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Determinants of Market Outlet Choices of *Tef*

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Abstract: In Ethiopia, specifically in Dendi district *tef* is cash crop for majority of the smallholder farmers. and the supply of *tef* in the study area still can't satisfy the existing market demand and the farmers are not benefited from the market price. This study was aimed at analyzing the factors affecting market outlet choices of *tef* producers in Dendi district. The study largely uses primary data that were collected through structured and semi-structured questionnaire. Both descriptive statistics and econometric models were used. Multivariate probit model was used to identify the determinants market outlet choices. From descriptive statistics result six *tef* marketing channels are identified in the district. The multivariate probit model result indicated that educational level of household head, household size, livestock owned, equines owned, land area under *tef*, distance to the nearest market and current market prices of *tef* significantly influenced *tef* producers' choice of alternative market outlets. The probability of choosing wholesalers, consumers, collectors and cooperatives outlets are 64.4%, 41.6%, 39.1% and 51.1%, respectively. Wholesalers is the most likely chosen market outlet while collectors are the less likely chosen market outlet. The joint probabilities of the households to jointly choose the four market outlets was 4.1% which is lower than the likely of not choosing all market outlets which is 5.2%. Therefore, strategies aiming at promoting *tef* producers' marketing and outlet choices should focus on strengthening the technical skills, resource base, infrastructural and institutional capacity of smallholder farmers.

Keywords: Smallholders, Multivariate Probit, *Tef*, Market Outlet, Dendi

1. Introduction

1.1. Background of the Study

Since the majority of population in developing countries like Ethiopia is agrarian and the agriculture sector is the main source of their livelihoods, participation of these households in agricultural markets is anticipated to positively affect their wellbeing. In Ethiopia the agricultural sector contributes 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 livelihoods for about 83% of the rural population [1, 2]. In the agricultural sector, cereals cover about 80% of the total grain crop area (9.97 million hectares) and contribute about 87% (23.1 million tons) of the grain production. Among cereals, *tef* (Eragrostis *tef*) stands first in terms of land area, followed by maize and wheat [3]. Ethiopia is the center of both origin and diversity for *tef* [4].

Tef is a staple food and one of the most important crops for generating farm income, cultural heritage, national identity and nutritional security. *Tef* has the highest market value among all cereals grown and it is a source of cash income for Ethiopian small farm households. It is the second most important cash crop after coffee and generating almost 500 million USD income per year for local farmers [5]. Compared to other staples, the price of *tef* has increased at faster rate in recent years, hence the price gap between *tef* and other staples is widening. Brokers in regional markets work as agents of traders and negotiate prices and grade levels with farmers who often have limited bargaining power [6]. However, smallholder farmers are not benefited from price increment due to market problems.

Market access has been identified as one of the critical factors influencing the performance of smallholders'

agriculture in developing countries [7]. Marketing plays an important role in agricultural production and accessibility of the market for commodities allows specialization of production, which in turn increases productivity and efficiency. Well-functioning market leads to efficient allocation of scarce resources and maximization of the general welfare of the society. Proper functioning market will only occur when enough markets and efficient market outlets exist for the sale of produced output and no single entity can individually influence the price [8].

The study area is found in West Shewa zone of Oromia region, central Ethiopia. West Shewa zone is potential area of *tef* production in central Ethiopia. The land area covered by *tef* in the zone was 205,573.1 hectares and from it 3,808,745.7 quintals of *tef* was produced during 2015/16 production year. The productivity of *tef* in the zone was (18.53 qt/ha) is higher than the national and regional average which was (15.6 qt/ha) [3]. There is lack of information in terms of identifying the factors affecting market outlet choices of *tef* producer particularly in Dendi district West Shewa zone of Oromia region, one of the potential areas of *tef* production in Central Ethiopia. Such information is essential for making knowledge-based decision that are geared towards improving market participation of smallholder farmers in *tef*.

Various studies on market outlet choices [9-12] were conducted in different regions of Ethiopia on pulse and vegetable crops. However, the past studies did not address the market outlet choice problems of *tef*. Since *tef* is the most economically and socially crucial crop, there is a strong need to address the prevailing information gap and contribute to proper understanding of the demographic, socio-economic, institutional and infrastructural determinants of market outlet choices of smallholder farmers in Dendi district. So, this study identifies factors affecting market outlet choices of *tef* producers and address the knowledge gap in the study area.

1.2. Objectives of the Study

The general objective of this study was to identify factors affecting market outlet choices of *tef* in Dendi district of Oromia, Central Ethiopia whereas the specific objectives are:

1. To identify the *tef* marketing channels in the study areas;
2. To identify factors affecting *tef* market outlet choices of *tef*.

2. Research Methodology

2.1. Description of the Study Area

Dendi district is located in Oromia regional state of West Shewa zone, Central Ethiopia. Dendi district lies at about 80 km west of Addis Abeba. The district is geographically situated within 038^{0}10'54"E longitude and 9° 01'16"N latitude and at an altitude of 2200 meter above sea level. Dendi district is bordered on the south by Dawo and Wenchi, on the west by Ambo and Elfeta, on the north by Jeldu, and on the east by Ejersa Lafo districts (Figure 1). The district has a total of 38 kebeles, of which, 35 are rural and 3 are urban. According to [13] the total population of the study district is 200715, male and female households constitute 85.6% and 14.4%, respectively.

