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Determinants of Onion Market Supply and Marketing Outlet Choice among Smallholder Farmers in Gode District in the Somali Regional State of Ethiopia

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ABSTRACT

Onion (Allium cepa L.) is an important horticultural crop in Ethiopia, contributing to smallholder income, food availability, and employment along the agricultural value chain. However, constraints in production, market information, credit access, extension services, transportation, and market linkages limit the ability of smallholder farmers to supply markets and select suitable marketing outlets. This study examined the determinants of onion market supply and marketing outlet choice among 245 smallholder farmers in Gode District, Somali Regional State, Ethiopia, using multistage sampling. Primary household survey data and secondary data were analyzed using descriptive statistics, multiple linear regression, and a multivariate probit model. The results showed that household head age negatively affected market supply, whereas access to market information, farming experience, quantity produced, credit utilization, oxen ownership, and extension contact had significant positive effects. The multivariate probit estimates indicated that age, education, access to market information, farming experience, production quantity, distance to market, credit utilization, and trust in buyers significantly influenced the choice of marketing outlets. Wholesalers and retailers were the major outlets used by producers. The findings suggest that strengthening market information systems, agricultural credit, extension services, rural transport infrastructure, farmer-trader linkages, and productivity-enhancing technologies can improve market participation and smallholder livelihood opportunities. These measures are relevant to sustainable rural development and contribute particularly to SDG 1 (No Poverty), SDG 2 (Zero Hunger), SDG 8 (Decent Work and Economic Growth), and SDG 9 (Industry, Innovation and Infrastructure) by supporting agricultural commercialization, productive economic activity, improved market access, and more inclusive rural value chains.

Keywords: *Onion marketing; Market supply; Marketing channel choice; Multivariate probit; Smallholder farmers; Ethiopia*

1. Introduction

1.1 Background of the Study

Agriculture serves as the cornerstone of Ethiopia's economy, making significant contributions to national revenue, job creation, food security, and export earnings. The sector underpins the livelihoods of a large proportion of the population and supplies essential raw materials for agro-processing industries (Cammack, 2017; Salami et al., 2010). Horticultural crops, in particular, play a pivotal role in elevating household earnings, enhancing dietary diversity, and creating employment opportunities (Ashinie & Tefera, 2019; Belew, 2015).

Among horticultural produce, onion (Allium cepa L.) stands out as one of the most extensively cultivated and economically valuable vegetables in Ethiopia (FAOSTAT, 2023). This crop enjoys robust market demand, features a relatively brief growing cycle, and offers better returns relative to many staple cereals (Etana et al., 2019; Hammad et al., 2023). Onion serves as an essential flavouring agent in Ethiopian cuisine and supplies vital vitamins, minerals, and antioxidants (Kumar et al., 2020). Moreover, onion cultivation contributes substantially to smallholder incomes and generates employment across the entire value chain, from production through transportation to final marketing (Gebretsadkan et al., 2018; Ochar & Kim, 2023).

The development of efficient and inclusive agricultural markets is also an important component of the global sustainable development agenda. The Sustainable Development Goals emphasize poverty reduction, food security and sustainable agriculture, inclusive economic growth, productive employment, and resilient infrastructure and market systems. In this context, improving the capacity of smallholder farmers to produce and market agricultural commodities can support rural livelihood development and strengthen the functioning of local food and agricultural value chains. For onion-producing households, access to reliable market information, agricultural finance, extension services, transportation infrastructure, and appropriate marketing outlets can influence the volume supplied to markets and the returns obtained from production. These dimensions are particularly relevant to SDG 1 on poverty reduction, SDG 2 on food security and sustainable agriculture, SDG 8 on inclusive and sustainable economic growth and productive employment, and SDG 9 on resilient infrastructure, innovation, and access to markets and financial services.

Despite its economic significance, the onion subsector's performance falls short of its full potential. Smallholder growers grapple with a multitude of challenges, including restricted access to enhanced production technologies, insufficient extension advisory services, underdeveloped market information systems, limited availability of credit facilities, logistical and transportation difficulties, and weak institutional linkages (Adenle et al., 2018; Gosa et al.,

2023). These impediments not only suppress production levels but also undermine farmers' ability to engage meaningfully in agricultural markets and select commercially viable distribution outlets.

Market engagement and channel selection constitute pivotal decisions for agricultural producers. The volume of produce directed to the market largely determines farm household earnings, while the chosen distribution pathway shapes both the prices realised and the transaction costs borne by producers (Branson & Norvell, 1983; Pritchard, 1969). Farmers may channel their output through wholesalers, retailers, rural intermediaries, or direct consumer sales, contingent upon an array of socioeconomic, institutional, and market-related considerations (Gudonavičienė & Alijošienė, 2008; Kozlenkova et al., 2015).

From a sustainable development perspective, understanding the determinants of market supply and marketing outlet choice is important because constraints at the farm and market levels may limit the participation of smallholders in agricultural value chains. Evidence on the factors affecting the quantity supplied and the selection of marketing outlets can therefore help identify interventions that improve market access, strengthen farmer-buyer relationships, expand access to productive financial services, and support rural infrastructure development. Such evidence is particularly valuable in relatively underserved agricultural areas where improving market integration can contribute to more inclusive rural economic development. The present study addresses this need by examining the determinants of onion market supply and marketing outlet choice among smallholder farmers in Gode District.

Several inquiries have explored the drivers of agricultural market participation and outlet selection within the Ethiopian context (Emana et al., 2015; Mossie et al., 2020; Tura & Hamo, 2018). Nevertheless, empirical investigations specifically addressing onion market supply and outlet preferences remain scarce in the Somali Regional State, and particularly within Gode District, where onion production has gained prominence as a livelihood strategy. Furthermore, prevailing studies tend to treat market supply and outlet choice as separate phenomena, offering a fragmented perspective on the combined determinants influencing both decisions.

Consequently, this study sought to examine the determinants of onion market supply and marketing outlet choice among smallholder farmers in Gode District, Somali Regional State, Ethiopia. The study provides evidence to support sustainable agricultural commercialization, rural livelihood improvement, and inclusive agricultural market development by identifying the production, institutional, socioeconomic, and market-related factors that shape the quantity of onions supplied and farmers' selection of marketing outlets. The findings are therefore relevant to sustainable development efforts related to poverty reduction, food security and sustainable agriculture, inclusive economic growth, and rural infrastructure and market access, particularly SDGs 1, 2, 8, and 9. More specifically, the

study addressed two core research questions: (1) Which factors determine the quantity of onions supplied to the market by producers? and (2) Which factors determine the marketing outlet choices of onion growers?

1.2 Conceptual Framework

The conceptual underpinning of this study rests on the premise that smallholder farmers' decisions concerning onion outlet selection are shaped by a confluence of demographic attributes, institutional arrangements, socioeconomic conditions, and marketing-related factors.

The conceptual frame work for market supply and outlet choice were represented by below figure.

