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Marketing System Analysis of Vegetables and Fruits in Amhara Regional State: Survey Evidence from Raya Kobo and Harbu Woredas

Mengesha Yayo Negasi¹

Abstract

This study attempted to analyze the different aspects of marketing system of vegetable and fruit in Raya Kobo and Harbu woredas, Amhara regional state using different indicators. Probit estimation for determinant of participation probability in vegetable and fruit production and OLS estimation technique were also applied for examining determinants of market supply and demand for vegetable and fruit products. Accordingly, the results showed that lack of genuine and timely market information, poor institutions and arrangements, poor marketing infrastructures (poor storage, cool chain facilities, packaging, weak pre and post harvest handling practices, non scientific grading and standard, etc), long market channel, high and unfair profit margin distribution among the value chain actors with little share to the farmers were observed in both vegetable and fruit market. These are an indicative of poor marketing efficiency and thereby suboptimal operation of the marketing system. The econometric regression result of this study exhibited almost similar results as previous studies however the determinants were not same for all sample crops (onion, tomato, mango and avocado) rather differs from crop to crop. In general, family size, total size of land, extension service, farmer's experience, average lagged price, distance from main road and age were found to be significant factors (with expected sign) of production participation in vegetables and fruits. Similarly, average current price, distances from main road, age, total size of land, farmers' experience, sex, number of oxen, and access to market information were found to be significant determinants of market supply of vegetables and fruits. Finally, family size, purchase frequency, amount of single purchase lot, average

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¹ Mengesha Yayo, Addis Ababa Science and Technology University
ymanga28@gmail.com or mengeshayayo@yahoo.com

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current price, income level, average expenditure on food and purchasing, and amount per trip were found to be significant line with expected sign as determinants of demand for vegetables and fruits in the study area. Hence, the results found in this study are clearly an indicative for taking appropriate measures in production side, market infrastructure, arrangements and institutions to improve the inefficient functioning of the marketing system.

Key words: Marketing system, structure, conduct, performance, channel, margin, production participation, market supply, market demand.

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1. Introduction

Efficient marketing system plays an important role in the economic development as it stimulates production, avoids unnecessary fluctuation in output and prices and reduces costs of production and unfair share of consumer's price. However, for attaining these benefits, marketing system and marketing technology have to keep pace with the production technology and socioeconomic development of the country. The experience of many countries suggests that in the absence of an efficient marketing system strategy, agricultural development cannot go very far to stimulate production and contribute to price stability (Khalon and George, 1985).

Particularly, marketing of vegetable and fruit crops do complex especially owing to its perishability, seasonality and bulkiness nature. This is also leading to high and fluctuating consumer prices and unfair share of the retailer's price. At same time, the livelihood of many smallholder farmers is becoming dependent on the cash income from commerce of agricultural product like vegetables and fruits. As a result, there has been due concern in recent years regarding the efficiency of marketing of fruits and vegetables. Of course, there are many similar studies done in marketing system of agricultural products which employed different approaches. Some of them

focused on the value chain analysis while other relied on market supply merely. However, for proper interventions and strategies in solving those problems and making the playing field more competitive, able suppliers get fair price and consumers pay reasonable price, comprehensive knowledge and empirical evidences on how the current marketing system of vegetables and fruits is operating and to what extent the challenges are prevailed is needed.

Hence, it is relevant to conduct a study on vegetable and fruit' marketing system using holistic approach (employing combinations of different approaches of studying marketing system and incorporating both supply demand aspect of marketing system). This is again believed that it will strengthen evidences for suggesting possible interventions to correct the problem. Realizing of this fact, this study has attempted to assess the marketing system (including determinant of production participation, market supply and demand) of vegetables and fruits in Raya Kobo and Harbu Woredas, Amhara Regional State. To meet the objective of the study, both primary and secondary data sources were employed. For analysis of the collected data, combination of different approaches and methods (both descriptive and econometrics) were used.

2. Literature

This part deals with the basic conceptual frameworks and empirical works on markets, marketing, marketing system and market channel, factors affecting market supply, the approaches and methods to evaluate the marketing system of agricultural products.

2.1 Conceptual Framework

2.1.1 Basic concepts

Agricultural marketing

The term marketing has been a debatable issue and defined in various ways by different intellectuals. Accordingly, marketing can be defined as the performance of all business activities involved in the flow of food products

and services from the point of initial agricultural production until they are in the hands of consumers (Kohls and Uhl, 1985; Bain and Howells, 1988). As of Kotler and Armstrong (2003), marketing is a societal process, by which individuals and groups obtain what they need and want through creating, offering, and freely exchanging products and services and value with others. In general, it is an institutional arrangement for buying and selling of products.

Marketing system

As cited in Andargachew (1990), the concept of marketing system comprises physical distribution of economic input and products as well as the mechanism of process or coordinating production and distribution. Branson and Norvel (1983) defined the marketing system in terms of what is otherwise known as marketing channel. In broad terms, marketing system may be defined as the totality of product channels, market participants and business activities involved in the physical and economic transfer of goods and services from producers to consumers. Marketing system operates through a set of intermediaries performing useful commercial functions in chain formations all the way from the producer to the final consumers (Islam *et al.*, 2001).

Marketing channel

It is a business structure of interdependent organizations from the point of product origin to the consumer with the purpose of moving products to their final consumption destination (Kotler and Armstrong, 2003). The analysis of marketing channels is intended to provide a systematic knowledge of the flow of goods and services from their origin (producer) to their final destination (consumer).

Market chain analysis

A marketing chain is used to describe the numerous links that connect all actors and transactions involved in the movement of agricultural products from the farm to the consumer (Lunndy *et al.*, 2004).

2.1.2 Approaches to the Study of Agricultural Marketing System

Studying agricultural marketing system requires different approaches for analyzing marketing performance, structure, conduct, functioning, challenges etc. The following are major and most commonly used once.

Functional approach

Studying marketing system using functional approach is just to break up the whole marketing process into specialized activities performed in accomplishing the marketing process (Kohls and Uhl, 1985). This approach helps to evaluate marketing costs for similar marketing middlemen and/or different commodities and costs and benefits of marketing functions (Kohls Uhl, 1985; and Andargachew, 1990). The widely accepted functions are: exchange (buying and selling), physical (processing, storage, packing, labeling and transportation), and facilitating (standardizing, financing, risk bearing, promoting and market information). The exchange function involves pricing, buying and selling which is a transfer of title between exchanging parties.

Institutional approach

This approach relies on the description and analysis of different organizations engaged in marketing (producers, wholesalers, agents, retailers, etc) and pays special attention to the operations and problems of each type of marketing institution. The institutional analysis is based on the identification of the major marketing channels and it considers the analysis of marketing costs and margins (Mendoza, 1995).

Commodity approach

In this approach, a specific commodity or groups of commodities are taken and the functions and institutions involved in the marketing process are analyzed (Kohls and Uhl, 1985). This approach is said to be the most practical as it helps to locate specific marketing problems of each commodity and improvement measures. This approach follows the commodity along the path between producer and consumer and is concerned

with describing what is done and how the commodity could be handled more efficiently (Purcell, 1979).

Structure, Conduct and Performance (SCP) model

SCP model is also one of the most common and pragmatic methods for analyzing marketing system. It analyzes the relationship between functionally similar firms and their market behaviour as a group and, it is mainly based on the nature of various sets of market attributes and relations between them and their performance (Scarborough and Kydd, 1992). This analytical method is based on the theory that market structure and market conduct determine the performance of a marketing system.

