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Research

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Abstract

Haricot bean is among the crucial food and cash grain legumes crops and have immense marketing potential in the world. It plays an important role in enhancing income and thereby ensuring the food security status of farm households. Despite such potential, a formidable marketing challenge faced in Kucha district of Southern Ethiopia. Cross-sectional 378 haricot bean-producing farm households were selected using four-stage sampling techniques. We used simple descriptive statistics, Heckman two-stage and multivariate Probit models to identify determinants of both market participation and outlet choices decisions of the farm household. The result shows about 85% of interviewed farmers have participated in selling haricot bean to market and the level of participation was found to be 65%. The key determinants of the market are the quantity of the haricot bean, extension service, average lagged year price of haricot bean, market information, and level of education of the household head were the main variables affected market participation decision of farmers while the extent of market supply affected by sex, family size of household, extension service, distance to all weathered road and the total quantity of output supplied to the market in 2019. The study suggests that strategies aiming for enhancing haricot bean market supply with appropriate market outlet choices should encourage farmers cooperative and linking them with terminal markets, enhancing yield, capacity building form production up to post-harvest handling, providing reliable and timely market information and improving poor road infrastructure must be considered while developing strategies for the improvement of the marketing system.

Keywords: *Haricot bean, Market participation, Outlet choice, Heckman Two-Stage; Multivariate Probit, Southern Ethiopia.*

1. Introduction

Haricot beans (Phaseolus vulgaris) is among the most important grain legumes crop originated in Peru and were introduced to Africa by Spanish and Portuguese traders during the 15th century (FOA, 2015). The crop is rich in nutrient particularly protein, minerals and vitamins, dietary fiber, and commercial potential. It also, play a crucial role in fighting hunger through enhancing both income and affordability of protein contents on food items, source of employment opportunities and improving soil fertility since mostly intercropped with other crops such as maize, sorghum and *enset* which helps for fixing atmospheric nitrogen and thereby contribute to the diversity and stability of the agriculture system (Demelash, 2018, FOA, 2015). The crop is mainly produced in low land areas densely populated areas of East and Southern African countries (Akibode, 2011).

In Ethiopia, haricot bean is one of the major food and cash crops where majority of its production cultivated under smallholder farming system and mainly produced in the lowlands area of the country. It is the second-largest crop in pulse production and third export commodity from the total export value of agriculture in Ethiopia (CSA, 2019). It is also an important cash crop for smallholder farmers mainly due to its short maturity period (less than 3 months) that helps for meeting the immediate household food demand, serves as a sources of protein contents in different types of traditional dishes and low input requirements of the nature of the crop (FOA, 2015). Besides, it has immune growing potential of foreign exchange earnings due to rising demand from the international market over the last recent years. However, the production and marketing of haricot bean were not modernized as compared to other countries (ERCA, 2015). In response to this, Ethiopian government has made special attention for modernizing and transforming subsistent-oriented to market-oriented production system by providing improved agricultural extension services, high yield improved seeds, established agricultural marketing institutions in different parts of the county as explained in the Growth Transformation Plan –II (GTP-II) which is the current five-year development plan of the country (MOFED, 2015). As a result, a considerable growth in haricot bean production, export volume and values observed over the last recent years (FOA, 2015; Shewaye, 2016; Shewaye et al. 2016; Demelash, 2018). However, there are a number of formidable marketing related problems which might be due to

several factors including demographic, socio-economic, farmer and farm specific, institutional attributes.

Previous empirical studies such as Amare (2017), Besufekad et al. (2018), Demelash (2018), ECEA (2009), Ephrem (2016), FOA (2015) and Shewaye (2016) attested that the driving factors that lead to the inefficiency of haricot bean market includes limited or lack of improved seed access, price volatility, high taxes and various fees at different levels, overvalued exchange rate, poor coordination skill amongst traders, lack of product quality standard, unfair trade practices imposed by brokers at the market place, lack of market information to producers, long market chain, and few market channel choices, limited grading and quality control systems, and asymmetry of price information that result in a low market participation of producer and a low share of the price for producers (excessive margins from traders over producers).

Recent empirical studies in Ethiopia such as a study by Adeoti et al. (2014) and Shewaye et al. (2016) identified the driving factors influencing market participation and its extents in different parts of the country. Similarly, Abebe et al. (2018), Kassa et al. (2017), Takele et al., (2017) Tadie et al. (2019) and Shewaye (2016) identified the factors affecting market outlet choice in different parts of Ethiopia. They found that farmer's decision to choose various market outlets affected by demographic, socio-economic, institutional, farmer and marketing characteristics. On the contrary, there are also a very few empirical studies done on specifically on haricot bean and identified the determinants of both market participation and outlets choices in Ethiopia particularly in study area. These types of studies are relevant and helpful to design strategy of resolving problems on the market chain and have a great impact on enhancing the welfare of farm households. Besides, no similar empirical studies carried out in the study area and this study help for resolving the underlying commodity-specific marketing rigidities and thereby not only enhancing the livelihoods of farmers but also assist the governments for their effective planning and specific intervention in the area. Hence, this study motivated to fill these noticeable gaps and aims to investigate both determinates of haricot bean market participation and outlet choices in Kucha district of Gamo zone in Southern parts of Ethiopia.

2. Research Methodology

2.1. Description of the study area

The study was conducted in Kucha district, Gamo Zone, Southern Nation Nationalities and Peoples' Regional State. Kucha is one of the 14 districts of Gamo Zone in the Southern Nations, Nationalities and Peoples' Regional (SNNPR) State. The district has a 32 rural administrative kebeles (lowest administrative unit) and 6 towns that were administered by the municipality. It is roughly situated between 6° 20" N-6° 40"N Latitude & 37° l0"E- 37° 30"E Longitude. The district bordered on the south by Dita and Deramalo, on the southwest by Zala, on the west by Demba Gofa, on the northwest by the Dawro Zone, on the north by the Wolayita Zone, on the east by Boreda, and on the southeast by Kogota districts of Gamo Zone. It is located around 444 km south of the country capital city Addis Ababa, 227 km from the regional capital city Hawassa, 177 km away from the Zonal capital city Arba Minch (KDFEDO, 2019).

