



**JIMMA UNIVERSITY COLLEGE OF AGRICULTURE AND
VETERINARY MEDICINE, DEPARTMENT OF AGRICULTURAL
ECONOMICS AND AGRIBUSINESS MANAGEMENT**

**ANALYSIS OF VEGETABLES MARKET PERFORMANCE IN KERSA
DISTRICT, JIMMA ZONE, ETHIOPIA**

An MSc Research Thesis Submitted to the postgraduate School of College of
Agriculture and Veterinary Medicine, Jimma University for the Partial Fulfillment
of the Requirements of MSc degree in Agribusiness and value chain management

By

IBRAHIM GALI

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JIMMA, ETHIOPIA

ANALYSIS OF VEGETABLES MARKET PERFORMANCE IN KERSA
DISTRICT, JIMMA ZONE, ETHIOPIA

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DEDICATION

I dedicate this piece of paper work to all my family and all who patronized me for their valuable contribution in my thesis work.

STATEMENT OF THE AUTHOR

I verify that this Thesis is my own work. It followed all ethical research and technical principles of scholarship in the data collection, data analysis, result interpretation and preparation of this Thesis. Any scholarly matter included in this Thesis has been cited for recognition. This thesis has been submitted in partial fulfillment of the requirements for a M.Sc. degree at the Jimma University. The Thesis is amassed in the Jimma University library and is permissible to readers by borrowing under the rules of the Library. I toughly declare that this thesis is not submitted to any other institution anywhere for the award of any academic diploma, certificate or degree.

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BIOGRAPHICAL SKETCH

The author was born in June, 1991 at Jimma in Jimma zone of Oromia Regional State, Ethiopia. He attended his elementary education at Lemlem elementary School. After favorably completed the primary school he then joined secondary education at Jiren Secondary School. He then joined Jimma Preparatory School to attend the preparatory education. After passed the ESLCE, he joined Haramaya University in November, 2011, for his first degree. Staying for consecutive three years he received the degree of Bachelor of Science in Agribusiness Management in July, 2013. After overstay in government office employed in Agriculture office in Kersa district, in October 2021, he joined the school of graduate studies at Jimma University for his MSc. degree in Agribusiness and Value chain Management.

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ACRONYMS AND ABBREVIATIONS

MSSM	Multi-Stage sampling method
ATA	Agricultural Transformation Agency
BLUE	Best, Linear, Unbiased And Estimation
CSA	Central Statistics Agency
CLR	Classical Linear Regression
CR	Concentration Ratio
GO	Government Organization
GMM	Gross Marketing Margin
Ha	Hectare
Qt	Quintal
HHI	Herfindall-Herischman Index
IFPRI	International Food Policy Institute
KDAO	Kersa District Agriculture Office
KM	Kilometer
MC	Market Concentration
NGO	Non-Governmental Organization
NMM	Net Marketing Margin
OLS	Ordinary Least Square
S-C-P	Structure, Conduct and Performance
TGMM	Total Gross Marketing Margin
VIF	Variance Inflation Factor

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Analysis of Vegetables Market Performance in Kersa District, Jimma Zone, Ethiopia

ABSTRACT

Analysis of marketing performance of vegetable plays an important role in the development of certain country by analyzing its profitability for participants and analyzing its marketing channels exist in the market chain. However, many study ignored to analyze market participation and its supply volumes simultaneously in Ethiopia. Thus, this study was aimed to analyze market performance, in Kersa district, Jimma zone, Ethiopia. A multi-stage random sampling technique was applied to collect data from 150 vegetable producer farmers. Additional data was collected from 15 vegetable traders selected purposively. Data was analyzed by using descriptive and econometric data analysis method. Heckman two stage models were applied to econometric analysis method. Descriptive analysis result indicated that the vegetable market structure of the study area was oligopolistic type. The result also showed that 67% of traders decided their price setting based on market price, while 33% of them decided based on negotiation with other traders. The marketing cost and profitability analysis result showed that all actors in the marketing chain benefited from vegetables production and marketing. Farm experience, extension contact, credit access, transportation access, non-farm income, and pesticide application had significant impact on both the probability of vegetables market participation decision, and its supply volumes. Therefore, it is important to promote extension technologies, market infrastructures, supporting farmers on obtaining initial capital for vegetables production and training farmers on controlling crop disease have to be done by Ethiopian government. The study findings are expected to fill knowledge gap on the title and help concerned organizations for further intervention. But it is limited to represent the whole country, since a sample respondents were selected randomly.

Key words: Vegetables, farmers, household, market performance, market participation, probit, Heckman two stages, Kersa, Ethiopia.