Market structure², conduct³ and performance⁴ (SCP) framework was derived from the neo-classical analysis of markets. The SCP paradigm was the brain child of the Harvard school of thought and popularized during 1940-60 with its empirical work involving the identification of correlations between industry structure and performance. This SCP hypothesis has led to the implementation of most anti-trust legislation. This was followed by the Chicago school of thought from 1960 (Edwards *et al.*, 2005). Accordingly, there are two competing hypotheses in the SCP paradigm: the traditional “structure performance hypothesis” and “efficient structure hypothesis”. The structure performance hypothesis states that the degree of market concentration is inversely related to the degree of competition. This is because market concentration encourages firms to collude. More specifically, the standard SCP paradigm asserts that there is a direct

² Includes the characteristics of the organization of a market that appear to exercise a strategic influence on the nature of competition and pricing within the market. This is investigated using tools like market concentration and barriers to entry for potential participant in the market.

³ There are no agreed up on procedures for analyzing the elements of market conduct. Yet, few points are considered to systematically investigate indications of unfair price setting practices and conditions under which such practices are likely to prevail such as formal and informal grouping, availability of price information (Scarborough and Kydd, 1992).

⁴ It indicates the effect of structure and conduct on prices, costs, and volume of output. It can be analyzed using market efficiency, costs and margins of marketing agents in different channels.

relationship between the degree of market concentration and the degree of competition among firms. This hypothesis will be supported if positive relationship between market concentration (measured by concentration ratio) and performance (measured by profits) exist, regardless of efficiency of the firm (measured by market share).

Thus, firms in more concentrated industries will earn higher profits than firms operating in less concentrated industries, irrespective of their efficiency. The efficiency structure hypothesis states that performance of the firm is positively related to its efficiency. This is because market concentration emerges from competition where firms with low cost structure increase profits by reducing prices and expanding market share. A positive relationship between firm profits and market structure is attributed to the gains made in market share by more efficient firms (Edwards *et al.*, 2005).

Here, it is worthwhile to mention how much the power of SCP framework is relevant to analyses the marketing system of agricultural products. Accordingly, from its components it is evident that SCP paradigm enables us to study how a given marketing system functions (in terms of the three elements of the model: structure, conduct and performance). It also helps us to identify the participants, size of market, product diversification, behaviour of the market agents and their interactions. Moreover; it deals with the efficiency of the market through its performance aspect of the market.

However, SCP framework is not free from limitations. One drawback can be its assumption of exogenous on market structure which means that it doesn't consider the dynamic aspect of the market, i.e. focuses only the static condition. It also fails to take in account the effects of technology development and economic growth on marketing system. Hence, considering the dynamic aspect of the market using other method is believed that it improves the results and thereby able to make sound inferences. Nonetheless, this is a bit complex and beyond the scope of this paper. Hence, this study only focuses on results obtained using the SCP paradigm. In general, this paper employed a combination of the aforementioned approaches to get better and sound results of analyzing marketing system.

2.1.3 Market supply

Marketed supply refers to the amount actually taken to the markets irrespective of the needs for home consumption and other requirements. Whereas, the marketable surplus is the residual with the producer after meeting the requirement of seed, payment in kind, and consumption by farmer (Wolday, 1994). Marketed surplus is defined as the proportion of output that is marketed (Harris, 1982). Marketed surplus may be equal to marketable surplus, but may be less if the entire marketable surplus is not sold out and the farmers retain some stock and if losses are incurred at the farm or during the transit (Thakur *et al.*, 1997). In the case of crops that are wholly or almost wholly marketed, the output and marketed surplus will be the same (Reddy *et al.*, 1995). The importance of marketed and marketable surplus has greatly increased owing to the recent changes in agricultural technology as well as social patterns. The decision to supply market is one big question but usually is taken after the product is at hand or if decided earlier some other decisions have to be considered.

Specifically, marketing of horticultural crops is quite complex and risky due to the perishable nature of the product, seasonal production and bulkiness. The range of prices from producer to consumer, which is an outcome of demand and supply of transactions between various intermediaries at different levels in the marketing system, is also unique for fruits and vegetables. Moreover, the marketing arrangements at different stages also play an important role in price levels at various stages (from farm gate to the final user). These features make the marketing system of fruits and vegetables to differ from other agricultural commodities, particularly in providing time, form and space utilities. While the market infrastructure is better developed for food grains, fruits and vegetables markets are not that well developed and markets are congested and unhygienic (Sharan, 1998).

2.2 Empirical literatures on Fruit and Vegetable Marketing system

There are enormous empirical works that shows how the vegetable and fruit marketing system in Ethiopia is functioning and factors that determine

vegetables and fruits production, market supply and demand. However, some of the most relevant are going to be reviewed below.

Bezabih and Hadera (2007) stated that the production of vegetables is seasonal and price is inversely related to supply. The situation is worsened by the perishability of the products and poor storage facilities. Farmers' bargaining power is low due to lack of alternative market outlet. They also found that the most common marketing channel immediately available to the farmer is through brokers i.e. up to three brokers between the producer and the trader which is an indication of long marketing channel. They recommended that the more the farmers organize themselves and access the terminal market, the more they benefit.

Bezabih (2008) also identified that lack of markets to absorb the production, low price for the products, large number of middlemen in the marketing system, lack of marketing institutions safeguarding farmers' interest and rights over their marketable produces (e.g. cooperatives), lack of coordination among producers to increase their bargaining power, poor product handling and packaging, imperfect pricing system and lack of transparency in market information communications as major marketing challenges.

Abraham (2013) stated that limited access to market, low price of product, lack of storage, lack of transport, low quality of product and lack of policy framework to control the illegal Ethio-Somalia trade route are the major marketing problems. Dendena *et al.* (2009) using value chain analysis on mango indicated that highly disorganized and fragmented industry with weak value chain linkages, long and inefficient supply chains, inadequate information flows and lack of appropriate production were explained as the major marketing problems. They recommended that institutional innovation to reduce the above challenges. Adugna (2009) also stated that the vegetable market conduct is characterized by unethical practices of cheating and information collusion that led to uncompetitive market behaviour even though the calculated concentration ratio did not indicate oligopsony

market behaviour (24.56%). He suggested that some corrective measures are required by the government as well as institutions like cooperatives.

Moreover, Abraham (2013) referred in Getachew (2009) has noted that the transition of the small-scale sector towards commercial production will ultimately be determined by the ability and willingness of producers to provide a commodity. Similarly, Mamo (2009) argued that the development of markets, trade and the subsequent market supply that characterize commercialization are fundamental to economic growth. However, this potential benefit is under challenges of imperfect marketing. Furthermore, the marketing system of vegetable was found as poor, limited access to market information and weak market linkage or non-existent. This was exacerbated by inadequate seed regulatory frameworks and supply of seeds of poor quality, poor post harvest handling which are attributed to low capacity and capability for policy implementation as well as unregulated vegetable seed supply (Bezabih *et al.*, 2014).

According to Wolday (1994), marketable supply of agricultural product could be affected by different factors including the size of land holding, the output level, family size, market access, price, inputs, formal education, oxen number, accesses to extension and credit services, distance to market, time of selling, access to labor and age. Additionally, Abay (2007) and Adugna (2009) found out that marketable supply of vegetables were significantly affected by family size, age of household, distance from main road, number of oxen owned, extension service and lagged price. Again, Ayelech (2011) using SCP⁵ approach and multiple linear regressions found that structure of the market indicates that licensing and years of avocado and mango trade experience did not hinder entry into avocado and mango trade, but capital, education and market information were barriers to enter into the trade. Based on regression model for market supply, she has identified quantity of avocado produced; experience, education and price of avocado in the previous year are factors that significantly affect quantity of avocado supplied to the market positively while lack of market access affects the supply negatively. Similarly, quantity of mango produced, education and

⁵ SCP – market structure – conduct – performance

extension contact are factors that significantly affect quantity of mango supplied to the market positively.

Furthermore, Abay A. (2013) stated that the variables that influenced the marketable supply positively were agricultural experience, access to credit, yield, land size, current year and lagged prices and negatively that of low access to improved inputs, collateral problem to get credit, poor storage facilities and low price of produce. In his study on value chain analysis of vegetables in Habro and Kombolcha, Abraham (2013) also found that marketable supply is significantly affected by access to market information and quantity of tomato produced in the case of tomato; access to extension service, access to market information, vegetable farming experience and quantity of potato produced in the case of potato; and Woreda dummy, non/off-farm activities, distance to the nearest market and quantity of cabbage produced in the case of cabbage.