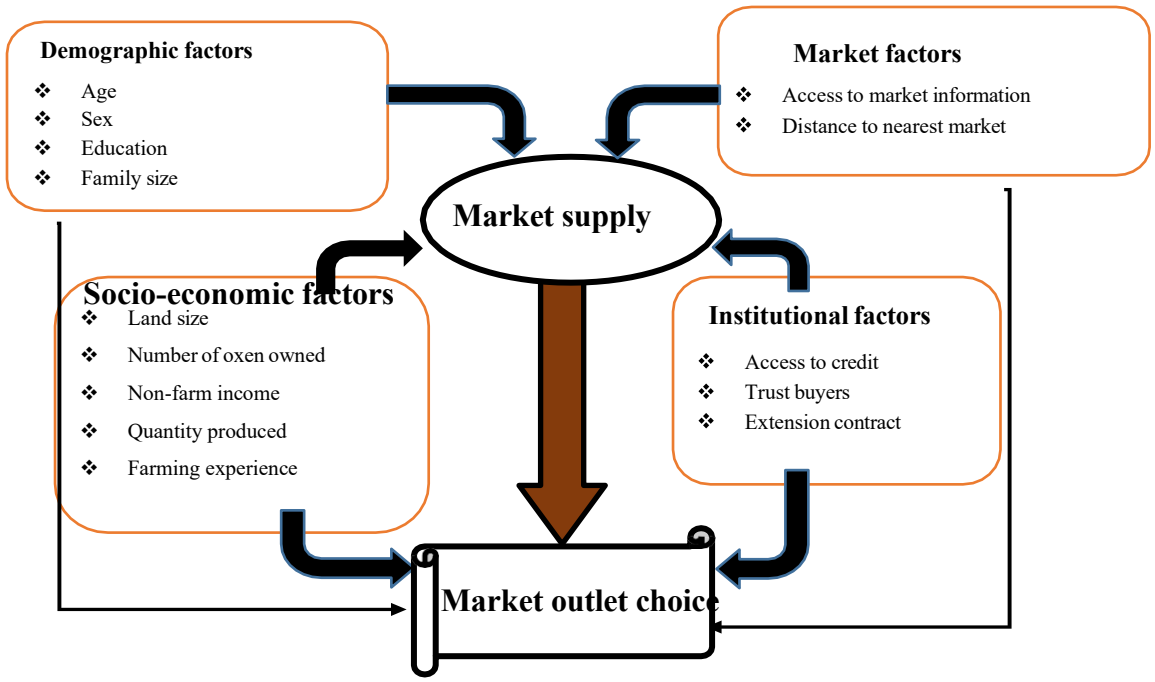

Figure 1: Conceptual framework

2. Methods and materials

2.1 Description of the Study Area

The study was conducted in Gode District, located in the Shabelle Zone of the Somali Regional State, eastern Ethiopia. The district is situated approximately 600 km from Addis Ababa and serves as one of the major agricultural production areas within the region. The area is characterized by predominantly arid and semi-arid climatic conditions, with agriculture serving as the principal livelihood activity for the majority of rural households.

The district benefits from the presence of the Wabi Shabelle River, which supports irrigated agriculture and enables the production of various crops throughout the year. Onion is among the major horticultural crops cultivated in the district due to its high market demand and income-generating potential. In addition to onion production, farmers engage in the cultivation of other vegetables and cereals as well as livestock production. The growing importance of onion farming in the district makes it an appropriate location for examining factors influencing market supply and market outlet choices among smallholder producers.

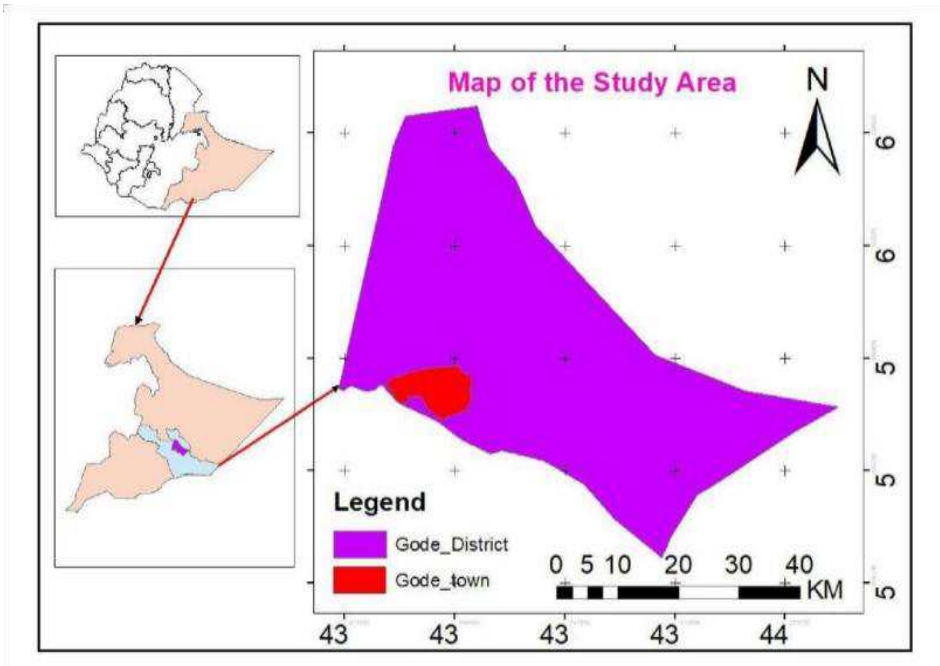

Figure 2: Map of the study area

Source: Adopted from ArcGIS computation and Ethiopian map (2025)

2.2 Research Design and Data Sources

A cross-sectional research design was employed to collect data from onion-producing households during the 2024 production season. The study utilized both primary and secondary data sources.

Primary data were collected through structured household interviews administered to sampled onion-producing farmers. Information gathered included demographic characteristics, production practices, market participation behavior, institutional services, and market outlet choices.

Secondary data were obtained from published and unpublished sources, including reports from the Ministry of Agriculture, Gode District Agricultural Office, Central Statistical Agency (CSA), research institutions, journal articles, books, and other relevant documents related to onion production and marketing.

2.3 Sampling Procedure and Sample Size Determination

A multistage sampling technique was employed to select representative onion-producing households. In the first stage, Gode District was purposively selected due to its substantial onion production potential and market participation. In the second stage, onion-producing kebeles were identified in consultation with agricultural experts and extension personnel.

Subsequently, representative kebeles were selected using simple random sampling techniques. Finally, a list of onion-producing households was obtained from local agricultural offices, and sample households were selected through simple random sampling.

The sample size was determined using Yamane's (1967) sample size determination formula:

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

Where; n is the sample size for the research use

N is total number of onion producers

e is the level of precision(0.06)

While a minimum precision level of 10% is generally acceptable, this study adopted a 6% precision level. This decision was made because precision levels lower than 6% would result in a substantially larger sample size, leading to increased costs associated with data collection. The sample size (n) was then calculated according to the following formula.

$$n = \frac{2064}{(1 + 2064)\ (0.06)^2} = 245 \quad \ldots\ldots\ldots\

$$Y = \beta 0 + \beta iXi + \mu i \text{----------} (1)$$

Where;

Y = market supply of onion; Xi = a vector of the explanatory variable (independent variable used to explain dependent variable) and 'i' is 1, 2, 3… n; β_0 = intercept of regression model; βi = parameters associated with explanatory variable (coefficient of the ith independent variable); μi= random error term.

2.8 Determinants of onion producers' market outlet choice

Onion growers have access to multiple marketing channels, including wholesalers, retailers, rural collectors, and direct consumer sales. Producers may opt for more than one outlet concurrently to maximize their anticipated returns. Consequently, overlapping channel usage is prevalent, with many farmers distributing their produce across several market outlets.

The analysis of categorical dependent variables, such as farmers' outlet selections, demands the application of specialized econometric techniques. Models appropriate for examining categorical choice outcomes include multivariate probit/logit and multinomial probit/logit specifications. The selection of the most suitable model is contingent upon the decision-making context and data characteristics (Mohammed et al., 2019).

Extant literature on factors shaping market outlet preferences reveals varied methodological approaches. Several investigations have employed the multinomial logit (MNL) model to assess the determinants of producers' channel choices (Emana et al., 2015b; Dessie et al., 2018; Thakur et al., 2023). The MNL model's relative simplicity in estimation and interpretation accounts for its widespread adoption.

Conversely, other scholars have applied the multivariate probit (MVP) framework to examine outlet choice determinants (Arinloye et al., 2015; Shewaye, 2016; Nuri, 2016; Addisu, 2017; Efa & Tura, 2018; Kiplangat & Vincent, 2018). The MVP approach offers enhanced flexibility by accommodating correlations among error terms across alternative choice equations. This characteristic proves particularly advantageous when producers simultaneously consider multiple outlets and channel decisions are not independent. By capturing these interdependencies, the MVP model yields more accurate and nuanced insights into the factors driving outlet selection behaviour.

