the existing coffee marketing system.

Even though there is a lot of research done on the Agricultural market supply chain, it is mostly concentrated on grain staples and livestock where little attention has been given to coffee.

B. Research Questions

1. Who are the major actors along the coffee supply chain and what does the coffee supply chain map looks like?
2. What does the market performance of actors look like across the coffee market Channel in the study area?

3. What are the factors that affect the volume of coffee supply to the market in the study area?
4. What are the factors affecting households' coffee market outlet choice decisions?

II. OBJECTIVES OF THE STUDY

The General Objective of this study is to analyze the coffee market supply chain, the case of Yubdo District, West Wollega Zone of Oromia Regional State, Ethiopia.

The Specific Objectives of the study were:

1. To identify coffee Market Channels and major actors in the coffee supply chain in the study area.
2. To assess the market cost and margin along the coffee market channel
3. To analyze the determinants of coffee producers, the volume of coffee supply, and
4. To identify determinants of coffee producers, market channel choice in the study area

A. Significance of the Study

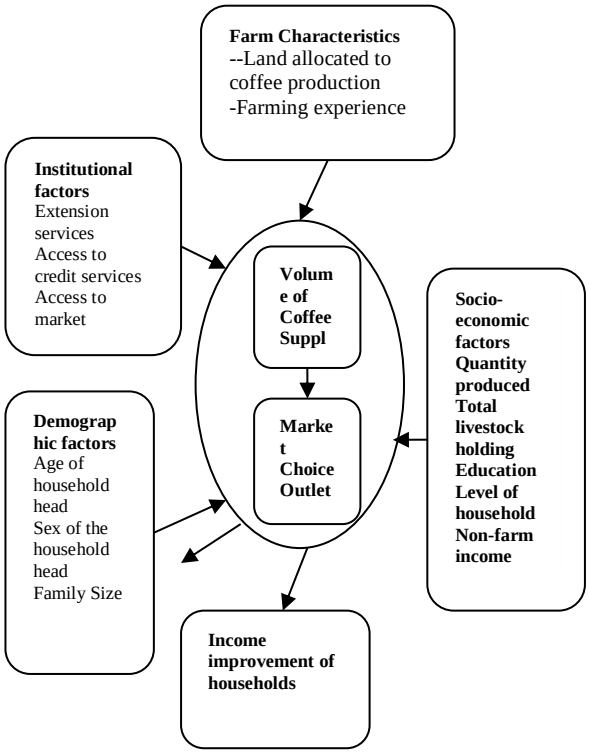
- This study provides information on the determinants of coffee supply to the market, the determinants of market outlet choice decisions, and the coffee supply chain in the study area.
- This study sheds light on required efforts to enhance the production and utilization of coffee at a larger scale to bring about economic development in the area.
- The information generated could also help a number of organizations including research and development organizations, traders, producers, policymakers, extension service providers, government, and non-governmental organizations to assess their activities and redesign their mode of operations and ultimately influence the design and implementation of policies and strategies.
- It could also help different actors to identify and analyze new ways of stimulating innovation.

B. Scope and Limitation of the Study

- This study was conducted in the Yubdo district and important information was collected from sample households and marketing actors involved in the subsector organization in the study area.
- Ethiopia had a wide range of diverse agro-ecologies, institutional capacities, organizations, and environmental conditions, the result of the study may have limitations to make generalizations and make them applicable to the country as a whole.
- However, the findings are expected to be useful for areas with similar context with the study areas.