Regarding demand determinants of vegetables and fruits, there is scarcity of literatures while Abay (2007) mentioned that vegetable as a group of crops from the horticulture category has a very wide importance both as a source of food and health care. On the contrary, the level of consumption is very low for reasons of unavailability and market imperfection. Moreover, he found that income, purchase frequency, distance, own price and single purchase lot that were identified to be significant determinant of demand for vegetable.

3. Methodology

3.1 Description of the study area

Northern Wollo which comprises 9 woredas is one of the eleven zones in Amhara National Regional State. The researcher became interested to conduct this study for different reasons. The first is that the researcher is well familiar with the area .Secondly; the areas have great potential of vegetables and fruits production in the region. It is thus among the leading vegetable and fruits crops grown zone in the region. Thirdly, after the first introduction of cash crops such as vegetables and fruits, many farmer have been engaged

in cash cropping in a small land size and their livelihood have been becoming dependent on such activities . However, farmers are frequently claiming that they are facing market problem severely apart from others. It was, thus, having these back ground that the researcher decided to conduct the study on the assessment of marketing system of vegetables and fruits. Specifically, Raya kobo and Harbu woredas were the main focus area of the study due to their major contribution of vegetable and fruit production in the zone.

Raya Kobo is one of the nine woredas found in Northern Wollo. It has a longitude and latitude of 12°09N 39°38 E with an elevation of 1468 meters above sea level. Its administrative center is Kobo town. It is located along Addis Ababa-Adigrat highway, 570 kilometers away from Addis Ababa in North East direction. This Woreda comprises 43 kebeles; out of those kebeles , five of them (namely Ayub, Aradom, Adisalem, Amaya and Abare) were major producers of vegetables and fruits.

Harbu is also one of the nine woredas found in the Northern Wollo. The altitude of this woreda ranges from 700 meters above sea level where the Mille enters the Afar Region, to 1900 meters at its westernmost point. It is located along the Addis Ababa-Adigrat highway, to North East direction of Addis Ababa. This Woreda includes 34 kebeles: out of those, five kebeles (namely Grana(018), Buhoro(09), Wute(08), Libso(014), Yeabyot and Fre(06)) were main growers of vegetables and fruits.

3.2 Source of data and sampling techniques

To meet the objectives of the study, both qualitative and quantitative approaches to data collection and analysis were employed. This is due to the fact that employing both qualitative and quantitative approaches in the study yields more evidences than the sum of the two approaches used separately.

Secondary data

As a supportive for primary data, secondary data were gathered from different official data sources. This helped the researchers to minimize and cross check the problem occurred during primary data collection. However, the explicit analysis part using those data is excluded just to minimize size of paper but used implicitly for crosschecking, sample selection and observing regional, national picture of vegetables and fruits marketing and production trends. Data on total land size and population types for econometric analysis were used from these sources.

Primary data

Primarily, the data for this study was collected from primary source using multiple data gathering instruments such as structured house hold level survey/questionnaires, In-depth interview, and Focus group discussion, Observation/field visit. It was collected through informal and formal surveys from key informants such as farmers, rural assemblers, brokers, whole sellers, retailers, final users/consumers, experts, development agents, office heads etc. The main data types/information collected include production, buying and selling, pricing, input delivery and distribution, market participation, problem and opportunities, characteristics of the market etc. Besides, secondary data on total land size and population types were consulted.

To ensure data qualities, the data collectors selected and interviewed those actors who have been involved in the activities for long period at least for 2 years. In addition to having quantitative data, especially price and supply data, the data collector crosschecked primary and secondary data. Whenever variation occur further discussion with the respondent was carried out.

Sampling techniques and procedures in each categories

The sampling element covered farmers, rural assemblers, whole sellers, brokers, retailers, consumer, development agents and experts on propionate to size basis.

Farmers sampling

In order to reach at the selection of the final sample households for the study, a combination of different sampling methods were employed. Initially, stratified multistage cluster sampling was used for sample selection. Therefore, at the first stage of sampling, two wordas were chosen from the zone based on purposive sampling which were chosen on the basis of some judgmental criteria such as their significant contribution of vegetables and fruits production in the zone as well as in the region and others justifications mentioned in study area description part). Next, 10 kebeles in total were selected from the two woredas. These 10 Kebeles (five from each woredas) were selected by purposive sampling (chosen on the basis of some judgmental criteria such as agro-climatic conditions, and geographical coverage and intensity of vegetable and fruit production (based on secondary data). The selected sample kebeles were Ayub, Aradom, Adisalem, Amaya and Abare from Raya-Kobo; Grana(018), Buhoro(09), Wute(08), Libso(014), Yeabyot and Fre(06) from that Harbu Woreda.

Finally, from the given list of farmers from those 10 kebeles, 100 households were randomly selected proportional to number of households per kebele. It was just to collect data on farmers' willingness to participate or not in both vegetables and fruits. Here, it was assumed that farmer' participation in both vegetables and fruits production.

Again, the same procedures were followed to choose farmers who supply their products to the market .Accordingly, 100 farmers from the two woredas were selected randomly from the list of farmers who are jointly supply both vegetables and fruits only. Respondent sample size per each Kebele was determined proportionally to the number of total onion and/or tomato, mango and/or avocado growing farmers per Kebele. Moreover, five experts/development agent/ workers were interviewed.

Rural assemblers, wholesalers, and brokers sampling

It was estimated that about 20 rural assemblers, 10 brokers, and 30 wholesalers used to participate in the marketing of the vegetable and fruit crops (based on rough informal assessment from Woredas' trade office).

However, it was believed to take arbitrarily five from each for detail interviewing. In fact, frequent rapid informal and observational surveys were also followed.

Retailers' sampling

The sample frame was developed by taking a count of vegetable retailers in the two main retail markets; Woldia and Dessie (selected due to their significant contribution of the market destination of the two products comes from the study area). Based on rough informal assessment from Woreda's trade office, it was estimated that 80 vegetable and 50 fruit retailers are found at Dessie; 60 and 30 at Woldiya; 20 and 10 at Kobo; 15 and 20 at Mersa central markets. After estimating the number of retailers, a proportion to size was taken and 30 from Dessie, 20 from Woldia, 15 from Kobo and 15 from Mersa were randomly selected. Finally, 80 retailers from the four towns in both vegetable and fruit crops were interviewed.

Consumers' sampling

The consumers' survey was meant to understand the demand behaviour for the products. The survey was taken from four major receiving towns namely, Woldiya, Dessie, Kobo and Mersa. 80 respondents were interviewed in the four towns through proportionate to size sampling technique. Accordingly, 30 respondents from Dessie; 20 from Woldiya; 15 from Kobo and 15 from Mersa for both vegetables and fruit crops were randomly selected and interviewed.

Finally, a total of 380 households in different categories were randomly included in the sample study.

3.2 Methods of data analysis

After collection of relevant data from various actors in vegetable and fruit marketing for each category such as farmers, traders and consumers using various data collection instrument, the data was managed in the following manner. Information collected through key informant interviews, rapid observation and focus group discussions were qualitatively analyzed. The

quantitative household survey data were coded and entered in to a computer for analysis using a computer software program called STATA version 11. Accordingly, the methods of analysis included both descriptive and econometric method.

3.3 Econometric models

This section attempted to cover model specification part of the current study for the analysis of understanding the factors determining production participation, volume of the vegetables and fruits supplied to market and demand analysis. It also devoted to describe the data nature and variable employed to estimate the specified models for this study. For analyzing this, probit estimation for participation probability and multiple regression OLS estimation technique for the rest two (determinant of market supply level and demand for vegetable and fruits) were employed.