In the present study, the multivariate probit model was selected as the preferred econometric approach for identifying onion market outlet determinants, surpassing alternative specifications. The MVP model is well-suited because it concurrently models the influence of explanatory variables on various channel choices while accounting for potential correlations among unobserved disturbances and relationships between outlet decisions (Belderbos et al., 2004).

Although multinomial models are appropriate when decision-makers must select a single outcome from a set of mutually exclusive and collectively exhaustive alternatives, this condition does not hold in the current context. Onion producers' channel selections are not mutually exclusive; farmers may simultaneously utilize multiple outlets. This necessitates an analytical framework capable of handling potential correlations among outlet choice decisions (Dow & Enders, 2004).

In reality, the relative risk of choosing one outlet can be affected by the relative risk of choosing another (Greene, 2003). The multivariate probit model relaxes this restrictive assumption, providing a more accurate representation of farmers' market outlet decision-making processes.

The selection of appropriate market outlet i by farmer j is y_{ij}^{A} defined as the choice of farmer j to transact market channel i (y_{ij}^{A}=1) or not (y_{ij}^{A}=0) is expressed as follows

$$y_{ij}^{A}=\begin{cases} 1, \ if\ y_{ij}^{A} = x_{ij}^{A}\alpha_{ij} + \varepsilon^{A} \geq 0 \leftrightarrow x_{ij}^{A} \geq -\varepsilon^{A} \\ 0, \ if\ y_{ij}^{A} = x_{ij}^{A}\alpha_{ij} + \varepsilon^{A} < 0 \leftrightarrow x_{ij}^{A} < -\varepsilon^{A\prime} \end{cases} \quad \ldots\ldots\ldots\

Where Wholesaler i, Retailer i, Rural collector and consumer i are binary variables taking values 1 if farmer i selects wholesalers, retailers, rural collector and consumers, respectively, and 0 otherwise; $x1$ to $x4$ are vector of the same set of explanatory variables x for each outlet; $\alpha 1$ to $\alpha 4$ a vector of parameters to be estimated for each outlet and ε disturbance term for each outlet.

In multivariate probit model, the use of several market outlets simultaneously is possible and the error terms jointly follow a multivariate normal distribution (MVN) with zero conditional mean and variance normalized to unity and ρ_{ji} represents the correlation between endogenous variables (Belderbos *et al*, 2004) given by:

$$\begin{pmatrix} \varepsilon^W \\ \varepsilon^R \\ \varepsilon^c \\ \varepsilon^C \end{pmatrix} \ldots\ldots\ldots N \left[\begin{pmatrix} 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} \begin{pmatrix} 1 & \rho_{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{pmatrix} \right] \quad \ldots\ldots\ldots\

influence positively/negatively the supply of onions and the choice of market outlets.

Sex of household head (HHSEX): This is a dummy variable that takes a value of 1 it the household head is male and 0 otherwise. The hypothesis is that male-headed households will exhibit a greater onion market supply and a tendency to select more beneficial market outlets. This expectation is grounded in the observation that, compared to their female counterparts, male household heads often benefit from advantages in resource access, market information, and social capital. Empirical evidence Bebe *et al*. (2012) highlight the resource limitations faced by many female farmers in vegetable marketing, while Addisu (2016) found that male heads were more prone to use collector outlets for potato sales. Collectively, these findings support the idea that gender roles and related disparities can affect market participation and choices. Therefore, male household heads were expected to have more chance of searching and choosing appropriate market outlets than female household heads.

Family size (FM-size): This variable is a continuous explanatory variable referring to the total number of household members living in the household in adult equivalents. While a larger household provides more labor for production, potentially increasing sales volume, it also increases consumption needs, potentially reducing the surplus available for sale. Prior research presents mixed findings. Some studies (Nigus, 2019) found a positive correlation between household size and the quantity of certain crops (like teff) marketed, while others found a negative correlation for different crops (like maize). Other research (Hailu, 2016; Tefera, 2014) suggests a positive relationship between household size and participation in specific markets, such as selling potatoes and chickpeas to wholesalers respectively. Therefore, family size was hypothesized to have either a positive or negative impact on both the volume of supply and the selection of market outlets.

Education status of the household head (EduHH): is a categorical variable representing the highest level of education attained by the household head. The categories are: 0 (illiterate), 1 (Religious), 2 (Primary and secondary), and 3 (Certificate). It is hypothesized that higher levels of education enable farmers to make more informed decisions regarding market channels. This is supported by studies on paddy rice (Bongiwe & Micah, 2013; Charles *et al*., 2012), which also found a positive correlation between education and the quantity supplied to the market. Moreover, Abraham, (2013) found that the educational level of the household head positively influenced decisions to use wholesale market outlets, while negatively influencing the use of retailer outlets.

Therefore, it is hypothesized that education status was positively affect the quantity of onions supplied and also affect market outlet choice either negatively or positively.

Access to market information (Acc_Mkt): this variable is a dummy variable, coded as 1 if the farmer has access to market information and 0 otherwise. It is assumed that farmers with access to market information will make more informed decisions and thus perform better in the market. Woldesenbet, (2013) found a positive impact of market information on the marketed supply of potatoes and tomatoes. Similarly, Tola, (2014) hypothesized that access to market information increases the likelihood of choosing roadside traders as a market outlet while decreasing the likelihood of choosing wholesalers for tomato producers. Consequently, access to market information is expected to positively influence the probability of choosing a preferred market outlet. Therefore, it was hypothesized that this variable has a positive relationship with both the selection of the best market outlet and the volume of onions supplied to the market.

Onion farming experience (EXH): It is a continuous variable, measured in years. It was expected to positively influence both onion market supply and outlet choice. More experienced onion farmers are hypothesized to produce larger quantities due to accumulated knowledge and skills. Furthermore, their familiarity with onion marketing and the varying profitability of different sales outlets is likely to lead them to choose more advantageous outlets. Ayelech, (2011) and Akalu, (2007) observed similar positive effects of experience on avocado and tomato production, respectively. Therefore, farming experience was anticipated to positively impact both onion supply to market and the selection of optimal market outlets.

Non/off-farm income (NFI): This is a dummy variable indicating whether the household derives income from activities other than farming (1 = yes, 0 = no). It is hypothesized that involvement in non-farm activities may affect the quantity of produce supplied to the market and outlet choice. Non-farm income can negatively influence market supply (Rehima, 2006; Beza, 2014), potentially because households with more non-farm income sell less of their agricultural produce, prioritizing consumption within the household. This is supported by Abraham (2013), who found that non-farm income decreases the probability of selling to the most profitable market outlet. Therefore, in this study, non-farm income was expected to negatively influence the quantity of onions supplied to the market and outlet choice.

The quantity of onions produced (QOP): It is a continuous variable measured in quintals. It was expected to positively influence both the volume of onions supplied to the market and the choice of market outlet. Households achieving higher onion yields per hectare are hypothesized to supply larger quantities and select more advantageous market outlets compared to those with lower yields. This is supported by Astewel's (2010), which revealed that the quantity of paddy rice produced significantly affected both market participation and the volume supplied. Consequently, in this study, the quantity of onions produced has a positive impact on market supply and the selection of market outlets.

Credit utilization (Acc-Util): It is a dummy variable taking the value one for households utilized credit and zero otherwise. It is hypothesized that access to and utilization of credit strengthen a farmer's financial ability to invest in necessary inputs (e.g. fertilizers, seeds), ultimately boosting onion production and expanding their market share. Thus, it was expected that credit utilization positively influences both the level of production and supplies. Furthermore, the increased production capacity driven by credit access can motivate farmers to explore and utilize a wider range of market outlets. Empirical evidence from Alemayehua *et al*., (2021) supports this notion, positively influence farmers' likelihood to participate in tomato and onion marketing. However, Tola and Ketema, (2014) hypothesized that access to credit negatively affected the probability of selling to wholesaler outlets. Therefore, in this study, access to credit was hypothesized to positively affect market outlet choice decisions, although the specific direction of that effect might vary depending on the outlet type.