The total area of the Kucha district is 1391.90 km^2 which is divided into two agro-ecological zones namely: mid highland (*Woina dega*) and lowland (*Kola*) accounting for 50.6% and 49.4% of the total area, respectively. Most of the district is found in the Omo Gibe drainage basin. The overall attitude of the district varies between 1000-2250 meters above sea level. Its average rainfall is from 1100mm to 1600mm while the mean annual minimum and maximum temperature of the area is about 21 and 25-degree centigrade respectively (KDFEDO, 2019). Based on CSA population projection, the district has a total population of 203,916 of whom 101,389 are men and 25,569 are women; 93.54% of its population were rural dwellers in 2014 (CSA, 2013).

2.2. Data Type, Sources and Methods of Collection

Both primary and secondary data type sources were used for this study. Primary data were collected from randomly selected smallholder haricot bean-producing farmers in the district using a pre-tested semi-structured questionnaire. The primary data constitute patient information related to the factors affecting market participation and outlet choice. In addition, Focus Group Discussion (FGD) and Key Informant Interviews were also collected to supplement the primary data. While secondary data were also collected from KDFEDO and Central Statistical Authority (CSA).

2.3. Sampling Design

The sample size of the study was determined based on the scientific formula provided by Kothari (2004). Accordingly, a total of 378 representative sample size determined using n= $\frac{Z^2*N*p*q}{e^2(N-1)+Z^2*p*q}$ formula with 95% confidence level with degree of variability (p) 5% or 1-p (q) 0.5, at 5% margin of error and N which is total farm households in Kucha district 25,569 household as per information from KDFEDO(2019).

To select households from the district, four-stage sampling technique was applied: In the 1st stage, the district was purposively selected due to the potential of haricot bean production as compared with other districts of Gamo zone in southern Ethiopia. In the 2nd stage, based on information from KDFEDO (2019), the study stratified Kebele based on agroecology and accordingly from total 32 rural Kebeles, 17 Kebeles (50.6%) was midland and the remaining 15 Kebeles (49.4%) were mid-land Kebeles. In the 3rd stage, 5 Kebeles from highland and 4 Kebeles from midland were randomly selected for the study. In the 4th stage, the total of 379 haricot producing farm households were selected randomly proportion to their total size.

2.4. Methods of Data Analysis

Descriptive statistics and econometrics analyses where used for analyzing cross-sectional data

I. Descriptive Statistics analysis

Descriptive statistical analysis such as frequency, mean, percentage, and standard deviations were used to explain the demographic, socio-economic, farm-specific attributes, institutional, marketing characteristics and haricot bean marketing channels. In addition, inferential statistics such as chi-square and t-test statistics were also used to compare the frequency and mean between haricot bean market participant and non- participants, respectively.

II. Econometric Model Specification

Heckman two-stage model: is used to analyze the determinants of market participation decision and volume/extent of participation in the haricot bean market. The model is widely used by most previous researches conditions on the existence of both incidental truncation data and sample selection bias (Adeoti et al., 2014; Shewaye et al., 2016; Takele et al., 2017). The existence of sample selection bias in this type of study expected than not due to the fact that most smallholder farmers might not sell haricot bean to the market only used for household food consumption which leads to the participation of the marker observed to some subset of the total population. Such missing observation potentially causes incidental truncation in the survey data (Gujarati, 2004). To account such potential limitation, the study applied the Heckman two-stage model. In this model, the decision either to participates in the market or not and the extent of market participation can be seen as a sequential two-stage decision-making process. In the first-stage, a farmer made the decision to participate in the sale of haricot bean or not is estimated using probit model, and the Inverse Mills ratio (IMR) is obtained from this model. In the second-stage, conditioned on their participation decision in the market, they made a decision of the volume of market supply and is estimated using Ordinary Least Square (OLS) regression equation by including IMR from the first model as independent variables and correct the selection bias in the model.

Following Heckman (1979), the model is specified and the first stage election equation (Probit model), specified as:

$$Y_i = X_i\beta_1 + \varepsilon_i \qquad (1)$$

Y^*_i is a binary variable denoted by 1, if household sales haricot bean to the market, 0 otherwise β_{1i} is a vector of unknown parameters to be estimated, X_i is vector of explanatory variables ε_1 is random error term.

The Second step involves a decision on the extent of haricot bean marketing is estimated by OLS as follows;

$$Y_{ji} = X_i^{'}\beta_{2i} + \varepsilon_i \qquad (2)$$

The intensity of market participation measured by the volume of sale (Y_i) is observed when a household participate in diversification (Y_i =1). This causes selectivity problem and the parameter estimates using OLS are inconsistent and biased. One can get consistent estimates using the following conditional regression function:

$$E(Y_i / Y_i^* > 0) = X_i^1 \beta_{1i} + \beta_\lambda \lambda_i \quad \text{where } \lambda_i = \frac{\phi(\omega_i^{'} \beta_{1i})}{\Phi(\omega_i^{'} \beta_{1i})} \tag{3}$$

Where λ_i denotes IMR, $\phi(.)$ denotes the standard normal probability density function and $\Phi(.)$ denotes the cumulative distribution function for a standard normal random variable. The value of λ_i is not known, but the parameters (β_{1i}) can be estimated using a Probit model based on the observed binary outcome (Y_i). Then the estimated IMR $\hat{\lambda}_i = \frac{\phi(\omega_i^{'} \hat{\beta}_1)}{\Phi(\omega_i^{'} \hat{\beta}_1)}$ is inserted into the regression equation as additional repressor and estimated using the following equation:

$$Y_i = X_i^{'} \beta_{2i} + \mu \lambda_i^{'} + \varepsilon_i \tag{4}$$

Where Y_i denotes the volume of haricot bean sold; β_{2i} is parameters to be estimated; X_i is vector of explanatory variables determining the volume sold; λ_i (lambda) is IMR that control sample selection bias; and μ is the coefficient of IMR and ε_1 is the error term.