A. Econometric model for production participation

Since the dependent variable (production participation is a qualitative with response of “yes” or “no” type. It is customary and appropriate to use discrete choice models dealing with such kind of binary responses are called binary choice models. Empirical works have provided a number of factors that affect farmers in production of vegetable and fruit crops. To analyze factors embedded in deciding participation, eleven variables were proposed for each crop. Accordingly, the basic formulation of model equation of this study is as follows:

$$Y_i = 'X_i + U_i - \tag{1}$$

Y_i – Is unobservable latent variable, $Y_i = 1$ when, $i Y > 0$ (Participated), $Y_i = 0$ Otherwise (Not participated)

Where,

Y_i is dependent variable - Participated or not participated; X_i is the explanatory variables listed under.

U_i : error term

B. Market supply model

A number of factors could influence the volume of vegetable and fruits to be supplied to a Market. Among the different variables that would explain market supply, the most important variables, (according to the reviewed literature) include family size, educational level, sex of household head, extension service, cash income from other crops, oxen number, production level, total size of land holding, distance to market, product prices (both current and previous), market information, the relative importance of the crop in question and others. However, it must be noted that the importance of these variables in explaining market supply level could be different depending on the crop type, region/area of production and degree of commercialization. As a result, taking into account specific situations at Raya Kobo and Mersa (better degree of farmers commercialization, high marketable proportion), it was decided to include age, sex of respondent, total size of land owned, family size, experience, distance from road, oxen ownership, market information, distance from development agent as determinants for volume of market supply for both vegetable and fruit crops.

Table 1: Variable and data description for production participation and market supply in vegetable and fruit

| Name of explanatory variable | Variable nomination | Definition | Measurement | Expected sign |
|---------------------------------|---------------------|---|---|---------------|
| Age | ag | Age of respondent which is continuous variable | Continuous variable measured in number years | +ve |
| Sex | sx | Sex of the respondent | Dummy variable 1 if male and 0 if female | Not expected |
| No of oxen | no_ox | This is a continuous variable | measured in number oxen a Farmers own | +Ve |
| Education level | edu | School attainment of the respondent | Measured in number of year in school | +Ve |
| Total size of land | tot_sl | Land size of the farmer | In hectare | +ve |
| Family size | fn | a continuous variable | measured in terms of number of family members in the household | +ve |
| Distance from Development Agent | dis_da | intensity of extension service/frequency of getting them for advise and others | Continuous variable measured in number of frequency of contact with development agent | -Ve |
| Distance from main road | dismr | It is the distance of the vegetables producer households from the nearest market | it is measured in hours of walking time or number of kilometer | -Ve |
| Lagged price | af_olp | Last year price /2013/ | Measured in kilo and Birr | + Ve |
| Extension service | ext_s | dummy variables (get or not) accessibility /coverage | Yes = 1 , No = 0 | +Ve |
| Experience | f_ex | Continuous variable an experience farmers/ years staying on farm production of vegetable and fruits | Measured in number of years | +Ve |
| Market information | mi | dummy variable | 1 if get information other wise 0 if not | +Ve |
| Income from other crops | in_oc | Continuous variable income earned by a farmer from off farm activity and other sources | Measured in Birr | - Ve/+Ve |

In this study, multiple linear regression models was used to analyze factors affecting farm level vegetables and fruit supply to the market in the study areas because of all vegetable and fruit producers participate in the market. Econometric model specification of supply function in matrix notation is the following. The estimation model is given as follows.

$$Y = X' + U \quad (2)$$

Where, Y = quantity of vegetables supplied to market; X' = a vector of explanatory variables

= a vector of parameters to be estimated; U = disturbance term

C. Econometric model for demand analysis

Different kinds of models can be used to analyze demand or consumption. These incorporate both single and systems of demand equations (FAO, 2003). The single equation models specify uncompensated demand equations.

The general demand functions can be generalized for a consumer buying n goods as:

$$Q = Q_i (P_1, P_2, \dots, P_n, I) = \quad (3)$$

Where, Q_i is quantity demanded; P is price; i denotes commodities, and I income.

Extending the demand function for individual consumers to that for a group of consumers in most empirical applications requires the inclusion of demographic variables besides prices and income (FAO, 2003). It is generally acknowledged that income and price are by no means the sole determinants of food consumption, although they are normally the easiest to measure. But there are many additional factors influencing food consumption like need, tastes and preference etc.

Elasticity applies to demand equations in which the dependent variable is quantity purchased (or specific use such as consumption) (Ferris, 2005). The log-log demand models enjoy a long history in empirical work. Its coefficients are elasticities (Asche *et al.*, 2005; Durham and Eales, 2006). In equations of log-log functional form, the coefficients are elasticities if the dependent variable is quantity purchased or consumed (Ferris, 2005).

$$\ln Y_i = \beta_0 + \sum \beta_i \ln X_i + U_i \quad (4)$$

Where, $\ln Y_i$ - natural logarithm of vegetable/fruit i consumed;

$\ln X_i$ –natural logarithm of explanatory variable

β_i – vector of explanatory variables, β_0 -intercept term, U_i - random term

In this model, the advantage of elasticities is that they represent relationships between percentages and the specific units involved do not have to be known.

Table 2: Variable and data description for determinant of demand for vegetable and fruit

| Name variable | Variable nomination | Definition | Measurement | Expected sign |
|--|----------------------------|---|---|----------------------|
| Monthly average consumption | lncon | dependent variable expressed as an average kilogram of onion or tomato consumed per household taking August 's month as a Representative. | in kilogram | Dependent variable |
| Family size | lnfn | the total number of family members under a household | a continuous variable expected to take positive coefficient | +ve |
| Income | lnmin | It is continuous variable expected to influence consumption level positively | Average monthly in terms of Birr | +Ve or -Ve |
| Price | lngapo | price of specific vegetable/ fruit crops | Current average price per Kilo in Birr | -ve |
| Purchase frequency | lnpurchfre | a categorical dummy. The more frequent a household purchased, the more quantity would consume | Take continuous numerical value | +Ve |
| Average expenditure on food | lnavgexpf | continuous variable | measured in Birr | +ve/-ve |
| Amount of vegetable/fruit purchased per trip | lnapuchpt | the quantity of a vegetable/fruit, a household purchased per single purchase. | It is a continuous variable measured in kilograms | + Ve |

Note: ln represents logarithmic expression

4. Result and Discussion

4.1 Descriptive analysis

4.1.1. Production

Among the total 100 sample respondent farmers, the majority of vegetable growers are joint producer of onion and tomato. The same is true in case of fruit producers, they involved primarily in production of both mango and avocado crops.

Moreover, age of respondents' ranges from 20 to 40 and 22 to 70 for vegetable and fruit growers respectively and its average is 40 and 44 for vegetable and fruit growers respectively. Out of 200 sample vegetable and fruit growers, 88 male and 12 female, 75 male and 25 female involved in vegetable and fruit production respectively. The average family size is 4 and 5 vegetable and fruit crop producers. Average educational level of respondents is grade 1 and 2 for vegetable and fruit growers respectively. The respondents' farm size also ranges from 0.3 to 1.5 hectare and 0.2 to 0.75 hectare for vegetable and fruit producers and its mean is 0.5 and 0.3 hectare for vegetable and fruit growers respectively. In terms of allocation for specific crops, majority of the respondents land size is allocated for Teff and Sorghum in Raya Kobo Woreda and Teff and Maize in Harbu woreda. As compare to other non-vegetable and fruit crop land size like Teff, sorghum, maize etc, the land allocated for that vegetable and fruit is smaller in size.

Farmer's access to main road and market was found very limited due to poor road network and limited transport services. Power shortage, limited access and discontinuity were other challenges they face in their production activities. More than 70% of the respondent in both vegetable and fruit production didn't have any market information and considered as a very serious challenges and there by forced them to be exploited and cheated by brokers and other middle men. About 80 % of the respondent replied that they did not have access to credit service in fruit and vegetable producers. However, 88% and 64% of the respondent had access to extension in fruit and vegetable producers respectively.