1. INTRODUCTION

1.1. Background of the study

Vegetables are grown world-wide in almost in 200 countries. At most three-fourths of vegetables occurs in Asia, mostly in China, which produces over half of the world's vegetables. Commercial vegetable production is a high input and labor intensive activities that needs a large labor force, from cultivation to processing, and marketing phases. The increase of total volumes of vegetables traded worldwide has been dramatic still, compared to overall exports of agricultural products, the importance of vegetable exports remaining minor. However in recent years the share has been raising and it is projected to continue to rise faster than other agricultural products due to the increased frequency of world trade level. The European Union (EU), followed by North America and Japan, are the world's most important fresh vegetable import regions. A large share of this comes from Africa, Latin America and the Caribbean, and from China, (*Silva Dias, J., 2010*).

Vegetables are a significant component of agricultural farming systems in Africa and have recently moved into research organizations, development partners and policy maker. Beyond income generating opportunities for producers, vegetable production for domestic and export markets is an important driver for growth due to employment opportunities in production, processing and trade, (*Mithöfer et al., 2023*).

In the 1990s, many countries, particularly in Africa and Latin America, changed their trade policies from protectionist to more openness economic liberalization, and export diversification. This opened the way for several new trade agreements that facilitated trade in high-value agricultural products, such as vegetables. In Sub-Saharan Africa, Ivory Coast and Kenya are the two most important vegetable producers for export, (*Minten et al., 2009*). Kenya was the single largest supplier of green beans to the European Union, followed by Ethiopia, South Africa, and Switzerland, (*Okello et al., 2007*).

In Ethiopia vegetables are producing by rain and irrigation at various part of the country and generating higher annual income and creating employment as a result improving livelihood of the households and other actors in the vegetable market chain (*Gebbru et al., 2019*).

Vegetable production in Ethiopia is increasing due to increased area allocation and increased yield per unit area. Although, vegetable marketing is constrained by lack of market information, poor market linkages, low institutional support, lack of value chain development to ensure participation and benefit to the smallholders (*Emana et al., 2015*).

Efficient marketing system plays an important role in stimulating production and accelerating the pace of economic development. It increases the income of farmers by reducing the number of middle men who hide market information or restricting the commission on marketing services. The establishments of an efficient marketing system would enhance farmers' prices for their farm products and enable them to invest their surplus in purchasing modern inputs. This may lead to an increase of production and productivity and it contributes to an increase in the

marketable surplus by cutting down losses in the process of storage, transportation, and processing (Megerssa et al., 2020).

Oromia is the largest region in Ethiopia and plays a significant role in the country's agricultural production, including vegetable cultivation. The region has a favorable climate and fertile soils, making it suitable for growing a wide variety of vegetables. The major vegetable crops grown in Oromia include tomatoes, onions, peppers, cabbage, carrots, and potatoes. Vegetable production has been increasing in recent years due to government initiatives, improved farming practices, and market demand. However, there are so many challenges including, pests and diseases, lack of access to improved seeds and fertilizers, poor market infrastructure, and post-harvest losses that affecting its productivity. Vegetables produced in Oromia are sold in local markets, regional markets, and urban centers within Ethiopia. There is also a growing export market for Oromia vegetables, particularly to neighboring countries. However, marketing of vegetables faces challenges such as poor market infrastructure, lack of market information, and price fluctuations, (Gosa et al., 2023).

In Ethiopia, vegetable production is not available in all parts of the country but southern parts particularly Jimma zone have a good potential in vegetable production which is mainly utilizing them for stable food subsistence, with less market-oriented activities, (Megerssa et al., 2020).

Agricultural activities such as animal husbandry and crop production are the main source of livelihood and income of the farmers in Kersa district. Horticultural crops production is very common next to cereals in the area. Kersa district produces a wide varieties of vegetables, including tomatoes, onions, peppers, cabbages, head cabbages, carrots, and potatoes. Vegetable production is predominantly small-scale, with farmers cultivating vegetables on small to large plots of land. Government initiatives improving farming practices and market development efforts are expected to contribute to the growth of the vegetables in the area. Though, production and marketing of vegetables in the study area faces many factors affecting its performances, there is no study conducted yet to identify it scientifically, (KDAO, 2023). Even though, this area has vegetable production potential, there is no empirical study done on production and market performance in the district. Therefore, this study aimed to investigate the vegetable market performance, to examine determinants of vegetable market participation and extent of supply volume in the study area.

1.2. Statement of the problem

The production of vegetable crops is generally more knowledgeable and capital intense than cereal crops, and is often riskier because these crops are much more costly to produce per hectare than traditional crops, and because yields and prices are more variable than field crops, (Silva, 2022).