The total area coverage of the district is 79,936.29 hectares. Dendi district is endowed with favorable climatic and natural resource conditions that can grow diverse annual crops for household consumption and for the market. The district has two agro-ecologies; highland (29%) and midland (71%), indicating that the district is dominated by midland agro-ecology. In the district, mixed farming system of both crops and livestock is common economic activity [13]. Cereal crops grown in the district includes: *tef*, wheat, barley, maize and sorghum. The district is known for its highest production of *tef*. *Tef* production takes the lion share and main source of income generation to farmers in the district. Around the study area, there are three commonly known *tef* marketing centers, namely, Ginchi, Kidame and Asgori.

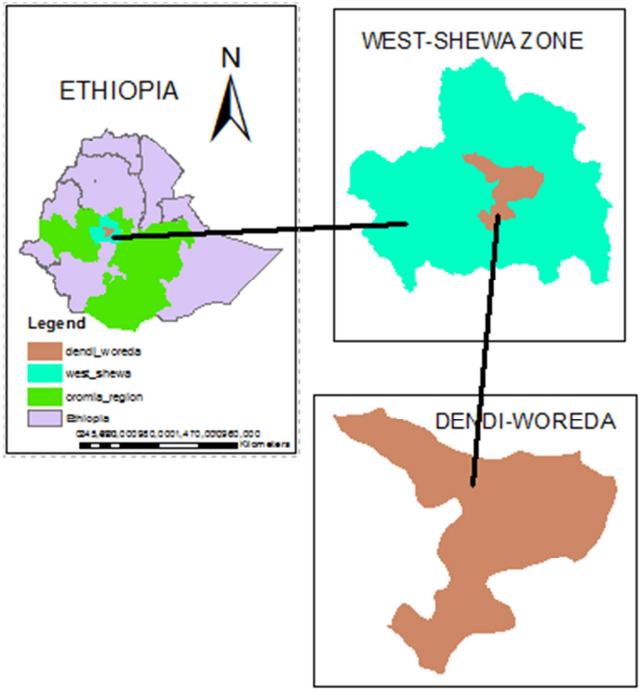


Figure 1. *Location of the study area.*

2.2. Data Types, Sources and Methods of Data Collection

Both primary and secondary data were used for this study. Primary data were collected from randomly selected *tef* producers in five rural kebeles, from *tef* traders and consumers in the district. The primary data collected from farmers were focusing on factors affecting market outlet choices, such as: demographic characteristics of the household, farming experience, livestock owned (TLU), equines owned (TLU), size of land allocated to *tef* production, distance to the nearest market, access to credit service, frequency of extension contact, non/off-farm income, current market price of *tef* and cooperative membership. Moreover, the interview schedule for *tef* traders includes:

demographic characteristics of traders, capital requirements, buying and selling activities. The interview schedule for consumers includes: demographic characteristics of consumers, source of income and buying activities.

Primary data were collected by structured and semi-structured questionnaires and by well-trained enumerators using Computer Aided Personal Interview (CAPI). In addition, checklist was used to generate data through group discussion. Secondary data on socio-economic information of the district, trends in agricultural production, opportunities and challenges of *tef* production and marketing were taken by reviewing secondary sources from published and unpublished documents of governmental institutions. Beside to these information, journals and websites were visited to generate relevant secondary information focusing on the objectives of the study.

2.3. Sampling Procedure and Sample Size Determination

The target populations for this study were smallholder *tef* producers, *tef* traders and consumers in Dendi district. Purposive and two stage random sampling procedure was used for the selection of sample household heads. Dendi district was selected purposively since it is the potential area of *tef* production in West Shewa zone, Central Ethiopia. In the first stage, five *tef* producing kebeles; namely, Dano Ejersa Gibe, Wamura Sako, Lokloka Abba, Werka Werabu and Yubdo Legabatu were selected randomly from a total of 24 *tef* producing kebeles of the district.

In the second stage, from the total of 2425 households in the selected five kebeles, 210 sample household heads were selected randomly, using probability proportionate to size of *tef* producer households in the kebeles. The total sample size (n=210) was determined following a simplified formula provided by Yemane [14]. Accordingly, the required sample size at 95% confidence level with degree of variability of 5% and level of precision equal to 6.6% were used to obtain a sample size required to represent the true population.

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

Where: n = sample size, N = population size (sampling frame) and e = level of precision.

In addition, data were also collected from 20 *tef* traders. Census survey was conducted to obtain relevant information regarding *tef* traders. Similarly, data were also collected from 32 consumers in Dendi district.

2.4. Methods of Data Analysis

Two types of data analysis methods, namely descriptive statistics and econometric models were used for analyzing the data collected from smallholder *tef* producers, *tef* traders and consumers.

2.4.1. Descriptive Statistical Analysis

Descriptive statistical analysis method such as mean, proportions, percentages, and standard deviations were used in the process of examining and describing farm households' demographic characteristics, resource ownership, institutional and infrastructural service, production characteristics, *tef* marketing channels, financial asset and demographic characteristics of *tef* traders and consumers.

2.4.2. Econometric Analysis

A Multivariate probit model (mvprobit) was used to identify factors affecting household choices of *tef* market outlets.

To investigate factors affecting market outlet choice of sample households Multivariate probit model was used. Multivariate probit model simultaneously models the influence of a set of explanatory variables on choice of market outlets, while allowing for the potential correlations between unobserved disturbances as well as the relationship between the choices of different market outlets [15]. In the study area, smallholder *tef* producers face different choices of market outlets like: wholesalers, consumers, collectors and cooperatives. Thus, in this study since *tef* is one of the cash crops that enables producers to choose more than one outlet that are not mutually exclusive to get better price. Considering the possibility of simultaneous choices of outlets and the potential correlations among these market outlet choice decisions multivariate probit model (mvprobit) was appropriate to capture household variation in the choice of market outlets and to estimate several correlated binary outcomes jointly.