Furthermore, according to rapid assessment during the survey period and information from Woreda agriculture office, the major suppliers of vegetable and fruit production in the study area are small land size holder farmers. There are some practices of supplying in cooperatives but very limited. The survey result showed that even if there are some improvements in farming system, still most farmers are following traditional system in their vegetable and fruit production process. There are sign of being reluctant to use fertilizer and best variety seeds. Hence, the responses from the respondents lead us to infer that mixed farming system (modern with less level and traditional with significant weight) is common farming practices in the sample study area in both vegetables and fruit productions. Government intervention through extension services has resulted in some improvement in production side but it was observed as limited in coverage and poor in quality due to various reasons.

Using frequent rapid field survey supported with group discussion and key informant survey, various problems were identified either they are production or marketing aspect. These can be summarized as a biotic such as market problem and perishability (high post-harvest loss and biotic (disease, insects and weeds).

Different aspects of marketing infrastructures such as standard and grades⁶, packaging⁷, handling systems, transportation etc, were also examined during the survey. Sacks are the most widely used packing materials for transporting vegetables. Onion is loaded on trucks using these sacks. Wooden boxes called it locally as 'kassa/satara/ satin' that have a carrying capacity of around 50 kg are used for transporting tomatoes. But, onion can be loaded on trucks without any packing materials. Retailers do not apply packing materials when they sell for consumers. Similarly, Wooden boxes called it locally as 'kassa/satara/ satin' that have a carrying capacity of

⁶ Agronomically, quality and long shelf life starts from production though no clear set quality standards found in study area in both vegetable and fruit growers. The expected vegetable and fruit quality include freshness, visually attractiveness, size, color, variety, neatness (spot free) and so on.

⁷ Packaging materials play important role in keeping freshness, reducing loss and damage of produces during transportation and storage

around 50 kg are used for transporting for mango and avocado. In terms of transportation⁸ modes, ISUZU, Minibus, animal backs and FSR are commonly used for fruit in descending order in both market destinations *i.e* Woldia and Dessie. While, Minibus, ISUZU and animal backs are the commonly used for vegetables in descending order in Dessie. However, ISUZU, Minibus, animal backs and FSR are the commonly used for vegetables in descending order in Woldia. Yet, shortage of transportation service, poor infrastructure, and power discontinuity were reported as infrastructural facilities constraints in the study area. During the survey period, it was also observed that there was no scientific proper post and pre-harvest handling practices partly due to shortage of storage facilities in the study area for both vegetable and fruit growers.

However, some opportunities were also observed in the study area that can be harnessed to improve the marketing system. Among the different opportunities that exist, the trend in the growth of production and marketing tradition in the area, experience (learning effect) and neighborhood effect (much more important in technology adoption), natural advantage of proximity to main road, Woldiya and Dessie, plainness, and excess ground water, conducive climate condition, the existence of good policy framework in agricultural development manifested by deploying development agents at each Kebele (even though its coverage and quality is still limited), and recent infrastructural development, the increasing use of mobile telephone and development of wireless telephone, the opportunity of different buyers come from different areas of the country like Tigray and Afar Regional state, even from Addis Ababa creating a confidence to farmers.

4.1.2 Marketing system

To have full picture and understanding of how a certain market is functioning, the analysis of marketing system of any crops should include three main components of market: namely market structure, market conduct

⁸ The transportation facilities in the study area have a great role in every activity of vegetable and fruit growers. They facilitate the conveying of products from farm to market place, source of energy for water supply and generating underground water for irrigation purpose

and market performance which can be again manifested by different indicators explained below in details.

A. Market structure

It can be analyzed based on the numbers and sizes of enterprises within the system, and the potential access of additional participants to it (licensing procedure, lack of capital and know how, and policy barriers) and the degree of transparency (Pender *et al.*, 2004). Accordingly, the structure of the market has been analyzed as follows.

i) Market participants

In this study, different vegetable and fruit market participants were identified in the exchange functions between farmer and final consumer. Hence, producer, local collectors, wholesalers, retailers, processors and final consumers of the product were identified as market participants in the study areas with different character, profit margin, unequal information access and unhealthy marketing interaction from farmers to end users. Market Concentration⁹ ratio was not calculated for both vegetable and fruit crops since the number of sampled whole sellers in study were small.

ii) Barrier to entry

According to the rapid appraisal, almost all of the retailers and rural assemblers had no license. Even the wholesalers did not have. The few wholesalers that were with licensing were those that supplied to institutions on bidding. In fact, all paid some amount of money every year as per the Inland Revenue decision. As disclosed from North and South Wollo Zones trade offices, retailers were not claimed to have business license, what was done was to register them in commercial registration. Wholesale market seemed to have no barrier to entry but an indirect blocking by the existing wholesalers to the new entrant not to get buyer (retailing client). In the case of retailers, entry was free but stall was a limiting factor.

⁹ Market concentration indicates to the number and relative size distribution of buyers and sellers in the market. For an efficient market, there should be sufficient number of firms (buyers and sellers); firms of appropriate size are needed to fully capture economies of size; there should be no barriers to entry into and exit from the market and should have full market information

The skill to manage customers, skill of lobbying selling and buying customers, 'skill' of cheating protect anybody to enter the business were considered by respondents as limitation in their business. Capital at retailers' level was not observed basic though necessary. In the case of wholesalers, there is a possibility to take credit from banks yet not an easy way and inadequate in size.

B. Market conduct

In this study, market conduct¹⁰ of vegetable and fruit market is analyzed in terms of the traders' and price setting, group forming, purchasing and selling strategies. The buyers' behaviour evaluated based on some selected parameters of loyalty, better price provision, immediate payment behaviour, bulk purchase, and production credit. Misbehaving is common characteristics of buyers. The perishability of the products exposed farmers for a wide range of cheating. The respondent farmers were asked whether they perceived cheating or not and they reported as it was a day-to-day phenomenon. Wholesalers and brokers were the leading cheaters. The cheating type included price, weight, defaulting an agreement, and any combination of these.

Based on the result obtained from group discussion with respondent farmers, their selling strategy was as immediately as to any buyer brought by brokers. They sold to anybody as far as he offered better price. However, the intervention of brokers influenced them to get good buyers directly. There was also no any contract-based marketing.

More than 70 % of respondent farmers had no accesses to market information from different sources on price and buyers. Lack of genuine and timely market information was observed as their critical problem in the study in both vegetable and fruit production which requires appropriate intervention.

¹⁰ Market conduct refers to the patterns of behavior of firms. This implies analysis of human behavioral patterns that are not readily identifiable, obtainable, or quantifiable (Pomeroy and Trinidad, 1995). There are no agreed upon procedures for analyzing the elements of market conduct. Rather, some points are put to detect unfair price setting practices and the conditions under which such practices prevail

Traders' behaviour was also observed as unpredictable because their main objective is profit maximization. They want to buy bulky product with low price .Since the vegetable and fruit products are highly perishable, farmers forced to sell their product with very cheap price which doesn't cover even their cost of production .Sometimes, they may drop it when the product highly spoiled. Furthermore, according to rapid assessment during the survey period, it was observed that there was no explicit forming of legal and illegal grouping among farmers, whole sellers, retailers and brokers rather they prefer to work independently since all are profit oriented which violates rule and regulation of trading system. However, there are some illegal traders who work informally.