Even if the Ethiopian government focused on the commercialization of subsistence agriculture as priority policy decision, market participation of farmers in Ethiopia is limited and agricultural markets are fragmented and not well integrated into wider market systems which increases transaction costs and reduces farmers' incentive to produce for the market because of the scarce

information on commercialization process and marketing behavior of farmers in the country (Mitiku A., 2014).

Vegetables accounted for 1.62% of total cropland in Ethiopia, while, root crops accounted for 2.06%. Despite its scope and importance, low yields, a lack of market information, market policy issues, infrastructure issues, and market access issues all had a significant impact on the sector. Also, vegetable marketing is constrained by lack of market information, poor market linkages, low institutional support, lack of value chain development to ensure participation and benefit to the smallholders, (Wondim, 2021).

Vegetable production in Ethiopia is increasing due to increased area allocation and increased yield per unit area. Although, vegetable marketing is constrained by lack of market information, poor market linkages, low institutional support, lack of value chain development to ensure participation and benefit to the smallholders (Emana et al., 2015).

Even if vegetable production is common in Ethiopia especially in Jimma zone due to its favorable agro-ecologies for its production and farmers in the study area have comparative advantage in horticultural crops production, they were not using their full potential in participating in vegetable markets due to imperfect marketing system, not actively participating in value chain, and their price taking attributes, horticultural crop risk faced. Inefficient marketing system and poor market infrastructure hinder factor for proper function of the marketing. The farmers' traditional attitude that horticultural crops are not use as staple food rather as additional luxury products might affect the level of farmers' vegetable market participation. In addition, due to low access in transportation many farmers prefer to sell their produce at farm gate at low price. This made them to get low income from their produce and made them to change their decision to participate in vegetable market, (Hegena and Teshome, 2022).

There are numerous studies conducted to analyze factors affecting market performances by many different authors which more of them conducted on grain crops while few of them were conducted on vegetable crops. Among these studies (Tufa et al., 2014), studied on determinants of smallholder commercialization of horticultural crops west Hararghe zone, in Ethiopia and found that gender, education, farm size, household size, irrigation access and market distance affect the participation decision in commercialization and level of commercialization significantly. (Yohanes, 2015), conducted study on performance and challenges of vegetable market: the case of Kombolcha district East Hararghe zone, Oromia Regional State, Ethiopia and found that land size, frequency of irrigation, extension contact, and family size had significance impact on vegetable market participation decision and its supply volumes. (Hegena and Teshome, 2022) on determinants of vegetable market supply by smallholder farmers, (Rikitu et al., 2019), on smallholder farmer's decision to participate in vegetable marketing and volume of sales, and found that sex, land size, market distance, access to irrigation, application of pesticide, and participation to civic organization affect the participation level of farmers in vegetables marketing. (Aliyi et al., 2021), on Determinants of market participation among smallholder vegetable producers in Southwest Ethiopia and suggested that sex, experience, distance from the

market, family size, education, land size, extension contact, market information, ownership of transportation, owning motor pump and membership of cooperative affect vegetables market participation decision and extent of participation. (Yayo et al., 2016), studied on marketing system analysis of vegetables and fruits in Amhara regional State: survey evidence from Raya Kobo and Harbu Woreda and found that average priced, distance from road, access to market information and total size off land had significance impact on tomato market participation. (Haile et al., 2022), studied on the determinants of vegetables market participation among smallholder farmers in Ethiopia and found that extension contact, market information access, transportation access, and size and family size had significant effect on market participation. Most of the studies focused on vegetables market performance and its market participation, while they ignored vegetables supply volume analysis. Therefore, this study was aimed to study vegetables market performance and its market participation decision and supply volumes the case of head cabbage, potato and tomato in Kersa district, Jimma Zone, Ethiopia.

1.3. Research Questions

The study expected to answer the following research questions.

1. What is the market structure, conduct and performance attributes?
2. What are the factors affecting vegetables market participation and supply volumes?

1.4. Objective of the Study

General Objective

The general objective of this study is to investigate the vegetable (potato, head cabbage and tomato) market performance in Kersa district of Jimma zone, Ethiopia.

Specific Objectives

The specific objective of the study is the following.

1. To investigate structure, conduct and performance of the vegetable markets.
2. To analyze vegetables market participation and supply volumes

1.5. Scope and Limitation of the Study

The study limited to analyzed structure, conduct and performances; market participation and supply volume analysis of vegetables (potato, head cabbage and tomato) of the study area. it s difficult to conclude the market performance of vegetables based on the result of the variables effect studied, because of the changing behavior of producer's overtime on vegetable production participation due to the nature of agricultural produces. The study may be limited to represent the whole country since the selected sample of the respondents representation is the district population.

