Determinants of market participation decision by smallholder haricot bean (Phaseolus vulgaris L.) farmers in Northwest Ethiopia

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Abstract: Current knowledge on product marketing in Ethiopia is poor and inadequate for designing and implementing policies to overcome problems in the marketing system. This study was conducted to identify the factors influencing the market participation decision of smallholder haricot bean (Phaseolus vulgaris L.) farmers in Northwest Ethiopia. Survey data were collected from 312 smallholder farmers and analyzed using Heckman’s two-step econometric model that estimates probit model in the first step and regression model with the parameters estimated using the Ordinary Least Squares (OLS) method in the second step. The educational status, non-farm income from nonfarm employment, number of extension contacts, gender, improved seed use, chemical fertilizer, and farmers' perception of land degradation were the significant variables affecting the market participation decision of smallholder farmers. The amount of haricot bean output supplied to the market were influenced by age, experience, livestock holding, nonfarm income, extension contacts, gender, market access, and membership in marketing association. Participation in the market can be improved by providing training and education regarding the production and marketing of haricot bean output and increasing farmers' contact with extension agents.

Subjects: Econometrics; Development Economics; Production, Operations & Information Management; Marketing

Keywords: market participation; smallholder farmer; haricot bean; supply chain; Hickman's two-step model

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1. Introduction

Agricultural commercialization is an important pathway towards economic growth and development in most developing countries that rely on agriculture (Timmer, 1997). There is a consensus among researchers and policymakers that the future of food security and poverty eradication in developing countries is hinged on the commercialization of smallholder agricultural production (Jaleta et al., 2009).

Market participation is the ability of an individual to participate in a market efficiently and effectively. In the context of this study, it is the transition of farmers from subsistence farming to a market engagement mode where inputs are increasingly purchased, and outputs are sold to traders. It is a marketing process that ends with a result. The transition from low to high market participation is influenced by the ability of farmers to produce products that meet market expectations in terms of quality standards, supply consistency, and ability to deliver products on time for sale at a sustainable price (Poole, 2017).

In developing countries, most smallholder farmer’s market participation is constrained by internal to the farmer and external factors. The internal factors are barriers that lead to farmers failing to meet market expectations due to lack of physical and financial assets such as land and credit, human assets such as skills, commercial contacts, labor, and time. The external factors include the absence of trade information, infrastructure, accessibility, and adequate institutions that enforce contracts (Poole, 2017).

Developing countries are confronted with serious challenges regarding agricultural commercialization due to a lack of access to information on supply, demand, price, and alternative opportunities (Anderson, 2003). These uncertainties make farmers vulnerable to various risks such as loss of income and assets that make shifting to commercialized agriculture difficult (Rogers, 1995). This vulnerability is more serious on smallholder farmers.

Marketing plays a crucial role in meeting poverty alleviation, food security, and sustainable agriculture goals, especially among smallholder farmers in developing countries (Altshul, 1988). Lack of bargaining power along with various credit bound relationships with the buyers has led to farmers being exploited during the transaction where most of the farmers become price takers. Most farmers are smallholders and hence, unable to obtain a fair price for their produce, which results in them to be unable to sustain their livelihood (Xaba & Masuku, 2013).

Current information and good marketing facility empower farmers to plan their production more in line with the market demand, to schedule their harvest at the most profitable time, to decide to which market to sell their produce, and to negotiate on a more even footing with traders (Lunndy et al., 2004). However, current knowledge on product marketing is inadequate for designing policies and institutions to overcome problems in the marketing system. According to MoA and MoA & ILRI (2013), enhancing the ability of poor smallholder farmers to actively engage in markets is one of the most pressing development challenges. Without having appropriate marketing conditions, the possible increment in output, rural incomes, and foreign exchange resulting from the introduction of improved production technologies could not be effective.

Agriculture continues to face several constraints and obstacles in Ethiopia. The major ones are adverse climatic conditions, lack of appropriate land use system resulting in the degradation of soil and other natural resources, limited use of improved agricultural technologies, the predominance of subsistence agriculture, and lack and/or absence of business-oriented agricultural production system and limited or no access to market facilities resulting in low participation of the smallholder farmers in the value chain. In comparison to this, the study by Jifara and Amsalu (2017) indicates that agricultural marketing is a very important factor for economic development, and the lack of an effective marketing system severely hinders the development of developing countries.
Pulses, which occupy approximately 13% of the cultivated land and account for approximately 10% of the agricultural value addition, are critical to the livelihoods of smallholder farmers in Ethiopia. Compared to cereals, pulses are higher-value crops that contribute to smallholder farmers’ income, and good sources of protein. Moreover, pulses offer natural soil maintenance benefits through nitrogen-fixing, which improves yields of cereals through crop rotation, and reduced fertilizer use leads smallholder farmers to save money (CSA, 2008).