Size of land allocated for onion (LSAO): this is a continuous variable measured in hectares, is a key factor influencing both onion supply and market outlet choice. Land is a critical agricultural input, and a larger land area dedicated to onions is expected to directly increase the volume supplied to the market. Yaregal (2018)'s hypothesis that land allocated to potatoes positively affects retailer outlet selection. Thus, the size of land allocated for onions was hypothesized to positively impact onion supply. Land allocated for onion production was also expected to influence the decisions regarding market outlet choice positively, potentially leading them to select more profitable or efficient outlets.

Distance to the nearest market (DNMkt): It is a continuous variable measured in walking minutes.

It was hypothesized to negatively affect both the quantity of onions supplied and the choice of optimal market outlets. Proximity to market reduces transportation costs and improves market access, leading to higher supply. This aligns with Wondmagegn (2014), who found that increased distance decreased coffee supply, and Efa *et al*., (2016), who observed a similar negative relationship between distance and teff supply. Furthermore, closer proximity is expected to increase the likelihood of selecting better market outlets, consistent with Riziki (2015) findings that distance significantly influences market outlet choice. Therefore, distance to the nearest market was expected to have a negative relationship with both quantity supplied and outlet choices.

Trust in Buyers (TRST): It is dummy variable. Coded as, 1 = trusted outlet, 0 = not trusted outlet) representing the farmer's confidence in a specific market outlet. The underlying assumption is that a higher level of trust reduces transaction costs for the farmer. Specifically, farmers who trust their buyers are expected to spend less time and effort on verifying the buyer's reliability and ensuring timely payments, making them more likely to choose that outlet. Empirical evidence from Addisu, (2016) suggests a complex relationship: trust in buyers was negatively correlated with selling potatoes to collectors and onions directly to consumers but positively correlated with selling onions to collectors. Consequently, it hypothesized that trust in buyers influenced market outlet choice, with the direction of the effect (positive or negative) depending on the specific outlet type.

Oxen ownership (OX_own): This is a continuous variable, quantified by the number of oxen possessed by the household head, and was hypothesized to exert a positive influence on the volume of onions supplied to the market. The rationale behind this lies in the anticipated reduction of production costs for farmers owning oxen, as they avoid the expense of renting draft power. Furthermore, owning oxen facilitates timely land preparation, a critical factor contributing to enhanced productivity and, consequently, a larger marketable surplus of onions. This expectation finds empirical support in Aysheshem's, (2007) study, which revealed a significant and positive relationship between oxen ownership and sesame market supply within the Metema District. Therefore, in this study, oxen ownership was expected to have a positive relationship with the supply of onions to the market.

Frequency of Extension Contact (FEXT): It is a continuous variable, quantified as the number of times a household interacted with agricultural extension agents in a year. This annual contact frequency, representing the household head's engagement with extension services, is a proxy for

access to valuable information and support. It is hypothesized that more frequent engagement with extension agents translates to better awareness of optimal farming practices and innovative technologies, leading to enhanced productivity and, consequently, a greater quantity of onions supplied to the market. According to Ayelech (2011), fruit farmers with increased access to extension services marketed a larger volume of their produce. Therefore, a positive relationship was anticipated between the frequency of extension contact and the volume of onions supplied to the market.

Table 2: Description of variables used in the multiple linear regression model

Dependent variable	**Notation**	**Types**	**Measurement**	**Sign**
Market supply	Mkt-sup	Continuous	Quintal	
Independent variables				
Age of the household head	HHAGE	Continuous	Years	-/+ve
Sex of the household head	SEXHH	Dummy	1 if Male, 0 if Female	-/+ve
Family size	FM-size	Continuous	Number of members of households	-/+ve
Education level of households	EDUHH	Categorical	0=illiterate 1=religious (2=primary and secondry) 3=certificate	+ve
Access to market information	Acc-Mkt	Dummy	1 = if the household has access to market information , 0= otherwise	+ve
Farming experience	FERHH	Continuous	Years	+ve
Access to non/off-farm income	NFI	Dummy	1 =Yes, 0 =Otherwise	+ve
Distance to the nearest market	DNMKT	Continuous	walking minutes	-ve
Quantity of Onion produced	QOP	Continuous	Quintal	+ve
Credit-Utilization	Cre-Util	Dummy	1 yes , 0 No	+ve
Land allocated for Onion	LSAO	Continuous	Hectare	+ve
Number of oxen owned	OX-own	Continuous	Number of ox	+ve

Frequency of Extension contact	FEXT	Continuous	Number Per year	+ve

Source: Researchers (2025)

Table 3: Description of variables used in the multivariate probit model

Independent variable	**Measurement**	**Sign on different market outlet choices**			
		Whole saler	Retailer	Rural collector	Consumer
Access to market information	Dummy (1=if the household has access to market information, 0= otherwise)	+ve	+ve	+ve	+ve
Age of household head	Continuous(year)	+ve	-ve	-ve	-ve
Sex of the household head	Dummy (1 if Male, 0 if Female)	+ve	+ve	+ve	+ve
Family size	Continuous(number)	-/+ve	-/+ve	-/+ve	-/+ve
Education status of the household head	Categorical(0=illiterate 1=religious 2=Primary and secondary 3=certificate	+ve	+ve	-ve	-ve
Access to market information	Dummy (1 =have access , 0= no access)	+ve	+ve	-ve	+ve
Distance from nearest market	Continuous(walking minutes)	-ve	+ve	-ve	-ve
Credit utilization	Dummy(1 if use credit, 0 didn't use credit)	+ve	+ve	+ve	+ve
Farming experience	Continuous (number of years)	+ve	+ve	+ve	+ve
Trust in buyers	Dummy (1 if trust, 0 Otherwise)	+ve	+ve	+ve	+ve
Access to non/off- farm income	Dummy (1 Yes, 0 Otherwise)	+ve	+ve	+ve	+ve

Quantity of onion produced	Continuous (quintal)	+ve	+ve	+ve	+ve

Source: Researchers (2025)

3. RESULTS AND DISCUSSION

3.1 Descriptive Statistics

3.1.1 Demographic and socio-economic characteristics of sample onion producers

Sex composition of household heads: As presented in Table 4, the majority of onion-producing households (93.06%) were headed by males, while female-headed households accounted for only 6.94% of the sample.

Access to market information: The survey findings indicated that 66.53% of onion-growing households had adequate access to information concerning onion market prices, quality standards, and available quantities. Conversely, the remaining 33.47% reported limited or no access to such market intelligence.

Educational attainment of household heads: The distribution of educational levels among respondents revealed that 15.51% had no formal education, 40.82% had received religious instruction, 42.86% had completed primary or secondary schooling, and merely 0.82% held a certificate-level qualification. These figures reflect a comparatively low level of formal educational achievement among the surveyed population.

Credit utilisation: Access to credit represents an important mechanism for enhancing smallholder agricultural productivity. Farmers who obtain credit can alleviate liquidity constraints, thereby facilitating timely procurement of production inputs relative to their non-credit-using counterparts. In the study area, credit was sourced from both formal institutions:- including microfinance organisations and banks and informal channels such as friends and relatives. Nevertheless, survey data indicated that credit uptake among sampled onion producers remained limited, with only 13.06% of respondents reporting credit utilisation, while 86.94% did not access credit services (Table 4).

Table 4: Descriptive statistics for both dummy and categorical variables

variable	Category	Frequency	Percent
SEXHH	Female	17	6.94
	Male	228	93.06
Acc-Mkt	No access	82	33.47
	Have access	162	66.53
EDUHH	Illiterate	38	15.51
	Religious	100	40.86
	Primary &secondary	105	42.86
	Certificate	2	0.82
Cre-Util	No	213	86.94
	Yes	32	13.06

Source: Owns survey (2025)

Age of household head: Age, measured in years, represents a key demographic characteristic influencing onion production and productivity. The mean age of sampled household heads was 46.5 years (SD = 12.95), with ages ranging from a minimum of 24 to a maximum of 75 years (Table 5).

Family size: Household size, expressed in adult equivalents, ranged from 2 to 6.5 persons, with a mean of 3.76 (SD = 0.94) among surveyed households (Table 5).