Multivariate Probit model: the producer's decision to participate in a given market derived from the maximization of expected utility from these markets and helps to reduce some risks than a single market channel (Arinloye *et al*., 2015). Econometric models such as multivariate probit/logit and multinomial probit/logit are useful models for the analysis of categorical choice dependent variables. Multinomial models are appropriate when individuals can choose only one outcome from among the set of mutually exclusive and collectively exhaustive alternatives. However, in the study area, there are several market outlets (Primary cooperatives, wholesalers, Assemblers, Retailers and consumers) and farmers have the possibility to select more one outlets simultaneously to maximize the expected utility and due to this there are some

overlapping and many farmers sell to more than one market outlet. In view of this, most previous similar researches applied multivariate probit (MVP) to analyze the determinants of market outlets choices in a different part of Ethiopia (Shewaye et al., 2016; Kassa et al., 2017; Abebe et al., 2018; Tadie et al., 2019). Similarly, this study applied the MVP model to analyze the simultaneous influence of the explanatory variables on market channel choices, while allowing the unobserved and/or unmeasured factors (error terms) to be freely correlated as well as the relationships between the choices of different market outlets (Belderbos *et al.*, 2004; Greene, 2012).

The observed outcome of market channels choice can be modeled following random utility formulation. Consider the ith farm household (i=1, 2, 3…N), facing a decision problem on whether or not to choose available market Let U_k represents the benefits of farmers to choose the mth market outlet where m denotes the choice of primary cooperative (Y_1), whole seller(Y_2), assembler (Y_3), consumer (Y_4) and Retailer(Y_5) . The producer decide to choose the mth market outlet if, $Y^* = U_k^* - U_0 > 0$. The net benefit (Y_{im}^*) 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):

$$Y_{im}^* = \beta_{im}X_{im} + \varepsilon_{im} \quad (5)$$

$$Y_{im} = \begin{cases} 1, if\ y > 0 \\ 0, Otherwise \end{cases}$$

Where Y_{im} (m=1, 2,…..5) denotes the market outlet choices, (Y_1) for cooperative, (Y_2) for whole seller, (Y_3) for assembler, (Y_4) for consumer and (Y_5) for Retailer (available for i^{th} haricot bean producer,(i = 1.....n) ; X_{im} *is a* vector of explanatory variables, β_{im} denotes the vector of parameters to be estimated, and ε_{im} are random error terms jointly follow a multivariate normal distribution with zero conditional mean and variance normalized to unity, the symmetric variance–covariance matrix Ω is explained by Eq. 6 where ρ_{ij} represent the correlation between different types of market outlets.

$$\Omega = \begin{bmatrix} 1 & \upsilon_{12} & \rho_{13} & \rho_{14} \\ \rho_{21} & 1 & \rho_{23} & \rho_{24} \\ \rho_{31} & \rho_{32} & 1 & \rho_{34} \\ \rho_{41} & \rho_{42} & \rho_{43} & 1 \end{bmatrix} \quad (6)$$

Explanatory Variables Measurement and Hypothesized variables

Demogramic, socio-eocnomic, farm specfic, institutional and market charactetstics explanataroy varaibles influcing both market participation and channel outle choice econometics models, with its measuments and expected hypotheses are explained in Table 1.

Table 1: Summary of independent variables, measurement and their hypotheses

Variables	Measurement	Market Participation & Sales Volume	Market channel choices				
			Cooperative	Whole seller	Assembler	consumer	Retailer
Biographic characteristics							
Age of household head	Years	+	+	+	-	-	-
Sex of household head	Dummy	+/-	+/-	+/-	-/+	-/+	-/+
Family size	Adult equivalence	-	+	+	-	-	-
Socio-economic characteristics							
Education level	Years	+	+	+	-	-	-
Current price of haricot bean	Birr per kg		+	+	-	-	-
Average lagged year price	Birr per kg	+					
Total quanity of harit bean output in 2019	Quintal	+	+	+	-	-	-
Farm specic attributes							
Land size for haricot bean	Hectare	+	+	+	+	+	+
Livestock size	TLU	+	+	+	-	-	-
Institutional charactestics							
Extension service	# of visit	+	+	+	-	-	-
Cooprative memership	Dummy	+/-	+/-	-/+	-/+	-/+	-/+
Use of credit	Dummy	+	+	+	+	+	+
Distance to wathered road	Kilometre	-	-	-	+	+	+

Awareness of quality and standard of haricot bean	Dummy	+	+	-	-	-	+
Market charactestics							
Distance to market	Kilometre	-	-	-	+	+	+
Market information access (Ownership of mobile phone)	Dummy	+/-	+	+	-	-	-

Source: Own survey, 2020

3. Result and Discussions

This section presents the descriptive statistics result and econometrics models results.

3.1. Description of sampled respondent characteristics

The result of the survey indicates that out of a total of 378 sampled farm households, 320 (84.65%) households have participated to haricot bean market and with 65% level of participation to the market in 2019/20 production year. In Table 2, the result of the comparison between participant and non-participant to the market shows that the proportion of female household head is higher among participants (85.4%) than non- participant (14.6%). The mean age of the household was 43.15 years with a standard deviation of 8.27, with the mean age 43.47 years to the participant and age of 41.41years to non-participants and its mean difference was significant at 10% levels of significance level. The average family size of sample respondents was 6.85 (adult equivalence) with a standard deviation of 2.25, with the mean 6.63 and 6.85 for participants and non-participant, respectively. The district average family size is greater than the national rural average family size which was 5.2 showing the availabilities of labor force (CSA, 2019). Accordingly, with regards to the educational level of sample household heads, the average number of education level was 3.11 years with a standard deviation of 3.17.

There is a significant difference to the total quantity of haricot bean supplied to the market between participant and non-participant. Participants have significantly supplied more quaintly of haricot bean to the market (3.81) than non-participant households (0.55). However, non-participants earned have earned the lower price of haricot bean during the 2019 cropping season and the previous year. The average farmland allocated to haricot production was 0.61 hectare with a standard deviation of 0.38, participants have significantly allocated more land for haricot

bean production during 2019/20 cropping season (0.67 hectare) than non-participants (0.28 hectare), and its mean difference was significant at 1% significance level. Similarly, the average livestock holding size was 6.43 TLU with a standard deviation of 0.61, participant households owned more livestock size (6.58 TLU) than non-participants (5.61 TLU), and its mean difference was significant at 5% significance level. The results of the comparison suggest that there is a positive correlation between land size and livestock holding size with participation to the market.