The production of pulses is concentrated in the Amhara and Oromiya regions of Ethiopia, which together account for 92% of the chickpea production, 85% of the faba bean production, 79% of the haricot bean (Phaseolus vulgaris L.) production, and 79% of the field pea production. Amhara region (where the study area is located) is the largest producer of three out of the four major pulse varieties of the country (faba beans, chickpeas, and haricot beans), while Oromiya leads production in the other major variety, field peas (CSA, 2008). Northwest Ethiopia, particularly Awi Nationality Administrative Zone, has a potential for haricot bean production. Although the region has a high potential for haricot bean production, farmers face marketing constraints.

There are several studies conducted on issues related to agricultural product marketing by smallholder farmers in different countries. For example, the report by Mwangi and Crewett (2019) indicates that farmers who use irrigation participate more in urban markets, have stronger price bargaining power, compete efficiently with market intermediaries, sell less at farmgate, and access to better marketing arrangements are skewed toward farmers with off-farm income and male-headed households. Gebrehiwot et al. (2018) reported that total land holding of the household, family size, the volume of vegetables produced and marketed, usage of irrigation technologies, interaction with extension agents, and access to market information and vegetable marketing significantly improve the livelihoods of smallholder producers. Similarly, other studies (Hagos et al., 2020; Hao et al., 2018; Megerssa et al., 2020; Ola & Menapace, 2020) were conducted on the different factors affecting the marketing/commercialization of agricultural products by using different methods of data analysis.

However, none of the above studies incorporated the endogeneity of the market participation decision process, and selection due to both observable and unobservable characteristics. This study methodologically addresses the biases noted in the literatures by applying Heckman’s two-step econometric model that accounts for endogeneity and selection bias (Heckman, 1979). Heckman’s two-step econometric model estimates the determinants of market participation decision through two steps, estimating the determinants of marketing decision by probit model in the first step and estimating the determinants of the degree of market participation by using Ordinary Least Square (OLS) technique in the second step. Furthermore, previous studies conducted on the determinants of market participation decision were not able to determine the factors affecting the degree of market participation; they only determine the factors affecting the binary (participating and nonparticipating) marketing decision of farmers. Moreover, this study adds knowledge, particularly in the context of Northwest Ethiopia where the literature on the determinants of market participation decision and the extent of participation by smallholder haricot bean farmers is rare. Therefore, the objective of this study is to identify the factors affecting the market participation of smallholder haricot bean farmers in Northwest Ethiopia.

The study aimed to answer the following research questions:

1. What are the factors affecting the decision of smallholder haricot bean farmers to participate in the market?
2. What are the factors influencing the amount of haricot bean marketing surplus supplied by smallholder farmers to the market?
2. Literature review

Various studies have been conducted to identify the factors and the constraints affecting the market participation decisions of farmers. The study by Alene et al. (2008) revealed that, in Kenya, transaction costs have a negative effect on market participation; however, institutional innovations such as group marketing are evolving to mitigate this problem. Farmer’s market participation can also vary with the product. For example, the farmers that participate in the export market of avocado are older, have larger farms, have received more training, own more Hass variety avocado trees, which is favored in the export market, and live near a well-functioning avocado farmers’ group (Amare et al., 2019).

Fischer and Qaim (2012) reported that although farmer groups in Kenya are inclusive of the poor, wealthier households are more likely to join. According to the findings of Hao et al. (2018), cooperative membership has a positive effect on selling to wholesalers and a negative effect on selling to small dealers but does not have a significant impact on selling to the cooperative itself. Access to land, usage of technology, productive assets, expected prices, and rainfall amount and consistency are strongly correlated with market participation for maize, kale, and milk (Olwande et al., 2015). By studying the dynamics of farmers’ consumption over a period of time and by controlling production and household characteristics along with possible confounding factors, Montalbano et al. (2018) showed that farmers’ food security is positively affected by participation in the market chain, irrespective of the choice of outlet.

Hagos et al. (2020) reported that the most important determinants of mango market participation are resource ownership (land allocated for mango and land fragmentation), asset ownership (number of productive mango trees and availability of mango seedlings), access to farmers’ clubs, support from knowledgeable individuals in the village, and income from different agricultural products. Lu et al. (2010) reported that farmers’ modern market participation will be further enhanced by faithful buyer–seller relationships with buyers and complying with buyers’ quality requirements; on the other hand, having formal contracts is directly related to farmers’ trusting interactions with buyers.

Ola and Menapace (2020) reported that access to extension services, credit, an additional source of income, and gender have larger relevance in Africa compared to South America and Asia, whereas membership in collective groups and access to irrigation facilities are important in Asia in determining participation in modern agricultural value chains and high-value markets. Megerssa et al. (2020) reported that age of household head, household family size, educational level of household head, labor market, market information, and distance from the marketplace were statistically significant factors influencing market participation among smallholder vegetable producers.