The observed outcome of market outlet choice can be modeled by the following random utility formulation. Consider the i^{th} farm household (i =1, 2….. N), facing a decision problem on whether or not to choose available market outlets. Let U_o represent the benefits to the farmer who chooses wholesalers and let U_k represent the benefit of farmer to who choose the K^{th} market outlets: where K denotes choices of wholesalers (Y_1), consumers (Y_2), collectors (Y_3) and cooperatives (Y_4). The farmers decide to choose the K^{th} market outlet if:

$$Y_{ik}^{*} = U_k^{*} - U_o > 0 . \quad (2)$$

The net benefit (Y_{ik}^{*}) that the farmer derives from choosing a market outlet is a latent variable determined by observed explanatory variable (Xi) and the error term (ε_i):

$$Y_{ik}^{*} = x_i'\beta_k + \varepsilon_i \left(k = Y_1, Y_2, Y_3, Y_4\right) \quad (3)$$

Where, in this study, Y_1 = wholesalers, Y_2 = consumers, Y_3 = collectors and Y_4 = cooperatives. Using the indicator function, the unobserved preferences in the above equation translates into the observed binary outcome equation for each choice as follows:

$$Y_{ik} = \begin{cases} 1 \; if \; x_i'\beta_k + \varepsilon_i > 0, \\ 0 \; if \; x_i'\beta_k + \varepsilon_i \leq 0 \end{cases} \left(K = Y_1, Y_2, Y_3 \; Y_4\right) \quad (4)$$

Where: x' is a vector of explanatory variables;

β denotes the vector of parameters to be estimated; and

ε are random error terms distributed as multivariate normal distribution with zero mean and unitary variance.

Y_i is a set of binary dependent variables such that: Y_1 = wholesaler, 1 for the farmer who choose wholesalers, 0 otherwise; Y_2 = consumer, 1 for the farmer who choose consumers, 0 otherwise; Y_3 = collector, 1 for the farmer who choose collectors, 0 otherwise and Y_4 = cooperative, 1 for the farmer who choose cooperatives, 0 otherwise.

In multivariate probit model, where the choice of several market outlets is possible the error terms jointly follow a multivariate normal distribution (MVN) with zero conditional mean and variance normalized to unity (for identification of the parameters) where $(\mu_{y1}, \mu_{y2}, \mu_{y3}, \mu_{y4})$ $MVN \sim (0, \Omega)$ and the symmetric covariance matrix Ω is given by:

$$\Omega = \begin{bmatrix} 1 & \rho_{y1y2} & \rho_{y1y3} & \rho_{y1y4} \\ \rho_{y2y1} & 1 & \rho_{y2y3} & \rho_{y2y4} \\ \rho_{y3y1} & \rho_{y3y2} & 1 & \rho_{y3y4} \\ \rho_{y4y1} & \rho_{y4y2} & \rho_{y4y3} & 1 \end{bmatrix} \quad (5)$$

Particular interest are off-diagonal elements in the covariance matrix, which represents the unobserved correlation between the stochastic components of the different type of outlets. This assumption means that the above equation generates a MVP model that jointly represents decision to choose particular market outlet. This specification with non-zero off-diagonal elements allows for correlation across error terms of several latent equations, which represents unobserved characteristics that affect the choice of alternative market outlets. Following the form used by Cappellari and Jenkins [16] the log-likelihood function associated with a sample outcome is given by:

$$\ln L = \sum_{i=0}^{N} \omega_i \ln \Phi(\mu_i, \Omega) \quad (6)$$

Where $_i$ is an optional weight for observation i, and Φ is the multivariate standard normal distribution with arguments μ_i and Ω, where μ_i can be denoted as;

$$\mu_i = (k_{i1}\beta_1 x_{i1}, k_{i2}\beta_2 x_{i2}, k_{i3}\beta_3 x_{i3}), While\ \Omega_{ik} = 1 \text{ for j = k and} \quad (7)$$

$$\Omega_{jk} = \Omega_{kj} = k_{ij}\, k_{jk} \rho_{jk}\ for\ j \neq k, k = 1, 2, 3 \ldots . With\ k_{ik} = 2y_{ik} - 1 \quad (8)$$

2.5. Hypothesis and Definition of Variables

In order to identify factors affecting market outlet choices of *tef* producers, the following dependent and independent variables were defined and hypothesized in the study.

Market outlet choice (MKTOCH): It is a categorical binary dependent variable measured by a choice of outlets defined and measured as binary outcome. The multivariate probit has a set of categorical binary dependent variables Y_i, such that: Y_1 = wholesalers; Y_2 = consumers; Y_3 = collectors; and Y_4 = cooperatives for the farmer who chooses wholesalers, consumers, collectors, and cooperatives, respectively. Definition and hypothesis of independent variables are indicated on Table 1 below.