Conceptual Frame Work of the Study

Fig. 1 Conceptual framework of the study

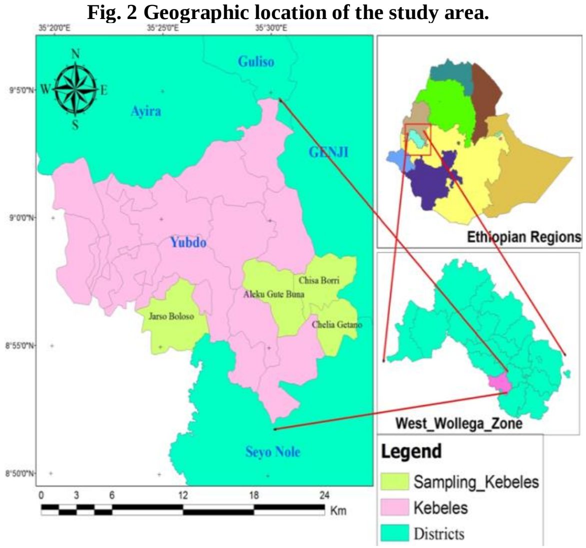


Source: Own computation 2019

III. RESEARCH METHODOLOGY

The study District has a total population of 97,219 (49,846 males & 47,373 females)from these total household sizes are7, 581 (762 female and 6819 male). According to the current administrative structure, the study area is divided into 20 'kebeles', out of which 18 are rural 'kebeles'. The district is predominantly dependent on agriculture, which accounts for 95% of the total population. The economic activity for the majority of the communities is characterized by mixed farming (both crop and livestock production). Maize, sourdough, and coffee productions are the major crop practiced in the area.

Fig. 2 Geographic location of the study area.



Source: Adopted from Arc GIS computation and Ethiopian map (2019)

A. Methods of Data Collection

Different methods of primary and secondary data collection were applied in the study. To collect Primary data, Semi-structured questionaries' are prepared by considering factors affecting sales volume, and demographic and socioeconomic characteristics of the sample households and considering coffee traders and consumers and determinants of household market choice outlet in the study area. The secondary data are collected through reading and summarizing to know the gaps that existed additionally informal discussions with the coffee producer are done and making a direct observation. DA's those working in the selected rural *kebeles* are used for data collection.

B. Sampling Technique:

During the survey period, two stages of random sampling technique were used to draw the sampling units of the study. In the first stage, since the household heads are homogenous in terms of coffee production Practice, living standards and the agro-ecological have no significant difference, random sampling techniques were employed. Based on this; four *kebeles* are elected out of 18*kebeles*. In the second stage, from the total of 830coffees producing households of selected four *kebeles*, having 132 sample household heads are selected randomly using probability proportionate to the size of coffee producer households in the area.

C. Sample Size Determination:

Using probability proportionate to the size of coffee producer households in the selected *kebeles* the sample size was determined based on the formula given by Yamane (1967) at a 95% confidence level with a degree of variability of 5% and level of precision equal to 8%:

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

$$n=\frac{N}{1+N(e)2}\ N=830 n=\frac{830}{1+830(0.08)2}=131.74\ n=132$$

Where n is the sample size, N is the total size of the coffee producers in selected *kebeles* (830), and e is the level of precision (8%).

Finally, using the above sample size and the total number of coffee producers from selected *Kebeles*, the numbers of sample households from four Kebeles are chosen proportionally as shown in the *table: 5 below.*

Table 1. Sample Size and Distribution of households

Sample Kebele	Total number of household	Proportionality (100%)	Total
ChisaBorri	198	0.24	32
ChelliaGetano	190	0.23	30
AlakuGute Buna	212	0.25	33
JarsoBoloso	230	0.28	37
Total	830	1	132

Source: District CTDMA and Kebele administration, 2018

The purposive sampling method is used to select rural collectors, wholesalers, retailers, primary cooperatives, and processors from the markets that coffee passed through. Accordingly, a total of 20 traders are selected as shown in the table: 6 below:

Table 2. Sample Size of Coffee Traders

Actors	**Number of traders**	**Sample size**
Collectors	30	5
Assemblers	4	4
Wholesaler	4	4
Primary cooperatives	18	4
Retailers	12	3
Total	68	20

Source: District CTDMA, 2019

D. Method of Data Analysis

Two types of data analysis, namely descriptive statistics and econometric analysis were used for analyzing the data collected from the sample households

E. Descriptive Statistics

The descriptive statistics such as frequency of distribution, percentage, mean and standard deviation were used to describe the demographic and socio-economic characteristics of sample households in the study area. The collected raw data were analyzed using the StataSE-14, and the Statistical Package for Social Science (SPSS) version 24.