Beyene et al. (2020) reported that the allocated amount of land, labor, seed, chemical fertilizer, and oxen have a positive and significant influence, whereas market distance and crop diversification have a negative influence on the production of haricot bean. In Ethiopia, the productivity and production of grain legumes are below its potential, primarily due to low input usage, limited availability of seed, lack of extension services, and market problems (Kebede, 2020). However, Andaregie and Astatkie (2020) reported that access to the product market and the experience of smallholder potato producers significantly influence the efficiency and marketing of potato output in Northern Ethiopia. These factors may also influence the efficiency and marketing of the haricot bean. Considering the above empirical literatures regarding the marketing/commercialization of agricultural products, this study aimed to identify the factors affecting the market participation of smallholder farmers and to estimate the effect of these variables.
3. Materials and methods

3.1. Sampling technique and sample size
The population of this study was all haricot bean smallholder producers in the Awi administrative zone of Northwest Ethiopia. There are a total of 12 districts in Awi zone administration of which four districts are producers of haricot bean. There are 3,140 smallholder producers of haricot bean in the four districts (Ayehu Guagussa, Zigem, Guwanguwa, and Jawi). Since these four districts are internally heterogenous and externally homogenous, a two-stage sampling (cluster sampling in the first stage and simple random sampling in the second stage) was done. In the first stage, the Ayehu Guagussa district that has 815 producers and the Jaws district that has 605 producers were selected. The combined population size is N = 1420. For the second stage, the sample size (n) was determined according to Yamane (1967) as follows:

\[ n = \frac{N}{1 + \frac{N(n)}{e^2}} = \frac{1420}{1 + \frac{1420(0.05)^2}{312}} = 312 \]

Then, this n = 312 was allocated to the two districts proportionally, which resulted in n₁ = 179 and n₂ = 133 smallholder farmers from Ayehu Guagussa and Jaws districts, respectively. Then structured questionnaires and interviews were used to collect data from the randomly selected farmers between 10 January 2020 and February 30, 2020.

3.2. Method of data analysis
In this study, descriptive statistics, tests of independence, and econometric analysis methods were used. To describe the demographic, socio-economic, and institutional characteristics of smallholder haricot bean farmers, means, percentages, and frequencies were used. The significance of the association between the two categorical variables was tested using the \( \chi^2 \) test of independence.

Regarding the econometric model, to estimate the coefficients of the factors that affect market participation decision and the extent of participation, this study used the behavior of the market participation model proposed by Barrett (2008). The key assumption of this model is the decision of smallholder farm households is based on the principle of utility maximization either in a form of the net seller or net buyer. In this study, a two-step analytical approach was followed to determine participation in the market. The main reason for the adoption of this approach is that market participation involves two-way decision: the decision to participate and the actual degree of participation. The decision to participate is a categorical variable that takes either 1 (participating decision) or 0 (nonparticipating decision). Hence, this decision can be modeled by a binary response model, specifically the probit model. The second decision of the farmers is on what amount of haricot bean output to be supplied to the market, which is a continuous variable measured in kilograms (kg). Hence, the second step decision can be modeled by a multiple regression model whose parameters can be estimated by using the Ordinary Least Squares (OLS) estimation method.

The two well-known methods appropriate for modeling the decision of participation and the actual level of participation are the Heckman selection model and Cragg’s double hurdle model (Musah et al., 2014). This study adopted Heckman’s sample selection model where sample selection occurs when farmers select themselves into either the participating group or the nonparticipating group.

The decision of farmers is based on their behavior, which in turn is affected by several factors (Willock et al., 1999). The characteristics of the farmer include education, gender, assets needed for production, external environment such as biophysical condition. The decision of a farmer is affected by several interrelated factors including biophysical, socioeconomic, institutional, and policy (Fountas et al., 2006; Wallace & Moss, 2002; Willock et al., 1999).
3.3. Econometric model for the determinants of market participation decision of smallholder farmers

A farmer is said to participate in the market if he/she sells a part of his/her output in the market. The decision to participate in the market solely depends on the farmer’s discretion. The market participation decision of haricot bean smallholder farmers, which estimates the probability of a household’s head to participate in the output market can be estimated using the following model:

\[ Y_i = \beta X_i + U_i \]  

(1)

\( Y_i \) = a dummy dependent variable (1 = market participation; 0 = no market participation) showing the haricot bean market participation of the \( i \)th farmer. If it is 1, it means the farmer sells a part of his/her output in the market and 0 means otherwise.

\[ \beta \] = a vector of coefficients of the explanatory variables

\[ X_i \] = a vector of the explanatory variables that affect market participation measured on the \( i \)th farmer, \( U_i \) is the \( i \)th error term.