Table 1. *Definition and hypothesis of independent variables.*

Variables	Type	Measurement	Expected effect			
			Wholesalers	Consumers	Collectors	Cooperatives
SEXHH	Dummy	1 if the household head is female; 0 otherwise	+	+	-	+
EDUHH	Continuous	Grades completed	+	-	-	+
HHSIZE	Continuous	No of household	+	-	-	-
FREXP	Continuous	No of years	+	-	-	+
LIVOWN	Continuous	TLU	+	-	+	+
NEQUIO	Continuous	TLU	+	+	-	+
AREA*TEF*	Continuous	Hectare	+	-	+	+
MRKTDIS	Continuous	Minutes of walk	-	+	+	-
FRQEXT	Discrete	Frequency	+	-	-	+
NONFAR	Continuous	ET Birr	-	-	+	-
CURPRT	Continuous	ET Birr per quintal	+	-	-	+

3. Result and Discussion

3.1. Demographic and Socio-economic Characteristics of Sample Households

As indicated in Table 2, out of total sample respondents, 172 (81.9%) were male-headed and 38 (18.1%) were female-headed households. Regarding cooperative membership, 104 (49.5%) of the sample households were members of cooperatives and 106 (50.4%) were not organized under cooperatives whereas 57 (27.1%) of the sample households has access to credit and 153 (72.8%) doesn't have credit access.

Table 2. *General characteristics of sample tef producers (dummy variables).*

Variables	Frequency	Percent
Sex of household head		
Female	38	18.1
Male	172	81.9
Cooperative membership		
Yes	104	49.52
No	106	50.48
Access to credit		
Yes	57	27.14
No	153	72.85

Source: Own survey result, 2017.

Accordingly, with regards to the educational level of sample household heads, the average number of formal

schooling completed was 4.17 years with a standard deviation of 3.61. The average household size of sample respondents in adult equivalent was 4.40 with standard deviation of 1.5 (Table 3). The average farming experience of sample respondents that an individual continuously engaged in *tef* production was 18.35 years with standard deviation of 7.3 (Table 3).

Table 3. *General characteristics of sample tef producers (continuous variables).*

Variable	Mean	Std. Dev.	Min	Max
Education level (years of formal schooling)	4.17	3.61	0	15
Household size (Adult equivalent)	4.40	1.58	1	8.15
Farming experience (No of years)	18.35	7.33	4	37
Livestock owned (TLU)	4.18	2.30	0	9.85
Number of equines owned (TLU)	1.20	0.94	0	3
Size of land under *tef* production (Hectare)	1.15	0.59	0.2	2.5
Distance to the nearest market (Minutes)	67.02	26.88	30	150
Frequency of extension contact (Count)	7.559	5.772	0	18
Non/off-farm income (ET Birr) [a]	3.899	5.106	0	16
Current market prices of *tef* (ET Birr/qt) [a]	1.834	1.843	1.835	0.202

Source: Own survey result, 2017.
Note: 'a' indicates the amount of non/off-farm income obtained and current market prices of *tef* in thousands (000) of ETB.

3.1.1. Resource Ownership of Sample Households

Ownership of physical resources is an important factor that affects alternative market outlet choices.

Land ownership

The analysis of survey data depicts that the average total land size owned by the sample households was 1.8 hectare with standard deviation of 1.3. The average area of land under *tef* production by sample households was 1.2 hectare with standard deviation of 0.6 (Table 3). The minimum and maximum land allocated for *tef* production was 0.2 and 2.5 hectares, respectively.

Livestock ownership

In the district, mixed crop and livestock farming system is dominantly used by farm households. Livestock resources are useful in the livelihoods of smallholders, oxen are the major contributors to crop production by serving as a draft power. The average livestock owned by sample households excluding equines was 4.2 TLU with a standard deviation of 2.3 (Table 3).

Equine ownership

In the study areas equines are used as a means of transport by smallholder farmers. Equines provide transport services for farm inputs from market to home, harvested farm produce from field to threshing center and for marketing of output. Out of total sample households 57 (27.1%) of them do not own equines. The rest 73 (34.7%), 62 (29.5%), and 18 (8.5%) of sample households owned one, two and three equines, respectively.

Off/Non-farm income activities

The major off/non-farm income generating activities in which sample households were participating in the study areas includes: animal cart, daily laborer, remittance and petty trade. The mean cash income obtained from off/non-farm income was 3899 ET Birr with standard deviation of 5106 (Table 3).

3.1.2. Institutional and Infrastructural Services of Farm Households

Sample households in the study areas received different institutional service regarding *tef* production and marketing.

Frequency of extension contact

Agricultural **e**xtension service provision on production and marketing have direct influence on the production and marketing behavior of the farmers. The average frequency of extension service provided for sampled households was 7.5 day/year with standard deviation of 5.7 (Table 3).

Distance from the nearest market

The distance from home to the nearest market place where farmers sold their *tef* produce was an average of 67 minutes of walk with standard deviations of 26.8 (Table 3). The minimum and maximum distance that *tef* producing households travel to the nearest market were 30 and 150 minutes, respectively.

3.2. Demographic and Socio-economic Characteristics of Tef Traders

3.2.1. Demographic Characteristics of Tef Traders

Demographic characteristics of sample *tef* traders were summarized in terms of sex, marital status, age, educational level and household size. Out of 20 sampled traders 8 (40%) of them are collectors and 12 (60%) of them are wholesalers. As indicated in Table 4, out of the total sample traders, 17 (85%) were male-headed and 3 (15%) were female-headed. Regarding marital status of sample traders 2 (10%) and 18 (90%) were single and married, respectively.

Table 41. *Distribution of sample traders by sex and marital status.*

Variables	Number	Percent
Sex Female	3	15
Male	17	85
Marital status Single	2	10
Married	18	90

Source: survey result, 2017.

As indicated in Table 5, the mean age of sample *tef* traders were 42 years with standard deviation of 8.759. The average

household size of sample trades was 4.8 persons with standard deviation of 2.667. Concerning educational status of *tef* traders, the average number of years of schooling completed was 5.35 years with a standard deviation of 3.731.