1.6. Significance of the Study

This study tries to be advent to the empirical literature on the tittle and give the basis for further study on the area. The result of this study attempt to help producers, traders and other actors by provide information to escalate production and marketing to the large scale to provide change in the result is important to researchers and development planners, policy makers and others on provide information on marketing margin, marketing chain, structure, conduct and performance marketing profitability analysis and factors affecting on vegetable market participation supply volumes. The result of this study also expected to avail government organization, non-governmental organization and students to improve their knowledge gap on vegetable market performance. Likewise, this study expected to avail everybody who needs to participate on vegetable production and trading by providing information on the status.

1.7. Organization of the Thesis

This study is organized in to five chapters. The remaining part of this study is organized according to the following. The second chapter is related with of literature reviews with detailed review on related topics on vegetables production, and marketing theoretically and empirically. The next chapter considers with research methodology, starts from description of study area and ends up with definition of econometric variables. In the fourth chapter, results and discussion presented on different topics of descriptive and econometric analysis including demographic and socio-economic characteristics of farmers and traders, vegetable market performance status, determinants of vegetable market participation, and extent of its supply volumes. The last chapter summarizes the results of the study with some recommendations.

2. LITERATURE REVIEW

This unit deals with the review of the literatures work on market performance analysis theoretically and empirically. Under this topic meaning and concepts of market, marketing, agricultural marketing in general and vegetables in specific, measurement of performance analysis, and others reviewed theoretically and empirically.

2.1. Theoretical Review

2.1.1. Definition and Concepts

2.1.2. Market definition

According to (Kotler *et al.*, 2015) “market is the set of actual and potential buyers of the product”. Market means “not to a place but to a commodity or commodities and buyers and sellers who are in direct competition with one another”.

The meaning of marketing was defined by many different authors. Among these the following are some of them. (Kotler2012), defined marketing as “the science and art of exploring, creating, and delivering value to satisfy the needs of a target market at a profit”. According to (Kotler *et al.*, 2015)”. Marketing is the business function that identifies customers’ needs and wants, determines which target markets the organization can serve best, and designs appropriate products, services, and programs to serve these markets.” According to the *American Marketing Association (1988)*, “Marketing is the process of planning, and executing the conception, pricing, promotion, and distribution of ideas, goods, and services to create exchanges that satisfy individual (customer) and organizational objectives.”

Agricultural marketing definition

The term agricultural marketing is composed of two words which are agriculture and marketing. Agriculture means growing or/and livestock while, marketing encompasses a series of activities involved in moving the goods from the point of production to point of consumption. The study of agricultural marketing comprises, all the operations, and the agencies conducting them, involved in the movement of farm produced foods, raw materials and other derivatives, such as textiles, from the farms to final consumers, and the effects of such operations on farmers, middlemen and consumers (Thomson, 2021).Agricultural marketing is a process that involves the assembling, storage, processing, transportation, packaging, grading, and distribution of different agricultural commodities across the country. Agricultural marketing is a process which starts with a decision to produce a saleable farm commodity, involves all the aspects of market structure or system, both functional and institutional, based on technical and economic considerations, and includes pre and post-harvest operations, assembling, grading, storage, transportation and distribution (Mirdha, 1976).

Agricultural market participation

Market participation is both a cause and a consequence of economic development and it forms commercialized society. It creates linkage between the input supplier and output side producer. Producers with low market participation have low agricultural productivity and they are the

poorest and food insecure. Market participation increases production and productivity by providing price information and cash to purchase inputs. Higher production and productivity could drive market participation because farmers with high productivity have surplus to participate in the market, *ceteris paribus*, (*Hegena and Teshome, 2022*).

Agricultural marketing approach

According to (*Kohls and Uhl, 1985*) there are four different approaches to the study of marketing, while other scholars identified other approaches additionally. These approaches explain clearly the mechanism and concept of marketing. These approaches are:

Commodity approach

This approach refers to the study of a product in detail. The marketing situation of each product chosen for study is examined from such view points as sources and conditions of supply, producer marketing organizations, policies, different middlemen who take part in distributing the product, (*Kohls and Uhl, 1985*).

Institutional approach

This approach relates to various marketing institutions like producers, wholesalers, retailers, processors, middlemen, exporters etc. engaged in marketing. It examines the activities of business organization or people involved in marketing, (*Kohls and Uhl, 1985*).