There are also significant differences in terms of institutional and market characteristics between participant and non-participants. The average extension contact during the cropping season was 2.7 times with a standard deviation of 1. Participants have significantly larger frequency of extension contact during 2019/20 cropping season (3.1) than non-participants (1.4). The proportion of farmers who are a member of farmers cooperative (37.6%) and use credit for haricot bean production (37%) is significantly higher among participants (3.7%) than non-participants (4%). Similarly, the proportion of farmers who have awareness regarding the quality and standard of haricot bean is significantly higher among participants (23.01%) than non-participants (1.59%). However, non-participants farm households are living nearer to the weathered road (19.81km) than participants (18.31 km). The findings suggest that farmers with access to extension services and cooperative members have higher propensity to participate in the market than others and its mean difference is significant at 1% significance level for both. The proportion of farmers who own a mobile phone is significantly higher among participants (81.48%) than non-participants (5.03%). Both participants (2.9km) and non-participant farm households (2.96km) are living with equal distance from the nearer main market center. The findings suggest that farmers who own mobile have a higher propensity to participate and its proportion difference is significant at a 1% level of significance.

Table 2: Table 1: Descriptive statistics of explanatory variables

Variables	Total		Market Participants (N =320)		Non-participants (N=58)		t- or λ^2 tests
Biographic characteristics	Mean (St. Dev.)/ % (frequency)		Mean (St. Dev.)/ % (frequency)		Mean (St. Dev.)/ % (frequency)		
Sex of the head (male)	(92.6)	(350)	(85.4)	(299)	(14.6)	(51)	(2.17)
Age of household head	43.15	8.27	43.47	8.21	41.41	8.48	-1.75*
Family size	6.89	2.28	6.63	2.09	6.85	2.25	-0.79
Socio-economic characteristics							
Total quanity of harit bean output in 2019	3.31	3.23	3.81	3.26	0.551	0.8	-7.57***
Education level	3.11	3.17	3.19	3.11	2.67	3.37	-1.22
Average lagged year price	5.84	1	5.58	0.81	5.76	0.97	-0.76
Current price of haricot bean	7.4	5.56	7.49	5.63	6.69	3.43	-1.21
Total quanity of harit bean output in 2019 in log	3.31	3.23	3.81	3.26	0.551	0.8	-7.57***
Farm specic attributes							
Land size for haricot bean	0.61	0.38	0.67	0.36	0.28	0.27	-7.73***
Livestock size (TLU)	6.43	3.29	6.58	3.33	5.61	2.98	-2.06**
Institutional charactestics							
Extension service	2.7	1	3.1	0.79	1.4	0.89	-14***
Cooprative memership	(41.3)	(156)	(37.57)	(142)	(3.70)	(14)	8.29***
Use of credit	(41)	(10.8)	(37)	(90)	(4)	(10)	(1.105)
Distance to wathered road (km)	18.53	15.6	18.3	16	19.81	13.4	0.677
Awareness of quality and standard of haricot bean	(24.6)	(93)	(23.01)	(87)	(1.59)	(6)	(7.508*)
Market charactestics							
Distance to market (km)	2.91	1.66	2.9	1.71	2.96	1.37	0.23
Market information (Ownership of mobile phone)	(86.5)	(327)	(81.48)	(308)	(5.03)	(19)	(153.4)***

Note: Variables in parentheses are frequency, percent and λ^2-test, respectively.

Source: Own survey, 2020

3.2. Determinants of Haricot Bean Market Participation status and extent

As shown in table 3, the result of Heckman's first stage i.e. Probit model examined the determinants of haricot bean market participation in the study area. The Wald test of the hypothesis that all regression coefficients are jointly equal to zero is rejected at the 1% statistical significance level which shows that all selected explanatory variables explained the model are relevant and jointly influencing the variations in probability of household decision to sell haricot bean to the market.

Table 3: The Heckman first stage (Probit) and second stage (OLS) results

	First stage (Probit) result			Second stage (OLS) result	
Variables	Coefficient (St. Error)	t-ratio	Marginal effects	Coefficient (St. Error)	t-ratio
Age of household head	0.0001 (0.02)	0.95	0. 002	0 .002 (0.004)	0.016
Sex of household head	0.47 (0.46)	0.611	0.0005	-.255** (0.142)	0. 0.07
Family size	- 0.064 (0.07)	0.3	-0.255	-0.023** (0.011)	0.041
Education level	-0.11 (0.05)	0.033	-0.0012**	0.0062 (0.012)	0.92
Livestock size	-0.001 (0.06)	0.94	-0.016	0.017 (0.012)	0.192
Land size for haricot bean	1.06 (0.68)	0.12	0.12	0.12 (0.12)	0.324
Use of credit	0.86 (0.55)	0.12	0.013	-0.132 (0.11)	0.23
Market information	1.32 (0.36)	0.00	0.27***	-0.27 (0.22)	0.2
Extension service	0.88 (0.25)	0.001	0.211***	0.21*** (0.06)	0.001
Use of credit	-0.52 (0.5)	0.317	-0.037	-0.132 (0.11)	0.23
Membership in cooperative	-0.04 (0.35)	0.89	-0.04	-0.04 (0.09)	0.6
Distance to market	0.0.26 (0.01)	0.63	0.07	0.07 (0.28)	0.011
Distance to wathered road	0.06 (0.014)	0.63	-0.014	-0.013*** (0.002)	0.000
Average lagged year price	0.29 (0. 17)	0.093	0.005*	-0.0004 (.0007)	0.537
Total quantity of product in 2019	0 .007 (0.002)	0.001	0.002***	0.002*** (0.0001)	0.000
Awareness of quality and standard of haricot bean				-0.029 (0.072)	0.689

Constant	-5.9 (1.87)	0.002		3.63*** (0.210)	0.000
IMR(lambda)	-0.6 2*** 0.2	0.002			
Wald chi^2(15)	499.8***				

Note: ***, ** and * represents significance at 1, 5 and 10%, respectively.