In the second step, the amount of haricot bean marketed surplus as a proxy for the degree of market participation was estimated by the following equation by including an estimate of the inverse mill’s ratio (\( \lambda_i \)) as;

\[ Y_j = \beta_j X_j + \lambda_j \mu + \mu_j \]  

(2)

where \( Y_j \) = The amount of haricot bean is marketed surplus as a proxy for the degree of market participation of smallholder farmers.

\[ \beta_j \] = unknown parameters to be estimated in the outcome equation

\[ X_j \] = factors that are expected to affect the amount of haricot bean surplus

\( \lambda \) = selection bias correction factor (Inverse mill’s ratio)

To estimate the factors affecting the market participation decision of smallholder farmers, Heckman’s two-step approach is an appropriate model that corrects the problem of simultaneity. It is established in the literature that Heckman’s two-step approach (Heckman, 1979) can only be used when the correlation between the two error terms is greater than zero so that it will correct the problem of selection bias (Hoffmann & Kassouf, 2005; Johannes et al., 2010; Siziba et al., 2011). According to Wooldridge (2010), this approach is based on the restrictive assumption of normally distributed error terms. In the first step of this two-step approach, the probit model is used to identify the factors affecting market participation (Eq. 1), and in the second step, the OLS method is applied to the identified factors affecting the degree of market participation (Eq. 2).

Probit model fitted in the first step also provides the value of inverse mills ratio (IMR). It is denoted by “\( \lambda \)” and is defined as “the ratio of the ordinate of a standard normal distribution to the tail area of the distribution” (Greene, 2007).

\[ \lambda_i = \phi(\rho + aX_i) / \phi(\rho + aX_i) \]  

(3)

where \( \phi \) is standard normal density function and

\[ \phi = \text{Standard normal distribution function} \]

According to (Greene, 2007), the IMR term corrects the problem of selection bias. If the term (\( \lambda \)) is not statistically significant, then sample selection bias is not a problem (Heckman, 1979).
A statistically significant value of $\lambda$ means that a significant difference exists between the farmers that participate in the market and those that did not participate.

The variables used were Age = age of the household head (measured in years); Educ = educational status of the household head (1 = literate; 0 otherwise); Fsz = family size (in number of persons in the family/household); Expe = farming experience (number of years the farmer produced haricot bean); Lnds = land size covered by haricot bean in 2019 (in hectare); TotLive = total livestock holdings in tropical livestock unit; Nonfi = nonfarm income from nonfarm employment (1 = Yes; 0 otherwise); Extco = number of extension contacts in 2019; Dis = distance from the farmer’s village to the market center (in km); Creus = credit was used (1 = Yes; 0 otherwise); Gender = gender of the household head (1 = male; 0 otherwise); woemp = women empowerment (1 = empowered; 0 otherwise); mktacc = access to market information (1 = Yes; 0 otherwise); trafaci = ownership of transport facility (1 = Yes; 0 otherwise); Iri = whether the farmer use irrigation (1 = yes; 0 = no); Impse = whether the farmer used improved seed (1 = yes; 0 = No); Chefe = chemical fertilizer use (1 = yes; 0 = no); Faper = farmers perception on land degradation (1 = low; 2 = medium and 3 = high degradation classes), and mktmem = membership to marketing association (1 = Yes; 0 otherwise). The analysis was completed using STATA (Version 15) software.

4. Results and discussion

4.1. Demographic and socio-economic characteristics of households

Descriptive statistics of the continuous variables used in the study indicated that the average age of the household head for the non-market participant was 38.7 years, whereas the average age of the market participant smallholder haricot bean farmers was 39.37 years. These ages indicate that both groups of smallholder farmers are at their productive age. The average family size of the non-market participant and market participant smallholder farmers was 5 and 4, respectively. This indicates that nonmarket participant smallholder households have a slightly larger family size than market participant households.

The average experience of the household head in haricot bean production for the nonparticipants and participants were 8.47 and 10 years, respectively. This result indicates that market participant households have long years of experience in the production of haricot bean. The mean landholding size of the participants household head was two times that of non-participants (1.84 vs. 0.92 ha). Similarly, the mean total livestock holdings of the participant household head were larger than that of the nonparticipant household head (6 vs. 4). Also, the average number of extension contacts of participant households in 2019 was 5 times, which is larger than that of nonparticipant households (3 times).

The $\chi^2$ test of independence between the categorical variables and the market participation decision of smallholder haricot bean farmers results are shown in Table 1. There was a highly significant ($p$ value $<$ 0.001) association between the educational status of the head of the household and market participation. Accordingly, 65% of the household heads were literate and participated, and only 1% of the household heads were literate and did not participate in the haricot bean market; and 9% of the household heads were illiterate and participated while 25% were illiterate and did not participate. This glaring evidence shows that education plays an important role in the decision of the head of the households to participate in the haricot bean market.