Producer's share: The producer's share also known as the Producer's Gross Margin (GMP), is the commonly employed ratio calculated mathematically as, the ratio of producers' price to consumers' price. Mathematically, the producer's share would be expressed as:

$P_s = \frac{P_x}{P_r} * 100 = 1\text{-TGMM}$ …… (2)

Where; P_s = Producer's share

P_x = Producer's price

P_r = Retailer price, and

TGMM = Total Gross Marketing Margin

The above equation shows that a higher marketing margin reduces the producer's share and vice versa.

Total Gross Marketing Margin: Computing the Total Gross MarketingMargin (TGMM) was always related to the final price paid by the end buyer and expressed as a percentage (Mendoza, 1995).

GMM = Consumers price – Producers price …… (3)

$$TGMM = \frac{\text{Consumer's price – Producer's price}}{\text{Consumer's price}} * 100$$ ……..(4)

It was also useful to introduce the idea of 'farmer's portion', or 'producer's gross margin' (GMP) which is the portion of the price paid by the consumer that goes to the producer. The producer's margin is calculated as:

$$GMM_P = \frac{\text{The price paid by the Consumer – gross market margin}}{\text{the price paid by the end–user}} * 100$$ ……(5)

Where, GMMp = the producer's share in the consumer price

Net Marketing Margin (NMM): It is the percentage over the final price earned by the intermediaries as their net income after their marketing costs are deducted.

$$NMM = \frac{Gross\ Marketing\ Margin - Marketing\ Cost}{Consumer's\ price} * 100$$ ……(6)

Where NMM = Net Marketing Margin

From this measure, the higher NMM of the marketing intermediaries reflects reduced down and unfair income distribution, which reduces the market participation of smallholders. To find the benefit share of each actor, the same concept was applied with some adjustments. In analyzing margins, first as shown in the above equation, the Total Gross Marketing Margin (TGMM) was calculated; which is the total consumer price that is left for different actors who founds between producers and final consumers. Then, the marketing margin at a given stage 'i' (GMA) was computed as $GMMi = \frac{Spi - Ppi}{Cp} * 100$

Where, $GMM_i$is the percentage of the Total Gross Marketing Margin at stage "i" $SP_i$is selling price at the i^{th} link; PPi is the purchasing price at the i^{th} link, and$C_p$is consumer price

Following Green (2003), the multiple regression modelswasspecified:

$$Y_i = F(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, X_{11}, X12\ and\ X13)$$

Where: Y_i = Volume of coffee Supply

X_1= Sex of the household head

X_2=Education level of the household head

X_3=Farming experience

X_4= Land size

X_5= Extension service

X_6= Credit access

X_7= Distance to the nearest market

X_8= Family size

X_9= market information

X_{10}=Off/ non-farm activities of the household

X_{11}= Price

X_{12}=Means of transportation Facility and

X_{13}=Membership to cooperative

The correlation coefficients were used to measure the linear relationship between any variables. Based on the proposed variables, the econometric model specification of supply function will be expressed as:

$Y = X'\beta + U$ …… (8)

Where: Y = quantity of coffee supplied to the market

X' =Vectors of explanatory variables

β= a vector of parameters to be estimated

U= the error term

When some of the assumptions of the Classical Linear Regression Model (CRM) will be violated, the parameter estimates of the above model may not be Best Linear Unbiased Estimator (BLUE). Hence, it is important to check the presence of multicollinearity, heteroskedasticity, and normality of the residuals among the variables that affect the sales volume of coffee during the analysis.

F. Test of Multicollinearity:

Before running the econometric model, all the hypothesized explanatory variables will be checked for the existence of multicollinearity problems. There may be two measures that will be used to test the existence of multicollinearity.