Source: Own survey data, 2020

Market information measured using ownership of mobile phone has a positive and significant effect on market participation decision at a 1% significant level. Market information is very important for farmers to supply their produce at the right time and at the right place. Farmers who have more access to market information incur less transaction cost which related to searching for market information. The marginal effect result shows that the producers who have market information have more probability of supply of haricot bean to the market at 27% than that have no information about markets.

The education of the household head has a negative and significant effect on market participation decision at a 5% significance level as opposed to the prior expectation. Education is a continuous variable and is generally recognized that education equips individuals with the necessary knowledge of how to make a decision. The marginal effect result shows that increasing 1 year of schooling of the household head decreases the probability of market participation in haricot bean by 0.12%. This might be due to educated households may calculate the cost and benefit based on market price trend and shift their attention to other profitable agricultural commodities. The FGD participants also confirmed that due to price fall haricot bean in the market they are shifting to other market-oriented products.

Average lagged year market price has positive and significant effect on the market participation/the probability to sale of haricot bean at 10% significant level. This due to, lagged year prices can stimulate production and thus marketable supply of haricot bean for the next year. If prices in one year are bad, farmers will often respond by planting less in the next year that leads to lower production. The result of marginal effect shows a one birr increase in one kilogram of haricot bean, increase the probability of participation by 0.5%. This study is in line with Aleminew (2010) red paper market participation was determined by lagged year price of the product in case of Bure district.

Number of extension visit has, significant and positive effect on the farmers ’market participation decision at 1% significant level. This could be attributed to the fact that an increase in the number of extension visits would avail up to date information regarding agricultural technologies that might improve productivity and therefore increase the marketable surplus. The marginal effect result indicated that an extra extension visit would increase the probability of farmers participating in the haricot bean market by 21.3%.

Total quantity haricot bean affects the market participation positively and significantly at 1% significant level. A marginal increase in haricot bean production has obvious and significant effect in market participation. This can be explained by the fact that haricot bean is among the cash crops grown in kucha district; the higher the produce the higher the farmers’ motivation to sell more to generate more income. The marginal effects result revealed that, a unit increase in the quantity of haricot beans produced increased the probability of market participation by 0.2%.

The second stage of the Heckman estimation model identified the significant factor that determines the volume of marketed surplus which is conditional on expected market participation decision and explained in Table 2.

The coefficient of the Inverse Mills ratio (Lambda) in the Heckman two-stage estimation is significant at the probability of less than 1 percent which indicates the existence of sample selection bias in the data. The value of correlation between the models (rho#0) which indicating that there is unobserved factors that can affect the participation of producers in haricot bean market and volume of participation in the district. So, in this stage sample selection correction factor is included in the second stage regression (OLS) model to eliminate the selection bias. Among hypothesized 17 variables 7 variables are significant and affect the volume of the haricot bean market supply. These variables are sex of household head, family size of household, distance to market, total quantity produced, distance to all weathered road, number of extension visit and IMR(lambda) or selection bias correction factor.

The sex of the household head significantly and negatively influences the volume of market participation. Being a female-headed household increases the proportion of haricot bean sales by 0.255 quintal and statistically significant at 5%. This implies that female-headed households have advantageous in supplying more volume than males. This may be due to currently the

government of Ethiopia and different NGOs particularly community vision Ethiopia (CBO) within the district are providing gender specific training for farmers that might help female farmers to supply more than males. This could be seen in terms of produced amount and sold amount i.e how much produced and how much sold.

The family size of a household as expected has a negative and significant effect on the volume of haricot beans supplied to the market at a 5% significance level. A unit increase in family size would reduce the volume of haricot beans to be sold by 0.023 quintals. The negative sign indicates that as the family size increases the quantity marketed would be decreased. This could be because a big family size increases the quantity of haricot bean needed for home consumption thereby reducing the marketable surplus.

The quantity of haricot bean produced has a positive and significant effect on the level of extent of haricot bean market participation ($p = 0.000$). A unit increase in the quantity of haricot beans produced would lead to a 0.0019 Qt increase in the quantity of haricot beans supplied to the market. Those farmers who produced more also sold more, which is consistent with expectation.

Distance to all weathered road affects the volume of haricot bean market supply negatively and significantly at 1% significant level. In this study, a kilometre increase in the distance far from all-weather roads, the volume of haricot bean market supply decreases by 0.013 quintals. This is because the producer lives closer to all weathered roads have accesses of different facilities than that of far away dwellers from all weathered roads. So, residents near to all weathered roads can get inputs as well as acquire information easily without incurring high transaction costs, but it may need a high cost for producers live in far away from all weathered roads which discourage the production and in turn volume of market supply. This result confirms with the findings of Shewaye (2016) that farm households located far from all-weather roads facing high transportation costs, this leads to high transaction costs. So, these farm households have discouraged to produce more as the price they received for their produce will lower due to high transportation costs.

Number of extension visit has positive and significant effect on volume of haricot bean market supply at 1% significant level. The Heckman two stage model shows that an increase in number of extension visit by one day would increase the volume of supply of haricot bean by 0.21 quintal. This result implies that the technical advice provided for farmers by development agent

and experts of agriculture on haricot bean production (on improved seed use, fertilizer application, row planting) and haricot bean marketing in turn enhance the volume of haricot bean marketing. This result is consistent with the findings of Kassa *et al*., (2017) who found that extension contact and advice significantly and positively influence producer agronomic practices that enhancing the productivity of banana in the area.

The inverse Mill's Ratio affects the quantity supplied negatively with 1% significance level and it indicates that in Heckman two-stage model, the correction for selectivity bias is significant and the error term in the selection and outcome equation is negatively correlated. This indicates that there was a sample selection bias, or the existence of unobserved factors that determine farmers' likelihood to participate in haricot bean market and thereby affecting the volume of participation. This result also confirmed by Shewaye (2016) in similar study.