Table 52. *Distribution of sample traders by age, household size and education.*

Variables	Mean	Standard deviation
Age	42	8.759
Household size	4.8	2.667
Educational level of traders	5.35	3.731

Source: survey result, 2017.

3.2.2. Financial Assets of Tef Traders

Initial working capital: The result indicated that the mean initial working capital of sample *tef* traders was 19627.5 ET birr with standard deviation of 10138.8. The minimum and maximum initial capital of *tef* traders were 12000 ET birr and 50000 ET birr, respectively.

Current working capital: The result revealed that the mean working capital of sample *tef* traders was 57875 ET birr with standard deviation of 105663.3. The minimum and maximum working capital of sample *tef* traders were 20000 ET birr and 500000 ET birr, respectively.

Table 63. *Financial asset ownership of sampled traders.*

Description	Mean	Std. dev.	Min	Max
Initial working capital	19627.5	10138.84	12000	50000
Current working capital	57875	105663.3	20000	500000

Source: survey result, 2017.

3.3. Demographic Characteristics of Sample Consumers

Demographic characteristics of sampled *tef* consumers were summarized in terms of sex, marital status, educational level and household size. The sampled consumers earn their income from different sources and the purchasing power of the consumer depends on his/her monthly income. The survey results indicated in Table 7, shows that the majority of sampled consumers were females; 21 (65.6%) and the remaining 11 (34.4%) were males. This shows that females' involvement in the *tef* purchasing activities was high. Regarding marital status of consumers, the majorities 28 (87.5%) were married and 4 (12.5%) were single.

Table 74. *Distribution of sample consumers by sex and marital status.*

Variables	Number	Percent
Sex Female	21	65.62
Male	11	34.38
Marital status Single	4	12.5
Married	28	87.5

Source: survey result, 2017.

As indicated in Table 8, the mean household size of consumer was 4.5 persons with standard deviation of 2.676. Regarding the educational level of consumers, the survey result shows that the mean number of years of schooling completed was 6.8 with a standard deviation of 3.486.

Table 85. *Distribution of sample consumers by household size and education.*

Variables	Mean	Standard deviation
Household size	4.5	2.676
Educational level	6.81	3.486

Source: survey result, 2017.

3.4. Tef Marketing Outlets

The survey result indicated that sample households in the study area sold their *tef* produce at different marketing center. The sample households sold varying proportion of their *tef* output to different market outlets in the district which include: wholesalers, consumers, collectors and cooperatives. Result of the survey in Table 9, indicated that 133 (63.3%) of households sold their *tef* output to wholesalers whereas 81 (38.5%), 87 (41.4%) and 104 (49.5%) of the sample households sold their *tef* output to collectors, consumers and cooperatives, respectively.

Table 9. *Market outlet choices of tef producers in the study area.*

Market outlets	Number of sellers	Proportion (%)
Wholesalers	133	63.33
Consumers	87	41.43
Collectors	81	38.57
Cooperatives	104	49.52
Total	405	192.85

Source: survey result, 2017.

The survey result showed that out of total output sold in the market wholesalers, consumers, collectors and cooperatives purchased 43.3%, 15.6%, 17.5% and 23.5% of *tef* produce, respectively (Figure 2). From the context of survey result, Smallholder farmers and market outlets in *tef* marketing were discussed below and the result of factors affecting *tef* market outlet choice of *tef* producer were discussed in econometric analysis result.

Smallholders: Farmers start from input preparation to produce *tef* for the purpose of cash earnings and household consumption. *Tef* producers in Dendi district supply their produce to the market by using equine transport and sold to wholesalers, collectors, consumers and cooperatives.

Wholesalers: wholesalers were the participants of the marketing system those who buy large volume *tef* with relative to other market outlets. Wholesalers in the study area buy *tef* from farmers, collectors and cooperatives. They sell the purchased *tef* to processors (hotels, restaurants and millers), consumers and to wholesalers at central market (Addis Ababa).

Collectors: Collectors are marketing actors those who assemble *tef* from farmers and deliver to wholesalers and also sell to consumers in the district. Some collectors in the district do not have sufficient capital to purchase *tef*, they operate with advances that they received from wholesalers.

Consumers: Consumers are those households who engaged in different income generating activities and purchase *tef* grains for consumption purposes from farmers, collectors or wholesalers.

Cooperatives: Cooperatives in the study area perform multi-functions. Cooperatives play a crucial role in supplying agricultural inputs (like: improved seed, fertilizer and herbicide) to the farmers and also involve in purchasing of agricultural output from farmers and resale it to wholesalers and seed enterprise. In addition, cooperatives provide in-kind credit (e.g. improved seed) for seed multiplication and also serve storage facility for the members.

Tef marketing channels

The analysis of marketing channels was intended to know the alternative routes that the *tef* output flows from producers to final destination. Marketing channels are alternative routes of product flows from producers to consumers [17]. Six alternative *tef* marketing channels through which *tef* produce flows to the final consumers were identified in the study areas.