Onion farming experience: Respondents reported an average of 18.5 years of experience in onion cultivation (SD = 11.09), with experience spanning from a minimum of 1 year to a maximum of 56 years in the study area (Table 5).

Distance to nearest market: Proximity to markets and road networks is expected to reduce marketing costs, thereby encouraging market participation and supply. The average walking time to reach the nearest local marketplace was 41.5 minutes (SD = 10.18), with travel times ranging from 15 to 80 minutes (Table 5).

Oxen ownership: The mean number of oxen owned by households was 1.08 (SD = 0.61), with ownership ranging from 0 to 4 oxen per household (Table 5).

Land allocated to onion production: The average land area devoted to onion cultivation during the production year was 0.88 hectares (SD = 0.88), ranging from a minimum of 0.1 to a maximum of 4 hectares.

Quantity of onion produced: The average onion output in 2024 was 51.7 quintals (SD = 28.07), with production quantities ranging from 5 to 235 quintals per household.

Table 5: Descriptive statistics of continuous variables

Variables	Mean	SD	Min	Max
HHAGE	46.5	12.95	24	75
FM-size	3.76	0.94	2	6.5
FEXHH	18.5	11.09	1	56
DNMkt	41.5	10.18	15	80
OX-Owns	1.08	0.61	0	4
LSAO	0.88	0.46	0.1	4
QOP in 2024	51.7	28.07	5	235

Source: Owns survey (2025)

3.1.3 Descriptive statistics of onion outlet choice (dummy and categorical variables)

Sex of household head by outlet choice: As presented in Table 6, male-headed households constituted the majority across all marketing channels: wholesalers (95.10%), retailers (92.97%), rural collectors (88.89%), and consumer outlets (80.43%). Female-headed households accounted for the remaining proportions: 4.90%, 7.03%, 11.11%, and 19.57%, respectively.

Educational attainment by outlet choice: Regarding education levels, illiterate producers represented 14.71% of those selling to wholesalers, 23.44% to retailers, 44.44% to rural collectors, and 41.30% to consumers. Producers with religious education accounted for 44.12%, 35.16%, 35.56%, and 34.78% of wholesaler, retailer, rural collector, and consumer outlets, respectively. Those with primary or secondary education comprised 39.22%, 40.63%, 20.00%, and 23.91% across the respective channels. Certificate holders constituted only 1.96% of wholesaler users, 0.78% of retailer users, and none among rural collector or consumer outlet users.

Market information access by outlet choice: Among producers with access to market information, 87.25% sold to wholesalers, 61.72% to retailers, 31.11% to rural collectors, and 26.09% directly to consumers. Conversely, producers without market information access accounted for 12.75%, 38.28%, 68.89%, and 73.91% of those selling through wholesalers, retailers, rural collectors, and consumer outlets, respectively.

Credit utilisation by outlet choice: Credit users comprised 50.98% of producers selling to wholesalers, 25.78% to retailers, 22.22% to rural collectors, and 17.39% to consumers. Non-credit users represented 49.02%, 74.22%, 77.78%, and 82.61% of the respective outlet channels.

Trust in buyers by outlet choice: Producers expressing trust in buyers constituted 70.59% of those using wholesalers, 46.88% of retailer users, 40.00% of rural collector users, and 34.78% of consumer outlet users. Distrust in buyers was reported by 29.41%, 53.13%, 60.00%, and 65.22% of producers across the respective channels.

Non/off-farm income engagement by outlet choice: Engagement in non/off-farm income activities was reported by 67.65% of wholesaler users, 62.50% of retailer users, 75.56% of rural collector users, and 71.74% of consumer outlet users. The corresponding proportions of producers without such income sources were 32.35%, 37.50%, 24.44%, and 28.26%, respectively.

Table 6: Proportion of household characteristics by onion market outlets (dummy and categorical variables**)**

Variables	Category	Wholesalers (%)	Retailers (%)	Rural collectors (%)	Consumers (%)
SEXHH	Male	95.10	92.97	88.89	80.43
	Female	4.90	7.03	11.11	19.57
EDUHH	Illiterate	14.71	23.44	44.44	41.30
	Religious	44.12	35.16	35.56	34.78
	Primary &secondary	39.22	40.63	20.00	23.91
	certificate	1.96	0.78	0.00	0.00
Acc-Mkt	Yes	87.25	61.72	31.11	26.09
	No	12.75	38.28	68.89	73.91
Credit-Util	Yes	50.98	25.78	22.22	17.39
	No	49.02	74.22	77.78	82.61
TRST	Yes	70.59	46.88	40.00	34.78
	No	29.41	53.13	60.00	65.22
NFI	Yes	67.65	62.50	75.56	71.74
	No	32.35	37.50	24.44	28.26

Source: Owns survey (2025)

3.1.4 Descriptive statistics of onion outlet choice (continuous variables)

Age of household head by outlet choice: The mean age of household heads varied across marketing outlets. Producers selecting wholesalers, retailers, rural collectors, and consumer outlets had mean ages of 46.21, 46.26, 48.71, and 41.52 years, respectively.

Household size by outlet choice: Average household size, expressed in adult equivalents, was 4.302 for wholesaler users, 3.632 for retailer users, 3.335 for rural collector users, and 3.302 for consumer outlet users.

Farming experience by outlet choice: The mean onion cultivation experience of sampled producers differed markedly across channels. Those selling to wholesalers reported the highest average experience (25.15 years), followed by retailers (17.16 years), rural collectors (15.66 years), and consumer outlets (10.63 years).

Quantity produced by outlet choice: The average onion output varied considerably by marketing channel. Producers supplying wholesalers recorded the highest mean production (66.10 quintals), followed by retailers (46.35 quintals), rural collectors (36.06 quintals), and consumer outlets (32.50 quintals).

Distance to market by outlet choice: The mean walking time to the nearest market was 41.79 minutes for wholesaler users, 39.39 minutes for retailer users, 42.55 minutes for rural collector users, and 36.63 minutes for consumer outlet users.

Table 7: Mean household characteristics by onion market outlets

Variables	Wholesalers		Retailer		Rural collectors		Consumers	
	Mean	S D	Mean	S D	Mean	S D	Mean	S D
HHAGE	46.21	9.225	46.26	14.10	48.71	15.62	41.52	15.17
Fm-size	4.302	0.929	3.632	0.870	3.335	0.746	3.302	0.866
FAEXP	25.15	10.40	17.16	10.51	15.66	9.349	10.63	11.78
QOP	66.10	27.61	46.35	26.75	36.06	18.55	32.50	36.21
DnMkt	41.79	9.637	39.39	10.90	42.55	11.51	36.63	11.10

Source: Owns survey (2025)

3.2 Onion Marketing

Producer participation in post-harvest handling and marketing: Producers were actively involved in the transportation and marketing of their onion produce. Post-harvest operations-including sorting, grading, storage, loading, and unloading-were predominantly performed by the farmers themselves.

Transport modalities: Three primary transport methods were employed to convey onions from farms to markets. The predominant mode entailed the use of pack animals, particularly donkeys and camels, with bagged onions loaded onto their backs. The second method involved manual carriage, whereby women

transported onions on their backs while men carried them on their shoulders. The third approach utilised motorized vehicles to convey onions from the nearest road access point to Gode town, the principal market centre in the district.

Marketing chain and timing of sales: The marketing channel originated with producers holding onion stocks for sale. In the study area, a substantial proportion of producers disposed of their onion harvest immediately after harvesting, primarily driven by concerns over product perishability and the pressing need for family income. Producers sold their output through multiple channels, including wholesalers, retailers, rural collectors, and direct sales to consumers.

3.3 Marketing Channels

Marketing channels denote the pathways through which agricultural produce flows from producers to end consumers. The structure and complexity of these channels are shaped by several factors, including the nature of the commodity, transaction volumes, consumer demand patterns, and the extent of regional production specialisation (Dimitri & Gardner, 2019). Each channel represents a distinct route that products may traverse, with implications for pricing mechanisms, product accessibility, and market coverage. A thorough understanding of these distribution pathways is essential for optimising the movement of agricultural goods and ensuring their effective delivery to consumers.