3.3. Haricot bean market outlets

Table 3 shows the different haricot bean market channels/outlets chosen by the haricot bean producers when selling their produce. One of the most commonly used market outlets by producers is the Assembler outlet which was chosen by about 38.32% of respondents that participated in the haricot bean market. While about 23.81% of respondents sold to the whole seller. Cooperative is also a haricot bean marketing outlet in the study area, only around 11.38% of sample households sold to the primary cooperatives while the others sold their produce directly to consumer and retailer outlets.

Table 3: Description of haricot bean market outlets

Supply decision	Haricot bean marketing outlets									
	Cooperatives		Whale seller		Assembler		Consumer		Retailer	
	Fr.	%	Fr.	%	Fr.	%	Fr.	%	Fr.	%
Yes	43	11.38	90	23.81	145	38.32	50	13.23	32	8.47
No	335	88.62	288	76.19	233	61.14	328	86.77	346	91.53

Source: Own survey data, 2020

3.4. Multivariate Probit Econometrics model Result

The result in table 4 below shows that the Wald test $\lambda^2(67)$ of 300.24 is significant at the 1% significance level indicating that the subset of coefficients of the model is jointly significant and

that the explanatory power of the factors included in the model is satisfactory; thus, the MVP model fits the data reasonably well. Likewise, the model is significant because the null that choice decision of the five haricot bean market outlets is independent was rejected at a 1% significance level. The results of the likelihood ratio test in the model (LR λ^2 (10) = 94.249 indicating the null that the independence between market outlet choice decision $\rho_{21} = \rho_{31} = \rho_{41} = \rho_{51} = \rho_{32} = \rho_{42} = \rho_{52} = \rho_{53} = \rho_{54} = 0$ is rejected at 1% significance level and there are significant joint correlations for two estimated coefficients across the equations in the models. This verifies that separate estimation of choice decision of these outlets is biased, and the decisions to choose the five haricot bean marketing channels are interdependent household decisions.

There are differences in market outlet selection behavior among producers, which are reflected in the likelihood ratio statistics of the estimated correlation matrix. Separately considered, the ρ values (ρ_{ij}) indicate the degree of correlation between each pair of dependent variables. The ρ_{31} (correlation between the choice for assembler and cooperative outlet), ρ_{51} (correlation between the choice for retailer and cooperative), and ρ_{32} (correlation between the choice for assembler and whole sell outlet), ρ_{41} (consumer and assembler outlet) are negatively interdependent and significant at the 5, 10, 1.and 1% probability levels respectively and ρ_{42} (consumer and whole seller outlet) are positively correlated at 10%. This finding leads us to the conclusion that haricot bean producers delivering to the assembler outlet are less likely to deliver to cooperative (ρ_{31}). Equally, those involved in retail market outlet are less likely to send their haricot bean to the cooperative (ρ_{51}), haricot bean producers delivering to the assembler outlet are less likely to deliver to the whole seller (ρ_{32}), haricot bean producers delivering to the consumers outlet are less likely to deliver to assemblers (ρ_{42}) but haricot bean producers delivering to the consumer outlet are also more likely deliver to wholesalers (ρ_{42}). This indicates a competitive relationship of an assembler with a cooperative outlet, retailer outlet with cooperative, assembler with wholesaler and consumer with assembler. It also indicates that the smallholder haricot bean producers have been used cooperative outlets as a substitute for retailers and assembler and assembler outlets as used a substitute for

consumers and wholesalers whereas, the complementary relationship between consumer and wholesaler market outlets.

The simulated maximum likelihood (SML) estimation of marginal success probability for each outlet's result shows that, the probability that haricot bean producers choose cooperative, whole seller, assembler, consumer and retailer, market outlets were 13.5, 29, 46.9, 15.6 and 10.5%, respectively. This indicates the likelihood of choosing retailer outlet is relatively low (10.5%) as compared to the probability of choosing assembler (46.9%), the whole seller (29%), a consumer (15.6%), and cooperative 13.5%. This implies that assembler is the most likely chosen market outlet by farmers. This is because the far-away settlement of producers from district town leads that the whole sellers to purchase low haricot bean produce at a time as well as the high market-related cost to supply to the whole seller price outlet.

The joint probabilities of success or failure of choosing five outlets suggest that the likelihood of households to jointly choose the five outlets is low which is 0.073% relatively lower compared to their failure to jointly choose them (13%). The joint probabilities of success or failure of the five outlet choice also suggest that households are more likely to fail to jointly choose the five outlets.

The result Table 4 shows that out of 15 explanatory variables included in the multivariate probit model that can affect the market channel choice of haricot bean in the district 12 variables have a significant effect on market channel choice.

Table 4: Multivariate Probit Model result

	Market outlets									
	Cooperative		**Whale seller**		**Assembler**		**Consumer**		**Retailer**	
	Coef.	(St.Error)	Coef.	(St.Error)	Coef.	(St.Error)	Coef.	(St.Error)	Coef.	(St.Error)
Age	-.0025	(.0178)	-.0254**	(.012)	.022**	(0.01)	.0273**	(.0116)	-.0069	(.0126)
Sex	.305	(.55)	.205	(.38)	-.23	(.295)	.41	(.402)	-.114	(.375)
Family size	-.014	(.040)	.029	(.050)	-.06	(.035)	-.023	(.044)	-.006	(.051)
Education level	-.014	(.040)	.022	(.032)	.0001	(.025)	-.035	(.031)	-.015	(.0326)
Extension service	-.13	(.194)	.27*	(.152)	.204*	(.114)	-.37***	(.134)	.292*	(.155)
Livestock size	-.012	(.044)	-.52	(.37)	.0032	(.028)	-.066**	(.032)	-.063	(.042)
Total quantity of haricot bean	.00021	(.001)	.00058	(.0004)	.0002	(.0003)	.00063*	(.0004)	.00032	(.0004)
Market information	.565	(.662)	1.0875**	(.55)	.954***	(.293)	.97**	(.410)	-.097	(.348)
Awareness on quality & standard	.47(.33)		.48	(.32)	-.686***	(.257)	.12	(.282)	-.434	(.342)
Cooperative membership	1.19***	(.370)	-1.15***	(.307)	.36*	(.209)	.312	(.223)	-.098	(.275)
Distance to market	-.0079*	(.119)	-.039	(.103)	.14**	(.058)	.0088	(.062)	.082	(.085)
Distance to weathered road	-.043	(.018)	-.077***	(.0174)	.028***	(.0065)	.023***	(.007)	-.0166*	(.009)
Current price	-.0048	(.007)	.033**	(.0156)	-.0023	(.0031)	-.001	(.0033)	-.0166	(.009)
Use of credit	1.63***	(.33)	-.94**	(.43)	-.34	(.28)	-.05	(.283)	-.0081	(.36)
Land size for haricot bean	-.14	(.407)	.05	(.04)	.52**	(.264)	.542*	(.277)	-.21	(.397)
Predicted probability	13.5%		29%		46.9%		15.6%		10.5%	
Joint probability of failure %			13							
Joint probability of success %			0.073							
Log likelihood			-541.423							
Wald –chi^2 (75)			300.24***							
Number of draws			5							
Number observation			378							
Estimated correlation matrix										
	ρ_1		ρ_2		ρ_3		ρ_4		ρ_5	
ρ_1	1				-.28**	(.123)	-		-.29*	(.17)
ρ_2			1		-.59***	(.086)	.223*	(.122)	-	
ρ_3	-				1		-.503*	(.1)	-	
ρ_4	-		-				1		-	
ρ_5	-				-		-		1	
Log likelihood ratio test			$\rho_{21} = \rho_{31} = \rho_{41} = \rho_{51} = \rho_{32} = \rho_{42} = \rho_{52} = \rho_{53} = \rho_{54} = 0$							
Chi^2 (10) =	94.2496									