Whether a household head received non-farm income from nonfarm employment was also a significant ($p < 0.001$) factor that influences the market participation decision of haricot bean smallholder farmers in Northwest Ethiopia (Table 1). The results showed that 50% received nonfarm income and participated, and only 1% received nonfarm income but did not participate. On
Table 1. Test of independence results between each of the 12 categorical variables and market participation decision of smallholder haricot bean farmers. The numbers shown in each cell are the counts out of n = 312 converted to percentages.

| Categorical variable                          | Category     | Market participant | P-value* |
|----------------------------------------------|--------------|--------------------|----------|
| Educational status of the household head     | Literate     | 1%                 | 65%      | <0.001*** |
|                                              | Illiterate   | 25%                | 9%       |           |
| Nonfarm income from nonfarm employment       | Yes          | 1%                 | 50%      | <0.001*** |
|                                              | No           | 25%                | 24%      |           |
| Whether the farmer used credit               | Yes          | 2%                 | 49%      | <0.001*** |
|                                              | No           | 24%                | 25%      |           |
| Gender of the household head                 | Male         | 3%                 | 49%      | <0.001*** |
|                                              | Female       | 25%                | 23%      |           |
| Whether there is market access               | Yes          | 17%                | 47%      | 0.772    |
|                                              | No           | 9%                 | 27%      |           |
| Whether there is transport facility          | Yes          | 12%                | 43%      | 0.055*   |
|                                              | No           | 31%                | 14%      |           |
| Whether the household used irrigation        | Yes          | 1%                 | 45%      | <0.001*** |
|                                              | No           | 29%                | 25%      |           |
| Whether the household adopted improved seed  | Yes          | 2%                 | 64%      | <0.001*** |
|                                              | No           | 24%                | 10%      |           |
| Chemical fertilizer use                      | Yes          | 4%                 | 56%      | <0.001*** |
|                                              | No           | 22%                | 18%      |           |
| Farmer’s perception on land degradation      | Low          | 0%                 | 61%      | <0.001*** |
|                                              | Medium       | 1%                 | 12%      |           |
|                                              | High         | 25%                | 1%       |           |
| Membership in a marketing association        | Yes          | 9%                 | 34%      | 0.100    |
|                                              | No           | 17%                | 40%      |           |
| Location                                     | Ayehu        | 15%                | 43%      | 0.902    |
|                                              | Jawi         | 11%                | 31%      |           |

* and * represent significance at the 1% and 10% levels, respectively.

The other hand, 24% did not receive non-farm income and participated, and 25% neither received nonfarm income nor participated in the market (Table 1).

There was a strongly significant ($p < 0.001$) association between using credit and market participation (Table 1). The results showed that 49% used credit and participated and only 2% used credit but did not participate in the haricot bean market. In contrast, 25% of the households did not use credit but participated, and 24% did not use credit as well as did not participate in the market (Table 1). The other categorical variable with a highly significant ($p < 0.001$) association with participation is the gender of the household head. Accordingly, 49% of the heads were male and they participated, whereas 3% were male and did not participate; but 23% of the heads were female and they participated while 25% were female and did not participate (Table 1).

Whether the smallholder farmers have access to transport facility was marginally significantly associated with the market participation decision ($p = 0.055$). As the results in Table 1 indicate, 43% of the respondents had access to transport facilities and they participated, and 12% of them
had access to transport facilities but they did not participate; but 14% of the respondents did not have access to transport facilities but they participated while 31% did neither have access to transport facility nor participate in market (Table 1). The other three categorical variables (whether there is market access, membership to a marketing association, and location) did not have a significant association with the decision to participate (Table 1).

Whether the household used irrigation water was significantly ($p < 0.001$) associated with market participation decision. As indicated in Table 1, 45% of the household heads used irrigation and they participated, and 1% used irrigation and they did not participate; but 25% of the household heads did not use irrigation but they participated in supplying their haricot bean product to the market while 29% did not use irrigation and they did not participate. There was a strongly significant association ($p < 0.001$) between the dummy variable representing whether the smallholder farmer adopted improved haricot bean seed and participation in the haricot bean market. Of the household heads, 64% adopted improved seed and participated in the haricot bean market while 2% adopted improved seed but did not participate, 24% did not adopt improved seed and did not participate, while 10% did not adopt improved seed but participated in haricot bean market (Table 1).

Chemical fertilizer use was strongly associated ($p < 0.001$) with the market participation decision of haricot bean farmers. Among the respondents, 56% of the households used chemical fertilizer and participated while 4% used chemical fertilizer but did not participate; 18% did not use chemical fertilizer but participate while 22% did not use chemical fertilizer and did not participate in haricot bean market (Table 1). Farmers’ perception of land degradation was strongly and significantly associated ($p < 0.001$) with the market participation decision of haricot bean farmers. Sixty-one percent of the respondents identified low degradation classes and they participated in the haricot bean market while none of the respondents identified low degradation class and they did not participate; 12% of the household heads identified medium degradation class and participated while 1% identified medium degradation class and they did not participate; 1% of the respondents participated but identified high degradation classes while 25% identified high degradation class and they did not participate (Table 1).