Variance Inflation Factor (VIF) for the relationship among the continuous explanatory variables and contingency coefficients for dummy variables. In this study, a variance inflation factor (VIF) and contingency coefficient were used to test multicollinearity problems for continuous and dummy variables, respectively.

According to Gujarati (2003) VIF was computed as;

$$VIF\ (X_j) = \frac{1}{1-R^2} \quad \ldots\ldots (9)$$

Where R is the multiple correlation coefficients between X_j and other explanatory variables. The larger the value of VIF, the more trouble it is. As a rule of thumb, if the VIF of a variable exceeds 10, that variable is said to be highly collinear (Gujarati, 2004).

G. Test of Heteroskedasticity:

Heteroskedasticity exists when the variances of all observations are not the same, leading to consistency but inefficient parameter estimates. There are a number of test statistics for detecting the presence of heteroskedasticity. According to Gujarati (2004), there is no ground to say that one test statistic of heteroskedasticity is better than the other statistics. Due to this, in this study, the assumption of absence of heteroskedasticity was detected by using the Breusch-Pagan test or hottest method.

IV. SUMMARY, CONCLUSION, AND RECOMMENDATION

A. Summary

- About eight coffee market channels were identified with each channel having a different marketing margin. The total gross marketing margin (TGMM) is highest in channel III which was 44.72 % and lowest in channel VII which was 0.3%. The survey results also showed that the maximum producers' share (GMM_P) is obtained in channel VII which was 91.5%. The lowest gross marketing margin was taken by the primary cooperative in channel III which was 2.98%.
- The result of the multiple regression model showed that Sex of the household head, educational level of household head, Family size of household, the experience of household on coffee production, total land size holding, and means of transportation were found to influence the sales volume of coffee positively and significantly.
- On the other hand, Distance to the nearest market had shown a negative and significant relationship with the sales volume of coffee.
- The multivariate probit model applied in this study was specifically intended to investigate factors influencing the sample households in choosing marketing channels. The sample households had four categories according to their channel choice decision but they are correlated.
- The result of the multivariate probit model showed that the likelihood that the sampled households choose collectors, cooperatives, processors, and wholesalers market channels were 64.4%, 57.7%, 35.1%, and 55.1%, respectively. The result also showed that the joint probability of using all channel choices was 3.8% and the joint probability of failure to choose all of the market channels was only 1.6%.
- The multivariate probit model result showed that the Experience of the household head, Sex, Education level of household head, and Credit access of coffee producers of coffee have a significant effect on the choice of collectors' market channel choice.
- The result also showed that Distance to the nearest market and membership to cooperatives have a significant effect on primary cooperatives' market channel choice. It also revealed that the Family size of the household head, Land Size, and Experience of the household head has a positive and significant effect on Processors market channel choice. Finally, Sex of the household head education level of household head, and credit access of coffee producer access to market information and transportation access have a significant effect on the producer's market choice.

B. Conclusion and Recommendations

1. To sum up, there are many actors involved in the coffee supply chain playing different roles in the study area like input suppliers, producers, collectors, primary cooperatives, processors, wholesalers, and Exporters.
2. The result of the multiple linear regression model analysis showed that distance to the nearest market had negatively and statistically influenced the quantity sold of coffee.
3. The result of multivariate probit model analysis shows that collectors, Processors, and Wholesalers channel choices are negatively and significantly influenced by sex, Education, Credit access, Land size, market information, and means of transportation Facility.

4. The study suggested that strengthening the existing primary education, up to certifying households and providing different trainees at different levels promotes coffee supply and market outlet choice channels services are an important issue.
5. Farming experience is positively and significantly influenced the sales volume of coffee.
6. Therefore, the government should consider better means of coping with access problems to the coffee market through increasing primary cooperatives and improving infrastructure facilities in order to reduce transaction costs associated with coffee market channel choice decisions of households in the study area.
7. Therefore, these factors must be considered in future intervention by strengthening efficient and area-specific extension systems, supporting extension agents by giving continuous capacity-building training so that they train farmers, and enhancing their knowledge on how to choose a beneficial market channel.

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