Note: ***, ** and* show the significant level at 1, 5, and 10% respectively. Parentheses indicate the standard error.

Source: Own survey data, 2020

Age of household has a negative and statistically significant effect on the likelihood of choosing the whole seller market outlet while a positive effect on the likelihood of choosing Assembler and consumer outlets at 5% levels of significance. The result shows that the aged households are more likely to choose assembler and consumer market outlet and less likely to choose whole seller outlet. This due to that, the older farmers did not travel to long distances to get whole sellers in the district market in addition to having a better knowledge of cost and benefits associated with various haricot bean market outlets. Meanwhile, they were more likely to choose consumer outlet to get benefits by retailing to consumers at market day and supplying to assemblers without more transportation cost. This finding is confirmed by Efa andTura (2018) study and they revealed that the experience of producer had a positive effect on choosing whole seller market outlet choice of tomato.

The number of livestock owned measured in TLU has a negative and statistically significant effect on the likelihood of choosing a consumer market outlet at a 5% significance level. This implies that the likelihood of choosing a consumer market outlet decreases if ownership of livestock (TLU) increases. The possible reason is that livestock production and haricot bean production compete for scarce land resources, necessitating that farmers often have to make choices. This leads to reduced haricot bean production and market channel choices. This result in line with Taye *et al*. (2018) that revealed the increasing number of livestock owned decreases the likelihood of choosing whole seller market.

The quantity of haricot bean produced has a positive and significant effect on the likelihood of choosing consumers market outlet at 5%, significance levels. This indicates that those who produce more quantity of haricot bean more likely to choose the consumer's market outlets. This is due to that farmer produce haricot bean in larger quantity might have a link with different market outlets to supply their product to the market, which implied that those households with large volume of haricot bean mostly prefer to use any combination of market outlets that existed in their area rather than delivering only to single market outlet. The result has consisted of the result of Efa and Tura (2018) that revealed producers who produced a high amount use a combination of market outlets existed in their area.

Access to market information has positive and significant effects on the likelihood of choosing the whole seller; assembler and consumers market outlets at 5, 1 and 10% level of significance.

This is due to market information makes the farmers informed on prevailing pricing condition which helps producers to analyze the price difference in their locality and the nearby main market and related market cost that increases probability of choosing whole sellers; assemblers and consumers market outlets which give relatively higher price by fair weighing and minimizing market cost to producers. The finding is in line with the finding of Kassa *et al*. (2017) on honey market channel choice that revealed market information has a positive and significant effect on the consumer market channel. The finding also agrees with the finding of Kiprotich (2014) that indicates price information increases the probability of choosing a local market that assembles the product. The result of Shewaye (2016) also confirmed with this finding that accesses to price information positively and significantly affects the probability of choosing an urban market that could include the whole seller.

Distance to market has a positive and statistically significant effect on the likelihood of choosing assembler market outlets while the negative and statistically significant effect on the likelihood of cooperative market outlets at 5% and 10% significance level respectively. The negative coefficient for a cooperative outlet and a positive sign for assemblers' outlet reveals farmers who have located farther away from market face higher transaction costs and so may supply to assemblers in their villages or in nearby villages rather than selling to others in the more distant market that increase transaction costs. This finding is similar to the finding of Kassa *et al* (2017) that reveals distance to the nearest market has a positive effect on the collector.

Distance to all weathered road has a significant and positive effect on the decision of choosing assemblers and consumer market outlet at 1% significant level and negative and significant effect on, whole seller and retailer market outlets at 1 and 10% significance level. The possible explanation for this is that the closer a household farm or house to all-weather roads, the more transportation facilities access. This result implies that farm households located far from all-weather roads facing high transportation costs because there are no transportation facility accesses and thereby leading to decide to choose the nearby market outlet i.e. the assembler's and consumer market outlets that buy at the farm gate. This result confirms the finding of Shewaye (2016) that distance to the all weathered road hinders the choice of private traders.

Household Membership to cooperatives has also a positive and significant effect on the likelihood of probability of cooperative market outlet and assembler market outlet whereas

negatively affect whole seller market outlet choice at 1, 10 and 1% significant level. This result shows that if a household head is a member of cooperative the probability of choosing wholesalers market outlet less likely than cooperative and assembler outlets. This is mostly related to awareness that those cooperatives provide production and market information to their members directly or indirectly and incentives of cooperatives like share dividends for members at the end of each year. This finding is in line with the finding of Kassa *et al*. (2017); Bongiwe & Micah (2013).