4.2. Econometric analysis

4.2.1. The first-step analysis

In the first-step Heckman analysis, the factors that affect the decision of market participation were determined. As it was described in the methodology section, the first decision of the farmers is deciding whether to participate or not to participate in the market of haricot bean. The factors affecting this binary decision are estimated by the probit model in the first step of Heckman’s two-step selection model. Table 2 shows the results of the first-step probit regression analysis. Seven variables were identified as significant variables that influence the market participation decision of smallholder haricot bean farmers in Northwest Ethiopia.

Educational status of the household head is an important determinant of the market participation decision. This is due to the fact that literate household heads are more aware of the importance of marketing and market participation. This was confirmed by the significant ($p = 0.016$, Table 2) influence of educational level on market participation decision. More educated farmers can collect not only marketing information but also search information on the availability of agricultural inputs that helps them to produce more and supply a large amount of produce to the market. Megerssa et al. (2020) also found that the educational level of the head of the household significantly influences the market participation of smallholder vegetable producers.

The availability of non-farm income from non-farm employment had a significantly ($p = 0.023$) positive impact on market participation decision (Table 2). Smallholder farmers who receive non-farm income from non-farm employment were more likely to decide to participate in the market of
haricot bean. The reason behind the significance of nonfarm income in influencing market participation may be because receiving non-farm income helps smallholder farmers to purchase agricultural inputs that would enable them to produce more and decide to sell more portion of their produce. This result is consistent with that of Mwangi and Crewett (2019) who reported that access to better marketing arrangements is skewed toward farmers with off-farm incomes. Ola and Menapace (2020) reported that access to an additional source of income has greater relevance in Africa compared to Asia and South America in determining participation in modern agricultural marketing.

The number of extension contacts was found to have a positive and marginally significant ($p = 0.076$) effect on the market participation decision of smallholder haricot bean farmers (Table 2). Smallholder farmers who were frequently visited by extension agents during the production season were more likely to participate in the supply of haricot bean output to the market. Since extension agents are a source of information on the usage of inputs, production and marketing, frequent extension visits increase the chance of farmers participating in the market. Male-headed households were also found to be more likely to participate in the selling of haricot bean output. As shown in Table 2, the gender of a household head had a marginally significant ($p = 0.093$) effect on market participation decision.

| Variable | Coefficient | P-value* |
|----------|-------------|----------|
| Age of the household head in years | 0.031 | 0.578 |
| Educational status of the household head | 2.617 | 0.016** |
| Family size of the household | 0.145 | 0.680 |
| Experience of the household head in the production of haricot bean | -0.074 | 0.472 |
| Proportion of land size allocated for haricot bean production | 0.084 | 0.828 |
| Total livestock holding of the household head | -0.063 | 0.858 |
| Nonfarm income from nonfarm employment | 4.674 | 0.023** |
| Number of extension contacts in 2019 | 1.084 | 0.076* |
| Distance to the nearest market center from farmer's village | -0.152 | 0.244 |
| Gender of the household head | 4.044 | 0.093* |
| Whether there is market access | 1.297 | 0.201 |
| Whether there is transport facility | -0.986 | 0.276 |
| Whether the household used irrigation | 2.748 | 0.134 |
| Whether the household head adopted improved haricot bean seed | 6.119 | 0.017** |
| Chemical fertilizer use | 4.565 | 0.062* |
| Farmer's perception on land degradation | 8.840 | 0.011** |
| Membership in a marketing association | -3.757 | 0.123 |
| Location | 1.447 | 0.243 |
| Constant | -0.965 | 0.787 |

****, ***, and * represent significance at the 1%, 5%, and 10% level of significance, respectively.
Table 3. The marginal effects of the variables on market participation decision of farmers

| Variable                                      | dy/dx  | P-value* |
|-----------------------------------------------|--------|----------|
| Age of the household head in years            | 0.024  | 0.867    |
| Educational status of the household head      | 0.942  | 0.014**  |
| Family size of the household                  | 0.123  | 0.654    |
| Experience of the household head in the production of haricot bean | −0.067 | 0.375    |
| Proportion of land size allocated for haricot bean production | 0.075  | 0.821    |
| Total livestock holding of the household head | −0.060 | 0.801    |
| Non-farm income from non-farm employment      | 0.895  | 0.002**  |
| Number of extension contacts in 2019          | 0.920  | 0.043**  |
| Distance to the nearest market center from farmer’s village | −0.101 | 0.187    |
| Gender of the household head                  | 0.620  | 0.924    |
| Whether there is market access                | 0.924  | 0.154    |
| Whether there is transport facility           | −0.816 | 0.275    |
| Whether the household used irrigation         | −1.981 | 0.102    |
| Whether the household head adopted improved haricot bean seed | 1.012  | 0.005*** |
| Chemical fertilizer use                       | 0.963  | 0.061*   |
| Farmer’s perception on land degradation       | 1.923  | 0.001*** |
| Membership in a marketing association         | −0.001 | 0.986    |
| Location                                      | 0.029  | 0.398    |

***, **, and * represent significance at the 1%, 5%, and 10% levels of significance, respectively.

Whether the household head adopts improved haricot bean seed has a positive and significant ($p = 0.017$) effect on the market participation decision of smallholder haricot bean farmers (Table 2). This indicates that the adoption of improved agricultural inputs, particularly improved seed, contributes to high production and productivity that can give farmers a room to supply their product to the market. This result is in line with that of Beyene et al. (2020) who reported that the adoption of improved agricultural input has a positive impact on the production and productivity of haricot bean in the SNNP region of Ethiopia. Kebede (2020) also reported that low input usage and limited availability of seed and market problems were the causes of the low productivity of grain legumes in Ethiopia.