Channel 1: Producers ⇒ Consumers

Channel 2: Producers ⇒ Collectors ⇒ Consumers

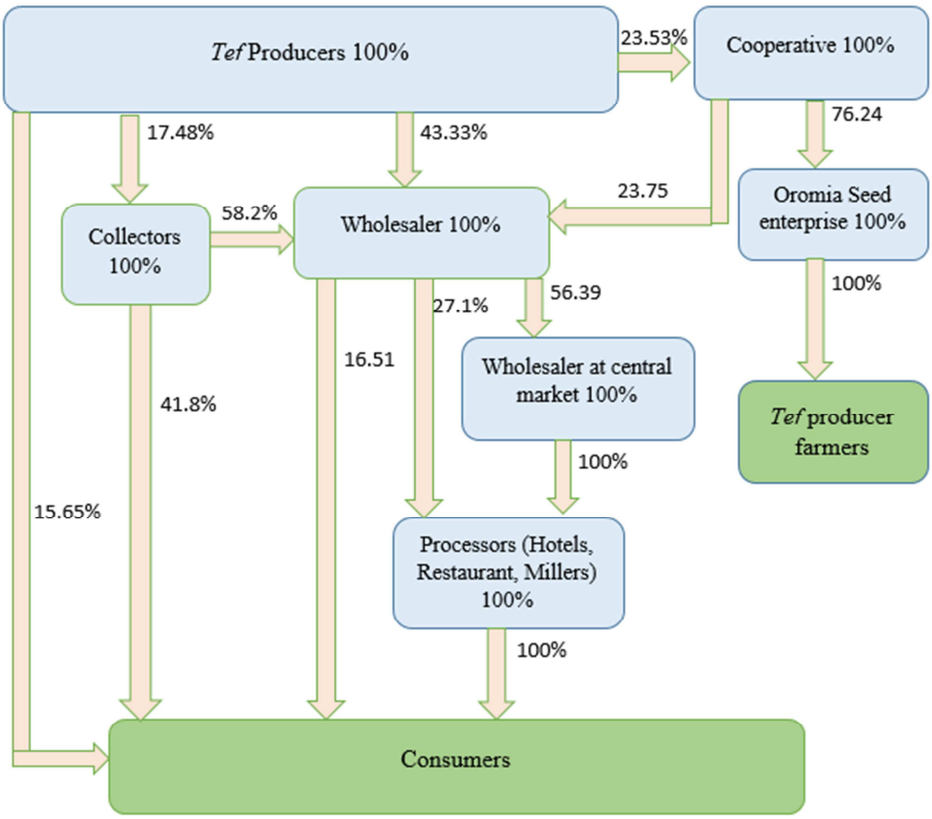
Channel 3: Producers ⇒ Collectors ⇒ Wholesalers ⇒ Processors ⇒ Consumers

Channel 4: Producers ⇒ Wholesalers ⇒ Wholesalers at central market (Addis Abeba) ⇒ Processors ⇒ Consumers

Channel 5: Producers ⇒ Cooperatives ⇒ Wholesalers ⇒ Consumers

Channel 6: Producers ⇒ Cooperatives ⇒ Seed enterprise ⇒ *Tef* producing farmers

These market channels with the proportion of *tef* outputs flow through the channels are indicated in the following Figure 2.



Source: own sketch (survey result, 2017)

Figure 2. *Tef marketing channels.*

3.5. Econometric Results

The data management for the study was done by using SPSS whereas analysis of the survey data was carried out by using STATA 15.

The multivariate probit model is used to estimate several correlated binary outcomes jointly. In this study the decisions of *tef* producers choosing wholesalers, consumers, collectors and cooperatives outlets are correlated. Since the decisions are binary the multivariate probit model was found to be appropriate for jointly predicting these four outlet choices on an individual-specific basis and the parameter estimates are simulated maximum likelihood (SML) estimators. Thus, an econometric approach was employed to test effects of the explanatory variables on the selection of a particular market outlet. The Wald chi^2 (44) = 177.63 is significant at 1% significance level, which indicates that the subset of coefficients of the model is jointly significant and that the explanatory power of the variables included in the model is acceptable. In this study samples are drawn 100 times to increase the accuracy, since higher number of draws increases the precision level. The results of likelihood ratio test in the model shows that likelihood ratio test of chi^2 (6) = 45.61, Prob > chi^2 = 0.000 is statistically significant at 1%

significance level, indicating the null that choices of the four market outlets is independent is rejected and there are significant joint correlations for two estimated coefficients across the equations in the models (Table 10). The likelihood ratio test of the null hypothesis of independency between the market outlet decision ($\rho_{21} = \rho_{31} = \rho_{41} = \rho_{32} = \rho_{42} = \rho_{43} = 0$) was significant at 1%. Therefore, the null hypothesis that all the ρ (Rho) values are jointly equal to zero is rejected, showing the goodness-of-fit of the model. So, there are differences in market outlet selection behavior among smallholders marketing *tef*, which are reflected in the likelihood ratio statistics.

Separately considered, the ρ values (ρ_{ij}) indicate the degree of correlation between each pair of dependent variables. The ρ_{21} (correlation between the choice of consumers and wholesalers outlet), ρ_{31}(correlation between the choice of collectors and wholesalers outlet) are negative and statistically significant at 5% significance level; ρ_{42} (correlation between the choice of cooperatives and consumers outlet) and ρ_{43} (correlation between the choice of cooperatives and collectors outlet) are negative and statistically significant at 1% significance level; and ρ_{32} (correlation between the choice of collectors and consumers outlet) are positive and statistically significant at 1% level. This result indicates that farmers selling their *tef* produce to the wholesaler outlets are less likely to deliver to consumers and collectors' outlets. Similarly, those farmers marketing *tef* to the cooperative outlet are less likely to deliver to consumers and collectors market outlets (Table 10).