The current market price of haricot bean is positively and significantly affected the likelihood of choosing the whole seller outlet at a 5% level of significance. The result implies that the whole seller in the study areas weight fairly the product and offers a fair price. This result confirms the findings of Fikiru *et al,* (2017) that revealed the current price of sesame affect the likelihood of choosing the whole seller market outlet positively.

Awareness about the quality standard of the product has a negative and significant effect on the likelihood of choosing an assembler market outlet. This is due to producers having awareness of the quality standard produces quality output and less likely supply to assembler outlet who buys in low price compared with other outlets that give emphasis on quality. During the FGD the committee member of cooperatives also said that the problem of the haricot bean market price deterioration is related to the quality of the product. Since 2015 it was branded like coca-cola colure and demanded by the exporters, but in the current years at the central market, Kucha/Selamber haricot bean was grouped in 3rd grade because of low quality. This problem is associated with a low awareness for producers as well as assemblers who buy low quality at low price and sort with the quality and supply for the whole seller in the district or send to the whole seller in the city.

Cultivated land for haricot bean has a positive and significant effect on the likelihood of the probability of assembler and consumer outlet at 5 and 10% significance level. The positive sign on cultivated land size for haricot bean variable shows that a farmer with large cultivated land, compared to farmers with small haricot bean land size would more likely to sell to assemblers and consumer. This implied that those households with large cultivating land sizes produce large volumes of haricot bean and supply to any combination of market outlets that existed in their area than delivering only to single market outlets.

The accesses to credit have a positive and significant effect on the probability of choosing a cooperative market outlet while the negative and significant effect on the wholesalers market outlet at 1 and 5% significance levels respectively. This implies that households who have credit accesses may produce more output this might be due to credit provide capital for farm households to spend in input market that boost yield and thus leading to more marketable surplus and also cooperatives give fertilizer and seed credit in the study area for the members and obliged to sell the output for cooperatives. This finding is consistent with the result of Efa &Tura (2018) Farmer's access to credit significantly reduces the likelihood probability that a tomato producer was selling to the whole seller market outlet.

Frequency/ number of extension visit has a positive and significant influence on wholesaler, assembler and retailer outlet choice decision at 10% significance level and negatively and significantly affect the outlet of a consumer at 1% significant level. Extension services increase the ability of farmers to acquire important market information as well as enable the haricot bean producers to improve production methods, hence leading to more output which in turn increases producers' ability to choose the best market outlet for their product and that to buy a large amount at once. This result confirms with the result of Taye *et al*. (2018) that shows the more extension provision increases the likelihood of choosing the retailer market of onion production.

ABBREVIATIONS

CSA	Central Statistical Authority
ECEA	Ethiopia Commodity Exchange Authority
ERCA	Ethiopian Revenue and Customs Authority
FGD	Focus Group Discussion
FOA	Food and Agriculture
KDFEDO	Kucha District Finance and Economy Development Office
MoFED	Ministry of Finance and Economic Development
SCP	Structure and Conduct Performance

SCP Structure Conduct and Performance

SNNPRS Southern Nations Nationalities and Peoples Regional State

4. Conclusion and Recommendations

Haricot bean is an important food and cash earning export item legumes crop and contributed a lot for foreign exchange earnings, creation of employment opportunities, and a source of livelihood for smallholder farmers. However, the marketing of haricot bean is highly volatile that makes producers are uncertain on the market outcome. The result of the first stage Heckman model shows the education level of household head, accesses to market information, number of extension visits, average lagged year price and the total quantity of haricot bean produced was found to be significantly influencing participation of the haricot bean market. While the second-stage Heckman model shows that sex, family size, the total quantity of haricot bean produced, distance to all weathered road, the number of extension visit were found to be significantly influencing the level of the haricot bean market participation. The multivariate probit result for haricot bean producers' outlet choice revealed a competitive relationship of an assembler with cooperative, a retailer with cooperative, assembler with wholesaler and consumer with assembler in the study area. In addition, the simulation results show that the probability of choosing cooperative, whole seller, assembler, consumer and retailer, market outlets fail to jointly choose simultaneously. Further, the model result also shows that age, number of extension visit, distance to market, access to market information, cooperative membership, awareness about the quality standard, distance to all weathered road, total livestock owned cultivated land size, accesses to credit and the current price of the product determine significantly the alternative market outlets choices of haricot bean producers in the study area.

Based on the finding, the local government in combination with regional and/or regional government should mobilize and organize haricot bean producers in cluster farming system so as to build their capacity via providing short-term training and various extension services to keep the quality of the product for the international market. Besides, strengthening the existing farmers' cooperative to supply quality haricot bean to the national market in a better organized the manner by reducing direct interventions of the intermediaries. Provision of technical advice to the farmers on haricot bean production and marketing, enhance the participation decision, volume of participation and choice of efficient haricot bean market channel. Creating a stable

demand for surplus production like contract farming system would also enhance farmers' decision on haricot bean production consistently. Governmental organization interventions in improving rural infrastructure in the form of establishing all-weather roads and strengthening the already started construction of Universal road access program project(URAPP) roads would assist non-participant farmers in participate in the market and as a result, the fair price would be enhanced through the low cost of transportation. In addition, it improves the integration of markets and thereby farm households will have an incentive to produce and supply more haricot bean since the returns they receive from their products would be high.

Farmers in the study area do not get timely market information upon which to base their marketing decision. They depend on traders and other farmer friends for price information. Therefore, there has to be an institution that can convey reliable and timely market information required by all stakeholders simultaneously. This would make the marketing system to operate efficiently and capably. The availability of timely and precise market information increases producers' bargaining capacity to negotiate with buyers of their produce. In order to obtain this advantage, there is a need to link market information with local FM radio program which focused on market price and linkage of farmers with markets is necessary to ensure a reliable market outlet for producers.

Availability of Data and Material

The datasets that support findings of this study are available from the corresponding author on reasonable request.

Competing Interest

The author declared no competing interest.

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Authors' contributions

The first author leads the overall research process and thoroughly revised all parts of the manuscript including abstract, introduction, methods, and interpretation of results. The second author participated in primary data collection, analysis, and interpretation of preliminary results. Both authors read and approved the final manuscript.

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