C. Market performance

Similarly, marketing performance can be analyzed by different indicators. However, for this study marketing margin and channel comparison were only used.

i) Marketing channel

The analysis of marketing channels was intended to provide a systematic knowledge of the flow of goods and services from its origin, producer, to final user, consumers. Accordingly, the study has tried to identify the different marketing channels or alternative routes the product follow from the point of origin to final destination i.e. Woldiya and Dessie vegetable and fruit market. The main marketing channels identified were:

- ***Vegetable marketing channel (onion and tomato)***

Channel 1: Farmer consumers (6.5 %)

Channel 2: Producer Broker wholesaler consumers (8%)

Channel 3: Producer Broker wholesaler retailers consumers (83.5%)

- ***Fruit marketing channel (mango and avocado)***

Channel 1: Farmer consumers (7.5%)

Channel 2: Producer Broker wholesaler consumers (10%)

Channel 3: Producer Broker wholesaler retailers consumers (82.5%)

The first channel is used by local smallholders to sell their vegetables and fruits. The amount of vegetables and fruits supplied through these channels account for 6.5% and 7.5% of the total vegetable and fruit transaction of the market respectively. The larger portion of the transaction is conducted using the third channel in both crops case. However, there are additional channels which are rarely practiced in the study area in both vegetable and fruit market. These are Farmer –Rural assembler- Wholesaler – Consumers, Farmer -Wholesaler-Out of region, Farmer – Rural assembler—Retailer—Consumer, Farmer – Rural assembler – Wholesaler—Retailer – Consumers. As a result, the long market channel observed in both vegetable and fruit market which made much of the profit to be taken by whole sellers and other middlemen like brokers and assemblers.

ii) Market margin

Cost and price information was used to construct marketing cost and margin. This is going to be analyzed using marketing costs and benefit share of actors in vegetable and fruit value chain.

As it is indicated in Table 3, in Woldia; in case of onion, the share of profit for farmers, whole sellers and retailers is 11%, 37% and 52% respectively. For Tomato, it shows that 11%, 58% and 31% for farmers, whole sellers and retailers respectively. Moreover, in case of fruit, it exhibits that 29 %; 41%; 30 % and 9%; 26.5%; 64.5% for mango and avocado consecutively.

In a similar fashion, in Dessie as illustrated in Table 4; the share of profit for farmers, whole sellers and retailers is 15%; 57.5%; 27.5% respectively for onion. For Tomato, it shows that 12% 52% and 36% for farmers, whole sellers and retailers respectively. Similarly, in case of fruit, it exhibits that 22 %; 48%; 30 % and 11%; 51.5 %; 37.5% for mango and avocado consecutively. In all cases, it indicates that the lion share of profit is taken by retailers and whole sellers without adding any value to it. This implies that the longer the market channel, the more the farmers are going to be exploited by the unnecessary channels or they get lower price/unfair for their products as compared to other middlemen. Hence, appropriate measures are needed here to enable farmers to get fair price for their products.

Table 3: Shares of actors' cost and benefit for vegetable and fruit marketing in Woldia

| Market Name: Woldia | | | | | | | | | | | | | |
|--|-----------------|----------------------|------------------|-----------------|----------------------|------------------|-----------------|----------------------|-----------------|-----------------|----------------------|------------------|--|
| Vegetable type: Onion, Tomato , Mango and Avocado | | | | | | | | | | | | | |
| Channel: 3 | | | | | | | | | | | | | |
| Crop type | Onion | | | Tomato | | | Mango | | | Avocado | | | |
| Actors/ Item (Birr/kilo) | Producer | Whole sellers | Retailers | Producer | Whole sellers | Retailers | Producer | Whole sellers | Retailer | Producer | Whole sellers | Retailers | |
| Production cost | 2.50 | | | 4 | | | 5.20 | | | 3.20 | | | |
| Purchasing price | | 4 | 7.50 | | 7 | 14 | | 8 | 12 | | 4.20 | 7 | |
| Marketing cost | | | | | | | | | | | | | |
| Transport | 0.4 | 0.60 | 0.40 | 0.80 | 0.60 | 0.40 | 0.20 | 0.40 | 0.30 | 0.20 | 0.50 | 0.40 | |
| Other costs (loading, unloading, broker fee) | 0.3 | 0.10 | 0.20 | 0.50 | 0.10 | 0.20 | 0.10 | 0.10 | 0.20 | 0.10 | 0.10 | 0.30 | |
| Total marketing cost | 0.70 | 0.70 | 0.60 | 1.30 | 0.70 | 0.60 | 0.30 | 0.50 | 0.50 | 0.30 | 0.60 | 0.70 | |
| Actor's average per unit cost | 3.20 | 4.70 | 8.10 | 5.30 | 7.70 | 14.60 | 5.50 | 8.50 | 12.50 | 3.50 | 4.80 | 7.70 | |
| Average selling price | 4 | 7.50 | 12 | 6.50 | 14 | 18 | 8 | 12 | 15 | 4.20 | 7 | 13 | |
| Marketing margin | 7.30 | 7.30 | 7.40 | 10.20 | 13.70 | 17.40 | 7.70 | 11.50 | 14.50 | 3.90 | 6.40 | 12.30 | |
| Price difference | 8 | | | 11.50 | | | 7 | | | 8.80 | | | |
| Marketing cost as% of price diff | 8.75% | 8.75% | 7.5% | 11.30% | 6% | 5% | 4.28% | 7% | 7% | 3.4% | 6.8% | 8% | |
| Marketing margin as% of price differ | 91.5% | 91.5% | 92.5% | 88.7% | 94% | 95% | 96% | 93% | 93% | 96.5% | 93% | 92% | |
| Actor's profit | 0.80 | 2.80 | 3.90 | 1.20 | 6.30 | 3.40 | 2.50 | 3.50 | 2.50 | 0.70 | 2.20 | 5.30 | |
| Actor's share of total profit | 11% | 37% | 52% | 11% | 58% | 31% | 29% | 41% | 30% | 9% | 26.5% | 45% | |
| Actor's share of average per unit profit | 20% | 37% | 32.5% | 18% | 45% | 19% | 31% | 29% | 17% | 17% | 31% | 40% | |
| Producer's share of retailer price on average | 33% | | | 36% | | | 53% | | | 32% | | | |

Source: Estimated based on survey data

Efficiency in marketing¹¹ is also the most used measure of market performance. The marketing efficiency was examined in terms of the price difference¹² (consumer price less price received by producer/farmer), marketing cost, and margin (price difference less marketing cost) for fruits and vegetables in the study. Therefore, the marketing cost and margin have been expressed as percentage to the price difference. The efficiency indicators thus obtained showed that in Woldia markets, the marketing cost for onion, tomato, mango and avocado varied between 7.5% to 8.75%; 5% to 11.30%; 4.28% to 7% and 3.4% to 8% respectively while in Dessie market, the marketing cost for onion, tomato, mango and avocado varied between 10% to 16.7%; 6% to 8%; 3% to 7% and 4% to 9% respectively.

The margin as a percentage of farmer-consumer price difference shows that the margins are very high in many cases but vary across the locations. In both market destinations (Dessie and Woldia), the margins are very high for all actors in the both vegetables and fruit crops market. The high percentage of margin to price difference is indicative of possible large trade profits (or inefficiencies), and poor marketing efficiency in fruits and vegetable (see the details in Table 3 and 4)

¹¹ Improved marketing efficiency is a common goal of farmers, marketing organizations, consumers and society. It is a commonplace notation that higher efficiency means better performance whereas declining efficiency denotes poor performance. Most of the changes proposed in marketing are justified on the grounds of improved efficiency (Kohls and Uhl, 1985).

¹² Variation in price difference and margin in absolute terms for the same commodity in different markets could be partly attributed to the varieties chosen for the study.