The simulation results also indicate that the marginal success probability for each equation (outlet choice decision) is reported below. The likelihood of choosing collector outlet is relatively low (39.1%) as compared to the probability of choosing consumer outlet (41.6%), cooperative outlet (51.1%) and wholesalers' outlet (64.4). This is an indicator that wholesaler is the most likely chosen market outlet by farmers and the low capacity of collector outlet to purchase more *tef* produce at a time and the limited capacity of collector outlet. The joint probabilities of success or failure of choosing four outlets suggests that the likely of households to jointly choose the four outlets is low. The likelihood of households to jointly choose the four outlets was 4.1% which is relatively lower compared to their failure to jointly choose them (5.1%). The result in Table 10, indicated that out of explanatory variables used in the multivariate probit model, educational level of household head, household size (adult equivalent), livestock owned (TLU), equines owned (TLU), size of land under *tef* production, distance from the nearest market, and current market price of *tef* were found to significantly affect the market outlet choice behavior of *tef* producers.

Education level of the household head: Education level of the household head has positive and significant effect in choosing wholesaler and cooperative outlet at 1% and 5% probability level, respectively. In addition, education level of the household head has negative relationship with the likelihood of choosing consumer and collector outlet at 1% and 5% level of significance, respectively. The positive relationship between education level and selling to wholesaler and cooperative outlets, and the negative relationship between education level and selling to consumer and collector outlets shows the fact that being educated enhances the capability of farmers in making informed decisions with regard to the choice of *tef* marketing outlet to sell their *tef* produce based on the benefit they obtain. These results are in line with the findings of [18] which found that by making informed decisions educated farmers choose the best market outlets to sale their farm produce.

Household size: Household size has positive and significant relation with the likelihood of choosing wholesalers outlet at 5% significance level, and negative and significant relation with the likelihood of choosing consumer and collector outlets at 5% significant level. This result indicates that, having more household size positively correlate with the likely of choosing wholesalers outlet and has negative relation with likely of choosing consumer and collector outlets. This finding is consistent with the finding of [11] which found that having large family size was a better for delivering output to the final market outlet.

Size of land under *tef* production: The likelihood of choosing wholesaler and cooperative market outlet was positively and significantly related with the size of land allocated for *tef* production at 1% and 5% levels of significance, respectively. The result indicated that those households who allocated large size of land for *tef* production would produce more output and they likely to sell to wholesaler and cooperative outlets. The result is consistent with the findings of [12] who found an increase in land allocated increases farmers' likelihood of choosing wholesaler outlet than consumers outlet.

Table 10. *Multivariate probit estimations of tef producers' market outlet choices.*

Variables	Wholesalers	Consumers	Collectors	Cooperatives
Sex of household	-0.232 (0.298)	-0.063 (0.253)	-0.152 (0.255)	-0.023 (0.279)
Education level	0.166*** (0.050)	-0.104*** (0.036)	-0.088** (0.036)	0.095** (0.038)
Household size	0.199** (0.089)	-0.155** (0.067)	-0.143** (0.066)	0.018 (0.071)
Farming experience	-0.003 (0.021)	-0.006 (0.016)	0.007 (0.015)	0.005 (0.016)
Livestock ownership	0.049 (0.075)	0.065 (0.060)	0.038 (0.060)	0.117* (0.065)
Ownership of equine	0.366* (0.188)	0.006 (0.140)	0.051 (0.139)	0.097 (0.148)
Land area under of *tef*	0.831*** (0.321)	0.285 (0.243)	-0.087 (0.243)	0.563** (0.267)
Distance from market	-0.624** (0.295)	0.461** (0.235)	0.517** (0.237)	-0.455* (0.268)
Frequency of extension	-0.013 (0.035)	-0.023 (0.026)	0.011 (0.025)	0.022 (0.027)
Non/off-farm income	-0.029 (0.023)	0.001 (0.019)	0.016 (0.019)	0.014 (0.021)

Variables	Wholesalers	Consumers	Collectors	Cooperatives
Current prices of *tef*	0.793 (0.624)	-1.191** (0.477)	-1.156** (0.481)	-0.229 (0.512)
Constant	-2.872** (1.299)	2.233** (0.964)	1.811* (0.972)	-1.099 (1.055)
Predicted probability	0.644	0.416	0.391	0.511
Joint probability success			0.041	
Joint probability of failure			0.051	
Number of draws (SML, # draws)			100	
Number of observations			210	
Log Likelihood			-402.23	
Wald chi^2 (44)			177.63	
Prob > chi^2			0.0000	

Estimated correlation matrix

	ρ_1	ρ_2	ρ_3	ρ_4
ρ_1	1.00			
ρ_2	-0.344** (0.142)	1.00		
ρ_3	-0.335** (0.147)	0.527*** (0.095)	1.00	
ρ_4	-0.224 (0.168)	-0.448*** (0.114)	-0.330*** (0.120)	1.00

Likelihood ratio test of $\rho_{21} = \rho_{31} = \rho_{41} = \rho_{32} = \rho_{42} = \rho_{43} = 0$
chi^2 (6) = 45.61 Prob > chi^2 = 0.0000
Source: Own computation from survey result, 2017
Note: Coefficient and standard errors in the parentheses
Symbols: ***, ** and * indicates significant at 1%, 5% and 10% levels, respectively.

Equines owned: Ownership of means of transport (equines) measured in TLU has positively and significantly related with the likelihood of choosing wholesaler outlet at 10% significance level. The result depicts that having equines positively correlate to the likely of choosing wholesalers outlet, due to the fact that those households who have equine transport go distant market in order to sale their *tef* produce to the market that offer better price than other outlets having low price. Since there is no vehicle transport service in the rural study area, ownership of means of transport (equine) offers a greater opportunity in market outlet choices. This result was similar with the finding of [10] who found that number of equines owned has positive and significant influence on probability of choosing the best outlets to sell outputs produced and to achieve higher price.