3.4 Onion Marketing Channels and Volume Distribution

Six principal marketing channels were identified for onion distribution in the study area. The total quantity of onions marketed by sampled households during the 2024 production year was estimated at 12,137 quintals. The channels, ranging from direct producer-to-consumer sales to those involving multiple intermediaries, are summarized below:

Channel	Pathway	Share (%)	Volume (Qt)
1	Producer → Consumer	2.1	256
2	Producer → Wholesaler → Consumer	27.5	1,565.3
3	Producer → Rural Collector → Retailer → Consumer	41.6	605.6
4	Producer → Rural Collector → Wholesaler → Retailer → Consumer	58.4	850.3
5	Producer → Wholesaler → Retailer → Consumer	72.5	4,126.7
6	Producer → Retailer → Consumer	39.0	4,733.0

The findings indicate that producers predominantly supplied their onions through wholesale channels. Across the 2024 production season, the proportion of onion output channelled through wholesalers, retailers, rural collectors, and consumers was 46.9%, 39.0%, 12.0%, and 2.1%, respectively.

Channel descriptions:

Channel 1 involved direct producer-to-consumer transactions at farm gates or local markets.
Channel 2 entailed producers selling to wholesalers, who then supplied consumers:-including hotels, restaurants, and cafés—with orders exceeding one quintal.
Channel 3 comprised producers selling to rural collectors, who subsequently supplied retailers, with retailers ultimately reaching consumers.
Channel 4 involved producers selling to rural collectors, who then sold to wholesalers; wholesalers supplied retailers, who finalised sales to consumers.
Channel 5 consisted of producers selling to wholesalers, who supplied retailers, with retailers completing the chain to consumers.
Channel 6 involved direct producer-to-retailer sales, with retailers subsequently selling to consumers.

The proportional distribution of produce flowing through these channels from production to final consumption is illustrated in Figure 4.1.

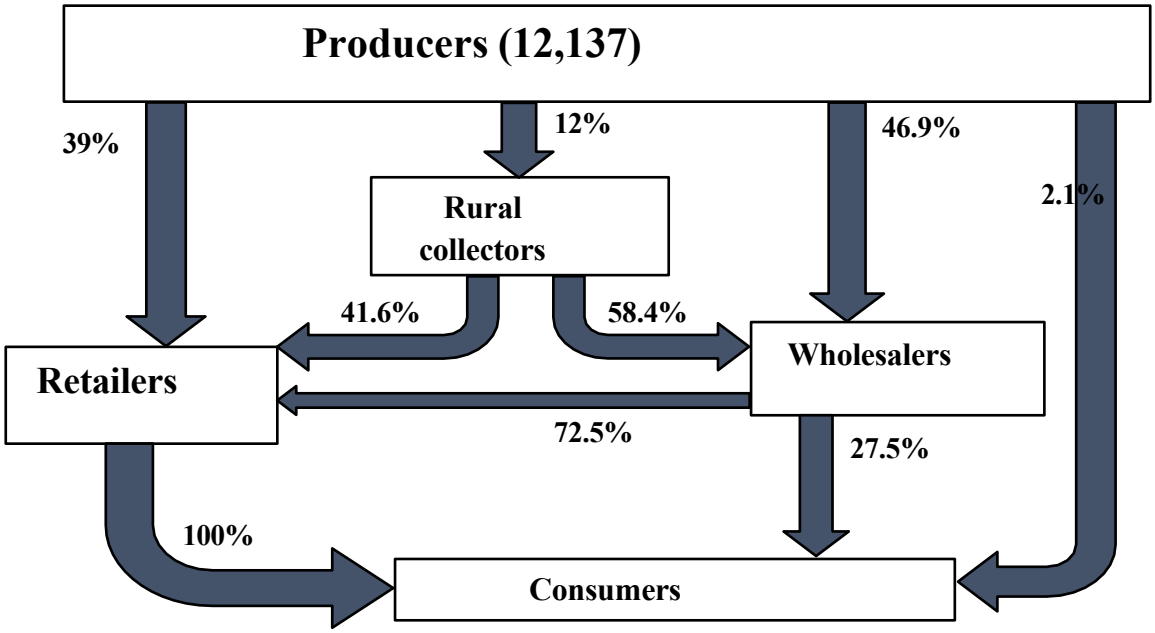

Figure 2: Onion marketing channel of Gode District.

Source: Owns sketching from survey data, (2025)

As depicted in Figure 4.1, wholesalers emerged as the primary recipients of onion produce, accounting for 46.9% of the marketed volume, followed by retailers (39.0%), rural collectors (12.0%), and consumers (2.1%). Considerable variation was observed in the volume transacted across the six identified channels, with two channels dominating onion distribution.

Channel 6 (Producer → Retailer → Consumer) recorded the highest transaction volume, with approximately 4,733 quintals marketed, representing the most significant channel in terms of volume. Channel 5 (Producer → Wholesaler → Retailer → Consumer) followed closely, accounting for 4,126.7 quintals. By contrast, Channel 1 (Producer → Consumer) registered the lowest volume, with only 256 quintals transacted, indicating limited direct producer-to-consumer sales.

The onion distribution system in the study area demonstrates strong intermediation, with wholesalers (46.9%) and retailers (39.0%) serving as critical conduits between producers and consumers. Channel 6, representing direct producer-retailer linkages, reflects a preference for shorter distribution chains that potentially ensure product freshness. Conversely, the minimal activity observed in Channel 1 suggests that producers face considerable challenges in establishing direct consumer sales.

3.5 Econometric Analysis

3.5.1 Factors Influencing Onion Market Supply

Prior to coefficient interpretation, classical linear regression (CLR) assumptions were evaluated. A multiple linear regression framework was deemed appropriate for analysing factors affecting onion market supply, as all sampled households participated in onion marketing and supply was measured as a continuous variable.

Model Diagnostics

To ensure estimation reliability, preliminary tests were conducted to detect potential violations of key assumptions, including multicollinearity, heteroscedasticity, and specification errors (omitted variable bias). Multicollinearity, arising from linear relationships among explanatory variables, complicates the identification of individual variable effects (Gujarati, 2002). The variance inflation factor (VIF) was employed to assess multicollinearity, yielding a mean VIF of 3.20, indicating no serious multicollinearity issues. The Breusch-Pagan/Cook-Weisberg test detected heteroscedasticity, which was addressed through robust standard errors. The regression specification error test ($F = 0.2435$) confirmed no omitted variables in the model.

Explanatory Variables

Thirteen explanatory variables were identified as potential determinants of onion marketable supply: age, family size, sex, and education level of the household head; onion farming experience; land allocated to onion production; quantity produced; oxen ownership; access to market information; distance to the nearest market; credit utilisation; non/off-farm income; and frequency of extension contact.

Significant Determinants

Of the 13 variables analysed, seven significantly influenced onion market supply: household head age, access to market information, credit utilisation, farming experience, quantity produced, frequency of extension contact, and oxen ownership. The remaining six variables exhibited no statistically significant effects.

Model Fit

The regression model demonstrated excellent goodness-of-fit, with a highly significant F-statistic ($p < 0.01$) and an R^2 value of 0.9876, indicating that the included explanatory variables collectively explain 98.76% of the variation in onion market supply.

Household Head Age

Age exerted a statistically significant negative effect on onion market supply at the 5% level. Older household heads tended to supply smaller quantities, potentially attributable to age-related declines in physical and cognitive capacities, reduced adoption of improved farming practices, and diminished overall productivity. A one-year increase in household head age corresponded to a 3.8% decrease in marketable onion supply, ceteris paribus. This finding aligns with Bongiwe and Micah (2013) and Gessesse (2009), who reported negative relationships between household head age and vegetable market supply.

Access to Market Information

Access to market information positively and significantly influenced onion marketable supply at the 5% level. Producers with market information access supplied, on average, 1.507 quintals more onions, all else constant. This result corroborates the findings of Abrha et al. (2020) and Ashenafi (2010), who observed positive associations between market information access and marketable supply of vegetables and grains, respectively.