Table 4: Shares of actors' cost and benefit for vegetable and fruit marketing in Dessie

| Market Name: Dessie Channel: 3 | | | | | | | | | | | | |
|---|----------|---------------|-----------|----------|---------------|-----------|----------|---------------|----------|----------|---------------|-----------|
| Crop Type Actors/ Item (Birr/kilo) | Onion | | | Tomato | | | Mango | | | Avocado | | |
| | Producer | Whole sellers | Retailers | Producer | Whole sellers | Retailers | Producer | Whole sellers | Retailer | Producer | Whole sellers | Retailers |
| Production cost | 2.50 | | | 1.20 | | | 5.20 | | | 3.20 | | |
| Purchasing price | | 4 | 8 | | 2.80 | 10 | | 8 | 14 | | 4.20 | 8 |
| Marketing cost | | | | | | | | | | | | |
| Transport | 0.4 | 0.80 | 0.30 | 0.60 | 0.60 | 0.40 | 0.20 | 0.50 | 0.40 | 0.20 | 0.50 | 0.40 |
| Other costs (loading, Unloading, broker fee) | 0.3 | 0.20 | 0.30 | 0.20 | 0.10 | 0.20 | 0.10 | 0.10 | 0.30 | 0.10 | 0.10 | 0.30 |
| Total marketing cost | 0.70 | 1 | 0.60 | 0.80 | 0.70 | 0.60 | 0.30 | 0.60 | 0.70 | 0.30 | 0.60 | 0.70 |
| Actor's average per unit cost | 3.20 | 5 | 8.60 | 2 | 3.50 | 10.60 | 5.50 | 8.60 | 14.70 | 3.50 | 4.80 | 8.70 |
| Selling Price | 4 | 8 | 10 | 2.80 | 10 | 13 | 8 | 14 | 18 | 4.20 | 8 | 12 |
| Marketing Margin | 5.30 | 5 | 5.40 | 9.40 | 9.50 | 9.60 | 9.70 | 9.40 | 9.30 | 7.50 | 7.20 | 7.10 |
| Price difference | 6 | | | 10.20 | | | 10 | | | 7.80 | | |
| Marketing cost as% of price d/ce | 11.7% | 16.7% | 10% | 7.8 % | 6.9% | 6% | 3% | 6% | 7% | 4% | 7.7% | 9% |
| Marketing margin as% of price d/ce | 88% | 83 % | 90% | 92% | 93% | 94% | 96% | 94% | 93 % | 96% | 92% | 91% |
| Actor's profit | 0.80 | 3 | 1.40 | 0.80 | 3.50 | 2.40 | 2.50 | 5.40 | 3.30 | 0.70 | 3.20 | 3.30 |
| Actor's share of total profit | 15 % | 57.5% | 27.5 | 12% | 52% | 36% | 22% | 48% | 30% | 11% | 51.5% | 37.5% |
| Actor's share of average per unit profit | 20% | 37.5% | 14% | 28.5% | 35% | 18.5% | 31% | 26% | 18% | 17% | 40% | 27.5 |
| Producer's share of retailer price on average | 40 % | | | 21.5% | | | 44% | | | 35% | | |

Source: Estimated based on survey data

4.2 Results of Econometric Analysis

In this part, major results and explanations of econometric analysis for production participation, determinants of market supply and demand are given. The estimation and analysis was done separately for each crops (onion, tomato, avocado and mango).

Tests

For each models, various appropriate tests were conducted .Among these, test for multicollinearity; All VIF values are less than 10. This indicates absence of serious multicollinearity problem among independent continuous variables (Table 4). Again, since there is heteroscedasticity common problem in the cross sectional data set, the parameter estimates of the coefficients of the independent variables may not be BLUE (Best Linear Unbiased Estimator). Hence, to overcome the problem, Robust standard error OLS analysis with heteroscedasticity consistent covariance matrix was estimated.

4.2.1 Production participation

Estimation of production participation decisions was made with probit. Hence, the regression result indicated in Table 5 shows that in case of onion, family size, total size of land, extension service, farmer's experience, and average lagged price were found to be significant in line with hypothesized sign. While, total size of land, extension service and distance from main road were the only factors that influence production participation in tomato crops same as hypothesized in the theory.

Age, family size, total size of land, extension service and farmer's experience are the significant factors with expected sign except age factors that affect mango production participation. Yet, total size of land, extension service and farmer's experience were only found to be significant with expected sign for avocado production.

As farmer's experience increased by one year, the probability to participate in onion, mango and avocado production increased by 0.03 (or 3%), 0.01(1%) and 0.01(1%) respectively. As lagged price increased by one Birr per kilogram, the probability to participate in onion production will increases by

0.05 (or 5 %). As farmer get extension service, the probability of participating in onion, tomato, mango and avocado production would increase by 0.67(or 67%), 0.69(or 69%), 0.61(or 61%) and 0.37(or 37%) respectively. Similarly, as total size of land increases by one hectare, the probability of participating in onion, tomato, mango and production would increase by 0.30(or 30%), 0.45(or 45%), 4.1(or 410%) and 0.69(or 69%) respectively.

Table 5: Production participation regression results for of both vegetables and fruits

| Variable /coefficient | Onion | | Tomato | | Mango | | Avocado | |
|-------------------------|--------------------|-----------------|--------------------|-----------------|-------------------|-----------------|-------------------|-----------------|
| | coefficient | Marginal effect | coefficient | Marginal effect | coefficient | Marginal effect | coefficient | Marginal effect |
| ag | -.04 (-1.57) | -.01 | -.03 (-1.08) | -.00 | -.07 (-2.85)** | -.02 | -.03 (-0.94) | -0.00 |
| fn | .51 (3.3)* | .18 | .01 (0.11) | .00 | -.19 (1.89)*** | -.05 | .21 (1.31) | 0.01 |
| tot_sl | .85 (1.64)*** | .30 | 2.2 (1.76)*** | .45 | 15.46 (3.53)* | 4.1 | 9.9 (2.28)** | 0.69 |
| no_ox | .27 (1.01) | .09 | -.06 (-0.41) | -.01 | -.01 (-0.06) | -.00 | .03 (0.10) | 0.00 |
| ext_s | 2.02 (2.93)** | .67 | 2.8 (5.45)* | .69 | 2.2 (3.78) * | .61 | 2.6 (3.05)* | .37 |
| dismr | -.00 (-0.76) | -.00 | -.01 (-1.92)*** | -.00 | -.00 (-0.53) | -.00 | -.00 (-0.76) | -0.00 |
| f_ex | .10 (2.06)** | .03 | -.11 (-0.95) | -.02 | .06 (2.00)** | .01 | .26 (2.21)** | 0.01 |
| dis_da | .27 (1.36) | .10 | .10 (1.50) | .02 | .06 (1.55) | .01 | .05 (0.57) | 0.00 |
| af_olp | .14 (2.03)** | .05 | .16 (1.07) | .03 | .00 (1.33) | .00 | .06 (0.57) | 0.00 |
| _cons | -3.92 (-2.09)** | | .23 (0.23) | | -.72 (-0.66) | | -5.6 (-2.18)** | |
| Obs. | | | 99 | 100 | | 100 | | 99 |
| Wald chi2(9) = | | | 48.05 | 56.78 | | 42.57 | | 17.66 |
| Prob > chi2 = | | | 0.00 | 0.00 | | 0.00 | | 0.03 |
| Log pseudo likelihood = | | | -13.05 | -19.75 | | -21.03 | | -16.5 |
| Pseudo R2 = | | | 0.80 | 0.69 | | 0.70 | | 0.74 |

(Production participation/not for vegetable and fruit for each model as dependent variable)

The numbers in Parentheses are Z-value and *, ** and *** show at 1%, 5% and 10 % significance level respectively.

4.2.2 Market Supply

Eleven explanatory variables were hypothesized to determine the household level marketable supply of onion, tomato, avocado and mango in the study area¹³.

Onion & Tomato

Average price, distances from road, age and total size of land were found to be significant determinant of onion with expected sign except age. Possible reasons might be with age retirement, unfamiliar and reluctant to produce cash crops because they usually produce stable food crops like teff, maize and sorghum. In case of tomato, average price, distances from road, access to market information and total size of land were found to be significant with expected sign except for market information.