Livestock owned: Number of livestock owned measured in TLU has significant and positive relationship with the likelihood of choosing cooperative outlet at 10% significance level. This is due to the positive impact of livestock on the *tef* production by providing cash to purchase improved seed and in-organic fertilizer for *tef* production, and oxen serve as a traction power this increases the amount of *tef* produced and the management of livestock makes the household to select nearby market outlet that benefits them. Thus, the result revealed that those households producing high amount of *tef* output are more likely selling their *tef* produce to cooperatives outlet.

Distance from the nearest market: Distance from the nearest market is negatively and significantly associated with likelihood of farmers selling to wholesalers and cooperatives outlet at 5% and 10% level of significance, respectively; and positively associated with likelihood of selling to consumer and collectors at 5% level of significance. The implication of this finding is that households located far away from the nearest market faces difficulty in delivering *tef* produce to wholesaler and cooperative outlet and the farmers sold to consumer collectors' outlet due lack of transport service in the study area and to reduce transaction cost of delivering *tef* produce to the market. This result is supported by the findings of [9] who found that market distance has negative relationship with wholesalers and positively related with collectors' outlet.

Current market prices of *tef*: Current price of *tef* is negatively and significantly associated with the likelihood of choosing consumer and collector outlets at 5% level of significance. This implies that the market price of *tef* shows some fluctuation at market day and due to fear of consumer and collectors offer lower price for *tef* than other market outlet farmers are not likely to deliver to consumer and collectors' outlet. The survey result indicates that consumers and collectors in the study areas have a limited financial capacity and wants to purchase smaller quantity of *tef* at lower price, due to this farmer are less likely sell to consumer and collectors' outlet and *tef* producers prefer other market outlets having higher prices. This result is consistent with the findings of [9, 19] who found own product price negatively affect the likely of selling to consumer and collector outlets.

4. Conclusion and Recommendations

The study was aimed at identifying determinants of market outlet choices of *tef* producers in Dendi district of Oromia region, Central Ethiopia. The study was conducted with the specific objectives of identifying *tef* marketing channels and factors affecting market outlet choices of *tef* producers in the study area. *Tef* producers in the study area sold *tef* grain through different market outlet based on their choice. In the study areas there are four *tef* market outlets, the survey result indicated that 133 (63.33%) of households sold their *tef* output to wholesalers whereas 81 (38.57%), 87 (41.43%) and 104 (49.52%) of the sample households sold their *tef* output

to collectors, consumers and cooperatives, respectively. Along this, six *tef* marketing channels through which *tef* produce flows to the final consumers are identified in the study areas.

The result of multivariate probit model revealed that the likelihood ratio test in the model is statistically significant at 1% significance level, implying choices of the four market outlets is interdependent. The probability of choosing wholesaler market outlet was significantly affected by education level of household head, household size, ownership of equine, land area allocated to *tef* production, and distance from the nearest market. The probability of choosing consumer market outlet was significantly affected by educational level of household head, household size, current market prices of *tef* and distance from the nearest market. The probability of choosing collector market outlet was significantly affected by education of household head, household size, distance from the nearest market and current market prices of *tef*. Likewise, the probability of choosing cooperative market outlet was significantly affected by educational level of household head, distance from the nearest market, livestock owned (TLU) and land area allocated to *tef* production.

The probability of choosing wholesalers market outlet is 64.4% whereas the probability of choosing consumers, collectors and cooperatives outlet is 41.6%, 39.1% and 51.1%, respectively. This shows wholesalers is the most likely chosen market outlet while collectors outlet is less likely chosen. The joint probabilities of households to jointly choose the four market outlets is 4.1% which is lower than the likely of not choosing all outlet which is 5.1%. The correlation between each pair of dependent variables implies that farmers selling *tef* grain to cooperative and wholesaler outlet are less likely to deliver to consumer and collector outlet.

From the findings of this study the following relevant recommendations are drawn. The multivariate probit model result showed that *tef* producers were influenced by different factors to choose appropriate market outlets to sell their *tef* produce. The finding suggests that an adjustment in each one of the significant variables can significantly influence the probability of choice of market outlets. Attending of formal education by household head is better in searching appropriate market outlets, thus the concerned authority should be able to increase the awareness of households about the importance of adult and formal education to choose appropriate market outlet in selling outputs.

Expanding equal accessibility of road infrastructures and availing transportation services needs government intervention to promote the effective marketing of *tef* through high price fetching outlet. Households who lives far from the nearest market without their own means of transport are unlikely to sell to wholesales outlet, indicating the importance of adequate road facilities, transportation services and equines in providing options for marketing *tef* produce to attain a better price. Since, traders want to operate in areas of good road facilities and better transport services, households tend to minimize transaction costs by selling to collector outlet who typically offer low prices. Therefore, this study recommends that improving of existing road infrastructure and creating conducive environment for transport service would reduce transportation costs as well as time spent to reach the market and enhance farmers to sell their produce to the outlet that results higher returns.

The study also points that increasing of size of land allocated to *tef* production positively related with the likely selling to wholesales and cooperative outlet. Here producing more output encourages the farmers to choose appropriate market outlets, thus concerned body has to advice farmers to efficiently utilize land resources. Livestock ownership has positive effect on *tef* production and selection better market outlets; thus, efforts are required in improving number of livestock ownership. Actual market price of *tef* is also an important factor to influence choice of appropriate market outlets. Increasing production alone is not enough without reasonable selling price, offering better price for *tef* produce can inspire farmers to produce more and in selling through the best market outlets. Hence, delivering of updated market price information is essential for farmers to make informed decision in marketing of *tef* output.

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