Farming Experience

Farming experience exhibited a statistically significant positive relationship with onion supply at the 5% level. Each additional year of experience was associated with a 0.173 quintal increase in marketable supply, suggesting that experienced farmers possess superior knowledge of optimal production and marketing strategies. This finding is consistent with Addisu (2016).

Quantity Produced

As hypothesised, the quantity of onions produced had a statistically significant positive effect on marketable supply at the 1% level. Higher production volumes translated directly into greater marketable surplus. This aligns with Giziew (2013), who found that increased production of various horticultural crops led to greater household marketable supply, and Melese et al. (2018), who observed positive relationships between onion yields and marketed volumes.

Credit Utilisation

Credit access positively influenced onion market supply at the 5% level. Households utilising credit supplied 2.621 quintals more onions compared to non-users, all else equal. This finding is consistent with Abrahim et

al. (2021) and Abay (2010), who reported positive effects of credit access on market supply of onions and pepper, respectively.

Oxen Ownership

Oxen ownership significantly and positively affected onion market supply at the 5% level. Each additional ox owned corresponded to a 2.162 quintal increase in farm-level supply, likely due to reduced ploughing costs for oxen-owning households compared to those hiring draft power. This result aligns with Aysheshm (2007) and Tegegne (2008), who found positive effects of oxen ownership on sesame and cotton supply, respectively.

Frequency of Extension Contact

Extension contact frequency significantly and positively influenced onion market supply at the 5% level. Each additional extension interaction was associated with a 0.656 quintal increase in marketable supply, reflecting enhanced technology adoption and improved production practices. This finding supports Addisu (2017) but contrasts with Melese et al. (2018), who reported negative effects of extension contact on market participation. This discrepancy suggests that extension service impacts may vary by region or implementation context.

From a sustainable development perspective, the findings indicate that agricultural market development requires interventions that address both production capacity and market access. The positive effects of market information, credit utilization, farming experience, oxen ownership, production quantity, and extension contact on market supply suggest that strengthening farmers' productive and institutional capacities can improve their participation in agricultural markets. Similarly, the multivariate probit results show that market information, credit access, production quantity, distance to market, education, farming experience, and trust in buyers influence the selection of marketing outlets. These findings indicate that sustainable agricultural commercialization depends not only on increasing production but also on improving farmers' ability to connect with appropriate markets and buyers.

The implications extend to several Sustainable Development Goals. Enhanced market participation and improved returns from agricultural production may contribute to SDG 1 by supporting smallholder livelihoods and income-generating opportunities. Improvements in agricultural production and market integration are relevant to SDG 2 because sustainable and productive agriculture contributes to food-system development, although household food security was not directly measured in this study. The income and employment generated through onion production, transport, trading, and retail activities are relevant to SDG 8, while

improved rural roads, market information systems, financial access, and agricultural technologies correspond to the infrastructure, innovation, and market-access dimensions of SDG 9.

Table 8: Multiple linear regression results of determinants of onion market supply.

Variables	Coefficients	Robust Std. Err.	t-value
Age of household head	-0.038**	0.017	-2.22
Sex of household head			
Male	0.367	0.698	0.600
Family size	0.616	0.424	1.45
Education level of household head			
Religious	0.315	0.563	0.56
(informal education) Basic education (1-12)	0.273	0.594	0.46
Certificate	1.795	1.200	1.50
Access to market information			
Have access	1.507**	0.673	2.24
Farming experience	0.173**	0.074	2.34
Non/off-farm income			
Yes	-0.553	0.572	-0.97
Distance to nearest market	-0.015	0.018	-0.87
Quantity of onion produced	0.729***	0.091	8.01
Credit utilization			
Yes	2.621**	1.267	2.07
Land size allocated for onion	4.312	2.935	1.47
Ox-Ownership of household head	2.162**	0.802	2.69
Frequency of extension contact	0. 656**	0.263	2.49
Constant	-0.178	1.461	-0.12
Number of observation	245		
F (15, 229)	1901.67		
Prob > F	0.0000		
R-squared	0.9876		
Root MSE	3.1541		

Note: Std. Err. = standard errors

*** and ** show the value statistically significant at 1% and 5%, respectively.

Source: Owns computation from survey, (2025)

3.5.2 Factors Influencing Onion Farmers' Marketing Outlet Preferences

Onion producers in Gode District have access to four alternative marketing channels: wholesalers, retailers, rural collectors, and direct consumer sales. A multivariate probit (MVP) model was employed to analyse the determinants of outlet selection decisions. This section presents and discusses the significant factors influencing farmers' channel preferences based on the MVP estimation results.

Model Specification and Diagnostics

The MVP framework allows households to select from multiple outlets simultaneously, recognising that producers may utilise several channels concurrently to maximise returns. The Wald test ($\chi^2(44) = 175.61$, $p < 0.01$) was statistically significant at the 1% level, confirming that the coefficients are jointly significant and the model possesses acceptable explanatory power.

The likelihood ratio test for independence among outlet choices ($\rho21 = \rho31 = \rho41 = \rho32 = \rho42 = \rho43 = 0$) was rejected at the 1% level, indicating that outlet selection decisions are interdependent. The estimated correlation coefficients revealed negative and statistically significant relationships between several outlet pairs: consumer-wholesaler ($\rho31$), retailer-wholesaler ($\rho21$), rural collector-retailer ($\rho32$), and consumer-retailer ($\rho42$), at 1%, 1%, and 10% significance levels, respectively. These negative correlations suggest substitution relationships between these outlet pairs (Table 4.7).

Marginal and Joint Probabilities

The simulated maximum likelihood estimation yielded marginal success probabilities of 53.1% for retailers, 42.5% for wholesalers, 19.1% for consumers, and 18.6% for rural collectors. The joint probability of selecting all four outlets simultaneously was extremely low (0.00041%), while the joint probability of selecting none was 5.21%, indicating that households rarely combine all channels. This finding suggests that the optimal channel mix is determined by outlet-specific factors.

Significant Variable Interpretations

Of the 11 explanatory variables examined, six were significant for wholesalers, four for retailers, five for rural collectors, and four for consumers, with varying significance levels.

Age of household head: Age exhibited a negative and significant influence on wholesaler outlet choice at the 10% level. Each additional year of age reduced the likelihood of selling to wholesalers by 1.6 percentage

points. This negative relationship may reflect older farmers' preference for farm-gate sales, reduced transport capacity, and greater aversion to marketing costs compared to younger producers. This finding contrasts with Melese et al. (2018), who reported that older farmers were better able to identify higher-priced outlets.

Education level: Education negatively and significantly affected rural collector and consumer outlet choices at the 5% level. Higher education levels decreased the likelihood of using these channels, as educated farmers possess better information-processing capabilities and are more likely to explore alternative, more profitable outlets. This aligns with Abraham (2013), who found that educated farmers favoured wholesalers over collector outlets.

Trust in buyers: Trust in buyers positively and significantly influenced wholesaler choice at the 5% level. Farmers who trusted traders were more likely to select wholesale channels, as trust reduces opportunistic behaviour and fosters cooperation. This finding contrasts with Addisu (2016), who reported that trust was positively associated with collector outlets.

Distance to nearest market: Distance positively influenced rural collector choice and negatively influenced consumer outlet choice at the 10% level. Greater distance increased the likelihood of using rural collectors while decreasing direct consumer sales. Households farther from markets were more likely to use rural collectors as intermediaries, consistent with Bardhan et al. (2012), who emphasised the importance of accessibility in farmers' outlet choices.

Quantity of onion produced: Production quantity positively influenced wholesaler choice at the 10% level and negatively influenced rural collector choice at the 5% level. Each additional quintal increased the probability of selling to wholesalers by 1.6% and decreased the probability of selling to rural collectors by 2%. Larger producers preferred wholesalers, likely due to the capacity to meet wholesale volume requirements, consistent with Muthini (2015).