Table 6: Market Supply Regression results for of both vegetables and fruits

(Volume sold/market supply in kilo as Dependent Variable)

| Variable/Coefficient | Onion | Tomato | Mango | Avocado |
|----------------------|----------------|-----------------|----------------|----------------|
| ag | -.21 (-2.03)** | -0.37 (-1.51) | -.16 (-1.43) | -.03 (-0.60) |
| sx | 3.71 (1.22) | 2.38 (0.60) | -4.1 (-2.50)** | -1.92 (-1.50) |
| fn | -.26 (-0.31) | 0.58 (1.23) | 0.01 (0.02) | -.07 (-0.26) |
| edu | -.14 (-0.44) | .23 (0.40) | -.61 (-1.63) | .06 (0.45) |
| tot_sl | 16 (3.26)* | 41.73 (2.24)** | 36.69 (3.66)* | 17.17 (3.04)* |
| no_ox | -.06 (-0.08) | 1.74 (-1.23) | 2.24 (1.82)*** | .27 (0.64) |
| dismr | -.18 (-4.59)* | -.22 (-2.06)*** | 0.02 (0.69) | -.00 (-0.04) |
| f_ex | 0.06 (0.49) | .16 (0.77) | 1.08 (3.99)* | 1.20 (7.23)* |
| af_op | 4.52 (5.43)* | 3.02 (2.98)** | 1.33 (2.31)** | .94 (3.35)* |
| mi | .54 (0.24) | -4.52 (-2.28)** | -.58 (-0.35) | 1.14 (1.47) |
| in_oc | 0.00 (1.04) | 0.00 (1.69) | 0.00 (0.36) | .01 (1.96)*** |
| _cons | 16.53** (2.56) | 30.23* (14.78) | -3.82 (-0.57) | -3.43 (-1.06) |
| Obs | 100 | 100 | 100 | 99 |
| R ² | 0.71 | .77 | .83 | 0.95 |

The numbers in Parentheses are t-value and *, **and *** show at 1%, 5% and 10 % significance level respectively.

¹³ Onion and Tomato, Avocado and mango are produced mainly for market and all crops are important cash crops in Raya Kobo and Harbu Woreda farmers in general. According to the research report, all sample households are good suppliers of the commodity to the market.

Mango & Avocado

Average price, farmers' experience in fruit production and market supply, number of oxen, sex and total size of land were found to be significant with expected sign in case of mango. While, for avocado demand, average price, distances from road, age and total size of land was found to be significant with expected sign. Here, sex affects the market supply of mango negatively. It might be due to the fact that females are not common producers of fruit crops in the study area, i.e usually it is left for men.

4.2.3 Demand Analysis

The consumption analysis is based August as a representative period. The month was selected for easiness reason to remember that the survey was taken at end of august 2014). As Table 7 below exhibits, in case of onion demand, family members, purchase frequency and single purchase lot were significant with hypothesized sign at 1 percent level of significance. While family members, current average price and purchase frequency were found significant with expected sign for tomato demand.

Table 7: Consumption Regression results for of both vegetables and fruits

(log of consumption of vegetables and fruits for each model as dependent variable)

| Variable/Coefficients | Onion | Tomato | Mango | Avocado |
|-----------------------|--------------|--------------|----------------|-----------------|
| lnmin | -.11 (-1.04) | -.24 (-1.32) | .04 (0.53) | -.25*** (-1.95) |
| lnag | -.19 (-1.07) | .01 (0.10) | .26 (1.07) | .42 (1.01) |
| lnfn | .38 * (3.92) | .37* (2.83) | -.19* (-2.07) | -.15 (-1.06) |
| lngapo | .36 (1.55) | .58** (2.68) | .74** (2.72) | .09 (0.78) |
| lnpurchfre | .47 * (4.15) | .44** (2.80) | .43* (3.53) | .00 (0.04) |
| lnavgexpf | .14 (1.20) | .18 (0.82) | .04 (0.47) | .61 * (3.83) |
| lnapuchpt | 0.44* (4.41) | -.08 (-0.81) | 10 (0.47) | .73* (6.64) |
| _cons | -.20 (-0.18) | -.93 (-0.84) | -3.21* (-2.94) | -.02 (-0.01) |
| Number of obs = | 56 | 79 | 54 | 50 |
| R ² = | 0.84 | 0.46 | 0.30 | 0.75 |

The numbers in Parentheses are t-value and *, **and *** show at 1%, 5% and 10 % significance level respectively. All variables are in logs.

Similarly, family members, average current price, purchase frequency were found to significant as determinant of mango demand. Income level, average expenditure on food and purchasing amount per trip were found significant in case of avocado demand in the study area. In terms of sign, income level was found to be negative in avocado demand .One possible reason might be avocado is considered as inferior good by the respondent. Family member was also found with negative sign opposite to the hypothesized sign due to the fact that with family members rising, purchasing power of consumers is going to decline and results in falling of demand for mango if they considered it as luxurious good.

5. Conclusion and Policy Implications

5.1 Conclusion

The findings of this study paints to other previous study except in some cases. Major findings of the study exhibited that farmer's access to main road and market was very limited due to poor road network and limited transport services. More than 70% of the respondent in both vegetable and fruit production didn't have any market information. Hence, lack of genuine and timely market information was observed as their critical problem and there by forced them to be exploited and cheated by brokers and other middle men in the study area. Marketing infrastructures such as non scientific proper post and pre-harvest handling practices, poor packaging, inefficient transportation and power service were also observed as hindering factor for proper function of the marketing.

Moreover, marketing system of vegetable and fruit in study can be summarized using different indicators.

In both vegetable and fruit marketing, the loin share of profit was taken by retailers and whole sellers without adding any value to it. Channel 3 (Producer Broker wholesaler retailers consumers) is the dominant market channel in both vegetable and fruit. Moreover, the margins as a percentage of farmer-consumer price difference showed that the margin are very high for all actors in the market but slightly varies across the market

destinations which is an indicative of possible large trade profits (or inefficiencies) and poor marketing efficiency in fruits and vegetable.

The econometric regression result of this study exhibited that in case of onion, family size, total size of land, extension service, farmer's experience, average lagged price, and in tomato; total size of land, extension service and distance from main road were found to be significant in line with expected sign as production participation determinants. Moreover, for mango; age, family size, total size of land, extension service, farmer's experience and in case of avocado; total size of land, extension service and farmer's experience were the significant factors (with expected sign) of production participation determinants.

Similarly, the regression result for market supply determinant showed that for onion; average price, distances from road, age, total size of land and in tomato; average price, distances from road, access to market information and total size of land were found to be significant with except sign except age. Furthermore, in mango; average price, farmers' experience, sex, number of oxen, total size of land and in that of avocado; average price, distances from road, age and total size of land found to be significant with expected sign except sex in case of mango.

Finally, in case of demand for onion, family size, purchase frequency, amount of single purchase lot, and that of tomato; family members, current average price and purchase frequency were found as significant determinants. Besides, family size, average current price and purchase frequency were found to be significant determinate of mango demand. For avocado demand, income level, average expenditure on food and purchasing, and amount per trip found significant in line with expected sign. Hence, the results found in this study are clearly an indicative for taking appropriate measures in production side, market infrastructure, arrangements and institutions or any combination of them to improve the sub optimal functioning of the marketing system.

5.2 Policy Implications

This study's conclusion and inferences indicated that some interventions should be taken at least to improve the inefficient functioning of vegetable and fruit marketing system and enhance the participation of farmers in vegetable and fruit production. Those interventions could be long run or short run solutions. The market system improvements revolve around institutional, legal frames, market linkage, capacity building (education and training), and developing market infrastructure facilities. The following concrete intervention will improve the marketing system and enable fair and equitable distribution of the welfare generated from the marketing system: Market infrastructure should be improved through storage (go-down) facilities, cold storages, cold-chain facilities, road network, loading and weighing facilities. Besides, the market integration and efficiency can be improved by making up-to-date market information available to all participants through various means, including good market information systems and various media which facilities the markets. Additionally, to overcome problems in extension services, capital bottlenecks, business skill gap, lack of proper/scientific grading and standards, pre harvest and post-harvest loss/wastage, increase access to improved inputs, strengthening credit institutions, defining and setting quality parameters, standards, grades, and establishment of storage and processing facilities are possible options. Strengthening of cooperatives, institutionalizing the marketing system and the commission agents' functioning, provision of education and training, improve transparency of price setting and availing market information are the most promising interventions.

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