Chemical fertilizer use had a marginally significant ($p = 0.062$) positive effect on the market participation decision of haricot bean farmers (Table 2). This indicates that using modern agricultural inputs like chemical fertilizers improves the yield of haricot bean so that farmers can decide to supply their surplus to the market. Beyene et al. (2020) also reported that chemical fertilizer positively and significantly influenced haricot bean production. Farmers’ perception of land degradation influenced the market participation decision of haricot bean farmers positively and significantly ($p = 0.011$; Table 2). This indicates that farmers who perceived low degradation class were more likely to participate in the haricot bean market. According to the finding of Tesfahunegn
Table 4. The second step OLS regression analysis results of Heckman’s two-step selection equation

| Variable                                | Coefficient | P-value* |
|-----------------------------------------|-------------|----------|
| Age of the household head in years     | −0.004      | 0.051*   |
| Educational status of the household head| −0.054      | 0.280    |
| Family size of the household            | 0.004       | 0.814    |
| Experience of the household head in the production of haricot bean | 0.009 | 0.018** |
| Proportion of land size allocated for haricot bean | −0.011 | 0.435   |
| Total livestock holding of the household head | 0.079 | <0.001*** |
| Non-farm income from non-farm employment | 0.230      | <0.001*** |
| Number of extension contacts in 2019   | 0.052       | <0.001*** |
| Whether the farmer is using credit     | 0.123       | 0.216    |
| Gender of the household head            | 0.168       | 0.078*   |
| Whether there is market access          | 0.080       | 0.099*   |
| Whether there is transport facility     | 0.002       | 0.972    |
| Membership in a marketing association  | −0.121      | 0.012**  |
| Location                                | −0.067      | 0.151    |
| Constant                                | 0.603       | <0.001*** |
| Mills Lambda (IMR)                      | −0.234      | 0.061*   |
| Number of observations (n) = 312        |             | <0.001*** |

****, ***, and * represent significance at the 1%, 5%, and 10% levels of significance, respectively.

In developing countries, like Ethiopia, improving the market linkage of smallholder farmers is one of the strategies to improve the productivity and production of agricultural outputs. It is through marketing participation that smallholder haricot bean farmers can improve their livelihoods and the income from their produce. In Ethiopia, studies have shown that smallholder farmer’s decision is affected by demographic, socio-economic, and institutional factors. However, there is a lack of studies conducted on the factors that influence market participation decision of smallholder farmers, and their degree of market participation. Hence, this study was conducted to identify the factors influencing the market participation decision and understand the extent of the market participation of smallholder haricot bean farmers. This will help policy makers to focus on the important factors influencing market participation.

(2019), socioeconomic factors determine farmers’ views on land degradation and land degradation in turn influences farm production and productivity.

4.2.2. The marginal effects of the determinants of market participation decision

Table 3 shows the marginal effects of the explanatory variables on the market participation decision of smallholder haricot bean farmers. As the results indicate, being literate increases the probability of participating in the market by 94.2% and the effect was significant (p = 0.014, Table 3). Receiving non-farm income by engaging in nonfarm employment increases the chance of smallholder household’s market participation decision by 89.7% and the effect was strongly significant (p = 0.002, Table 3). An increase in the number of extension contacts by 1 visit increases the chance of households being a seller of haricot bean output by 92.0% and the influence was significant (p = 0.043, Table 3). Being a male-headed household increases the chance of the household’s participation in the market by 62.0%, and this effect was marginally significant (p = 0.074, Table 3).

Adopting improved seed increases the likelihood of the farmers to participate in the haricot bean market by 101.2% and the result was positive and strongly significant (p = 0.005) (Table 3). Using chemical fertilizer input increases the probability of haricot bean farmers’ market participation
decision by 96.3% and the coefficient was marginally significant ($p = 0.061$) and positive (Table 3). Perceiving low-class land degradation by farmers increases the chance of market participation by 192.3% and the coefficient was highly significant ($p = 0.001$) and positive (Table 3). As shown in Table 3, the other variables did not have a significant impact.