Farming experience: Experience positively influenced rural collector choice and negatively influenced retailer and consumer outlet choices at the 5% level. Each additional year of experience increased the probability of choosing rural collectors by 3.7% while decreasing retailer and consumer outlet probabilities by 2.9% and 4.3%, respectively. Experienced farmers may have better knowledge of costs and benefits across outlets, selecting channels offering superior prices. This contrasts with Emana et al. (2015b), who found that experience negatively affected potato collector outlet choice.

Credit utilisation: Credit access positively influenced wholesaler choice and negatively influenced retailer choice at the 5% level. Credit users were more likely to sell to wholesalers, likely due to increased capacity to handle larger volumes, meet wholesale demand, and invest in transport or storage. This aligns with Mebrat (2014), who demonstrated positive impacts of credit on vegetable production.

Access to market information: Market information access positively influenced wholesaler and retailer choices at the 5% level and negatively influenced rural collector and consumer choices at the 1% and 5% levels, respectively. Producers with market information were 53.7% more likely to choose wholesalers and 52.2% more likely to choose retailers, while being 85.8% and 56.3% less likely to choose rural collectors and consumers, respectively. Access to price information enables farmers to evaluate price differentials and select outlets offering higher returns. This is consistent with Endris et al. (2020) and Wosene et al. (2018), who found positive associations between market information and wholesale/retail channel use.

Table 9: Determinants of onion producers' market outlet choice multivariate probit model result

Variables	wholesalers		Retailers		Rural collectors		Consumers	
	Coef	S E	Coef	SE	Coef	SE	Coef	SE
Constants	-1.705**	0.783	1.100	0.671	-1.44**	0.759	2.097**	0.821
HHAGE	-0.016*	0.009	0.004	0.006	0.011	0.007	-0.010	-0.010
HHSEX	-0.881**	0.399	0.132	0.358	0.193	0.375	-0.583	0.376
HH-size	0.361	0.156	-0.168	0.128	0.012	0.171	-0.126	0.166
EDUHH	-0.028	0.131	0.079	0.109	-0.299**	0.132	-0.353**	0.139
AccMktI	0.537 **	0.248	0.522**	0.214	-0.858 ***	0.252	-0.563**	0.266
FAEXP	0.012	0.016	-0.029**	0.013	0.037**	0.015	-0.043**	0.020
QOP	0.016*	0.009	0.007	0.006	-0.020**	0.009	0.010	0.008
DnMkt	-0.004	0.010	-0.008	0.007	0.016 *	0.009	-0.017 *	0.010
Acc-Cre	0.560 **	0.220	-0.381**	0.193	-0.040	0.262	0.084	0.272
NFI	-0.033	0.213	-0.454**	0.179	0.351	0.227	0.267	0.237
TRST	0.603**	0.207	-0.243	0.175	-0.232	0.213	-0.274	0.225
Predicted probability				0.249		0.087		1.098
Marginal success prob 0.425				0.531		0.186		0.191
Joint probability (success)								0.00000413
Joint probability (failure)								0.0521029
Number of draws (#)								5
Observation								245
Log likelihood								-393.324
Wald $\chi2$ (44)								175.61
Prob > $\chi2$								0.0000***
Estimated correlation matrix								
	ρ 1		ρ 2		ρ 3		ρ 4	
ρ 1	1							
ρ 2	-0.635(***)		1					
ρ 3	0.119		-0.069(***)		1			
ρ 4	-0.046		-0.220(*)		-0.049		1	

Likelihood ratio test of: ρ 21 = ρ 31 = ρ 41 = ρ 32 = ρ 42 = ρ 43 = 0

$\chi2$ (6) = 93.7118 Prob > $\chi2$ = 0.0000

Likelihood ratio test of: ρ 21 = ρ 31 = ρ 41 = ρ 32 = ρ 42 = ρ 43 = 0

Note: Coef = Coefficient and SE = Standard errors

Symbols: ***, **, and * show the value statistically significant at 1%, 5% and 10% respectively. Where ρ1, ρ2, ρ3 and ρ4 stands for wholesaler, retailer, rural collector and consumer respectively.

Source: Owns computation from survey result, 2025.

4. Conclusions and Policy Implications

3.1 Conclusions

This research investigated the determinants of onion market supply and marketing outlet preferences among smallholder producers in Gode District, Somali Regional State, Ethiopia. The findings confirm that onion cultivation constitutes a vital livelihood strategy and an important income source for rural households in the study locality.

The analysis established that wholesalers and retailers serve as the predominant marketing channels through which farmers distribute their onion output. The multiple linear regression results indicated that household head age exerted a negative influence on onion marketable supply, whereas access to market intelligence, farming experience, production volume, credit utilisation, oxen ownership, and extension contact frequency demonstrated significant positive effects on the quantity marketed.

The multivariate probit estimates further revealed that age, educational attainment, buyer trustworthiness, market proximity, production quantity, and farming experience significantly shaped farmers' outlet preferences. These results underscore the critical roles that both socioeconomic characteristics and institutional factors play in determining market engagement and marketing behaviour among onion producers.

3.2 Policy Implications and Recommendations

The empirical findings have implications for sustainable agricultural development in Gode District. The recommended interventions are intended not only to increase onion market supply and improve farmers' outlet choices but also to strengthen inclusive rural value chains, improve livelihood opportunities, and reduce market-access constraints. These measures are consistent with the broader objectives of SDG 1, SDG 2, SDG 8, and SDG 9.

Drawing from the study's empirical findings, the following policy measures are proposed:

Strengthen market information systems: Agricultural extension agencies and development partners should improve farmers' access to timely and accurate information on prices, demand, buyers, and market conditions through extension services, mobile-based platforms, and local market information centers. Improved market information can strengthen farmers' bargaining position and facilitate better integration into agricultural markets, contributing to inclusive rural economic development.

Expand rural credit services: Financial institutions should broaden access to affordable and appropriate agricultural credit so that smallholder farmers can purchase inputs and expand productive capacity. Improved access to finance can support household livelihood opportunities and agricultural commercialization.

Improve extension services: Extension services should be strengthened in both production and marketing. More frequent and better-targeted extension contact can improve agronomic practices, productivity, post-harvest handling, and market-oriented decision-making.

Improve rural transport infrastructure: Investment in rural roads and transportation facilities is needed to reduce physical market-access constraints and transaction costs, particularly for producers located far from markets. Such infrastructure improvements are relevant to resilient rural economic systems and SDG 9.

Strengthen farmer-trader linkages: Mechanisms that promote reliable and trust-based relationships between farmers and buyers should be encouraged. Stronger market linkages can reduce transaction uncertainty and support more stable participation in agricultural value chains.

Promote productivity-enhancing technologies: Improved seed, irrigation technologies, appropriate agronomic practices, and other productivity-enhancing technologies should be promoted according to local conditions. Higher and more reliable production can strengthen marketable surplus and support sustainable agricultural commercialization.

3.3 Future Research Directions

Future studies should investigate the profitability and efficiency of different onion marketing channels and assess the role of digital market information systems in improving market participation among smallholder farmers. Additionally, comparative studies across districts and regions would provide broader insights into onion marketing systems in Ethiopia.

Declarations

Funding

This study did not receive any financial support from funding agencies in the public, commercial, or not-for-profit sectors.

Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethics Approval

This study was approved by the Institutional Review Board (IRB) of the College of Dry-land Agriculture, University of Kabridahar, in accordance with the Declaration of Helsinki 1964 and the National Research Ethics Guidelines of Ethiopia. Informed consent was obtained from all individual participants included in the study.

Clinical Trial Registration

Not applicable. This study is not a clinical trial.

Consent for Publication

Not applicable. This manuscript does not contain any individual person's data in any form.

Competing Interests

The authors declare that they have no known financial or personal conflicts of interest.

Data Availability

The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Authors' Contributions

All authors participated in the conceptualization and design of the study. SB conducted data collection and drafted the manuscript. SB, TB, MC, and DM performed data analysis. TB, MC, and DM provided critical review and editing. All authors read and approved the final manuscript.

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