4.2.3. Second step OLS estimation of the regression model
The results of the OLS estimation of the parameters of the second step regression model are shown in Table 4. The value of the IMR was positive and marginally significant ($p = 0.061$), which indicates that the error terms of both the selection equation and the outcome equation were correlated positively. Hence, market participation decision is highly related to the degree of participation. This further shows the presence of sample selection bias and therefore justifies the use of Heckman’s two-step model. In other words, there is a significant difference between participating and non-participating smallholder haricot bean farmers.

The coefficient of the age of the household head was negative and significant ($p = 0.051$), which confirms that older farmers are supplying significantly low haricot bean output to the market (Table 4). The negative relationship between age and level of market participation may be due to the inability of old-aged farmers in accessing the information on inputs and marketing. Megerssa et al. (2020) also reported that the age of the household head was a statistically significant factor influencing market participation among smallholder vegetable producers.

The coefficient of experience of the household in the production of the haricot bean was positive and significant ($p = 0.018$) (Table 4). This indicates that farmers having long years of experience in the production of haricot bean will have a higher level of market participation. This could be because experience in producing haricot bean gives farmers a chance to identify production and marketing challenges and identify who needs and when they need haricot bean output. This is in line with what was reported on a different crop where the experience of smallholder potato producers positively and significantly influences technical efficiency in Northern Ethiopia (Andaregie & Astatkie, 2020).

The coefficient of the total livestock holdings of the household head was positive and strongly significant ($p < 0.001$, Table 4). This means that those households with a large number of livestock are more productive, produce a higher amount of haricot bean, and supply a higher proportion of the output. Since smallholder farmers plough their land by using oxen, large livestock holding will increase production and productivity of haricot bean, and hence supply to the market. Hagos et al. (2020) found that income from livestock sale is the significant determinants of mango market participation.

The coefficient of nonfarm income from nonfarm employment was positive and strongly significant ($p = 0.001$, Table 4). This is because, it helps farmers in getting the required input needed for the production of haricot bean. The relevance of additional source of income to participate in modern agricultural marketing in Africa was also reported by Ola and Menapace (2020).

The coefficient of the number of extension contacts was positive and strongly significant ($p < 0.001$, Table 4). An increase in the number of extension visits by extension agents helps smallholder farmers to get enough information about the production and marketing of the produce. Agricultural extension agents are the main source of information regarding the marketing and production of agricultural produce. Gebrehiwot et al. (2018) also reported that contact with extension agents is significantly improving the livelihood of smallholder producers.

The coefficient of the gender of the household head was positive and marginally significant ($p = 0.078$) (Table 4). This indicates that male-headed households are supplying a high volume of haricot bean output to the market. This may be because in rural area males are considered as the main players of the majority of economic activities in their household. This result is consistent
with the finding of Mwangi and Crewett (2019) who reported that access to better marketing arrangements is skewed towards farmers with male-headed households.

The coefficient of the market access dummy variable was positive and marginally significant ($p = 0.099$) (Table 4), which indicates that haricot bean farmers who have access to market are supplying a large volume of haricot bean output to the market. Availability of market access saves the farmers from incurring transaction costs such as transport and communication costs, and they can get better prices that cannot be influenced by market intermediaries such as brokers. Gebrehiwot et al. (2018) also reported the significant role of access to market information for improving the livelihoods of smallholder producers. Kebede (2020) also reported that market problems are the main reasons for the low production and productivity of grain legume. Beyene et al. (2020) also reported that the probability of the adoption of improved inputs is negatively influenced by market distance. Access to the product market has a significant influence on the efficiency and marketing of potato outputs as well (Andaregie & Astatkie, 2020).

The coefficient of membership in a marketing association was negative and significant ($p = 0.012$, Table 4). This can be because membership in a marketing association may take the household head's time instead of bringing a positive contribution to the marketing of their outputs if the marketing association is not performing its function effectively. This negative result could vary in different countries and sectors. For example, Hao et al. (2018) reported that cooperative membership has a positive impact on selling to wholesalers.

5. Conclusions and recommendations
The objective of this study was to identify the factors affecting the market participation decision of smallholder haricot bean farmers and the determinants of the amount of haricot bean output supplied to the market by smallholder farmers. To achieve the objective, survey data were collected from randomly selected 312 smallholder haricot bean farmers and analyzed using $\chi^2$ test of independence and Heckman’s two-step selection equation model.

The results of this study revealed the educational status of the household head, non-farm income from non-farm employment, number of extension contacts, the gender of the household head, whether the household head adopts improved haricot bean seed, chemical fertilizer use, and farmers’ perception of land degradation are the significant factors that influence market participation decision of smallholder haricot bean farmers. The amount of haricot bean supplied to the market was significantly influenced by the age of the household, the experience of the household in the production of the haricot bean, total livestock holding of the household head, non-farm income from non-farm employment, number of extension contacts, the gender of the household head, access to market, and membership in a marketing association.

Based on the findings of this study, improving communications between farmers and extension agents is recommended to increase the dissemination of new and modern production processes, tools, and technology because the majority of the farmers are not aware of them.

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