Functional approach

It is about the study of various activities or functions performed in the process of marketing of goods and services. These functions are buying, selling, financing, transportation, banking, risk bearing, market information etc. there are three general types of functions performed in any marketing system. These are exchange functions, physical functions and facilitating functions. Exchange functions are buying and selling activities, (*Kohls and Uhl, 1985*).

Decision making approach

This approach is of vital importance from the view point of making management. Various decisions are taken at every level of management. In successful marketing, decision making occupies an important place, (*Kohls and Uhl, 1985*).

Agricultural marketing classification

Agricultural marketing classified into four based on location. These are local/village markets, primary market, secondary market and terminal markets. Local/village market constitutes of the customers who will buy the products or services in the vicinity of where they are produced. It is near village market which is mainly village buyers. Primary wholesale markets are big towns, exchange by producers/farmers themselves. Secondary wholesale markets are near districts or railways junction between traders and wholesalers. Terminal markets are metropolitan cities or sea ports. Sea board markets are seashore, imports and exports mainly. Agricultural marketing

also classified into input marketing (seeds, manure, fertilizers, agricultural implements etc.) and product marketing (by products and/or value added), (AERI,2022).

The features of agricultural marketing

Agricultural products marketing are known by their various features among other non-agricultural products. Among these features perishable products, continuous demand, fluctuation in price, presence of intermediaries, inelastic demand, and elastic supply are the major.

2.1.3. Structure-conduct-performance Approach (S-C-P)

A. Market Structure

Market structure is a decision of the number and nature of participants in the market. Market structure consists of the relatively stable features of the environment that influence the behavior and rivalry among the buyers and sellers operating in a market (*Pender et al., 2004*). Some examples of market structure include the number of buyers and sellers, the number of sellers of agricultural inputs such as fertilizer and veterinary drugs, barriers to entry into the market and the nature of trading relations. The main structural elements important to market performance analysis are concentration, barriers to entry, vertical and coordination/integration.

Market Concentration Ratio

Market concentration ratio is the measurement of the concentration of the top firms in the market (*Times, 2021*). Market share is used as a reference to formulate. The value of top firms may be three or maximum five. If the top firms keep on gaining market share, then we say that the industry has become highly concentrated. Concentration within industry can be defined as the degree at which small number of firms make up for the total production in the market. If concentration is low, it simply means that the top 'n' firms are not influencing the market production and the industry is considered to be highly competitive. On the other hand, if the concentration is high, it means that top 'n' firms influence the production or services provided in the market the industry then is said to be oligopolistic or monopolistic (*Kotler, 2012*).

Market concentration is a function of the number of firms and their respective shares of the total reserves in a market (*Times, 2021*). Market concentration is closely associated with market competitiveness (*Harvard Business Review 2016*). There are various factors that affect market concentration. These are barriers to entry (high start-up capital), economies of scale, brand loyalty, industry size and age, product differentiation and current advertising levels, firms specific factors (research and development levels) and human capital requirements (*Junashvili and David, 2002*).

Measure of market concentration

The major commonly used measures of concentrate

on are Concentration Ratio(CR), Herfindahl-Hirschman Index(HHI) and Gini - Coefficient(GC).

Concentration Ratio (CR)

A simple measure of market concentration is to calculate $1/N$. Thus

$MC = 1/N$ where N is the number of firms in the market, 1 indicate pure monopoly and will decrease with the number of active firms in the market, non-increasing in the degree of symmetry between them. Concentration ratio is the proportion of industry output accounted for by n largest firms. These can be calculated by the following formula.

$CR_n = \sum_i^n Si$ where Si where Si is the market share of firm I and n is total number of firms in the market. But market share of individual firm can be calculated by the formula:

$Si = Qi/\sum Q$ where Qi is the quantity of output produced by firm i , si is market share of firm i and $\sum Q$ is the total quantity of output produced by certain market.

Herfindall-Hirschman Index (HHI)

HHI is the most commonly used concentration measures. The HHI is calculated by summing of squares of the market shares of each of the firms in the market. These can be according to the following:

$HHI = \sum_i^n Si^2$ where Si is the market share of firm I and n is total number of firms in the market. When all n firms are of equal size, then $HHI = 1/n$. The strength of the HHI lies in its ability to combine information on both the number and the size distribution of firms. For this reason it is the preferred measure of concentration. The HHI can range from $1/N$ to 1. However, when using percentages a HHI can range from 1 to 10000. In most markets, HHI below 1500 indicates a market with low concentration, a HHI of 5000 indicates a duopoly and a HHI of 10000 indicates a fully monopolized market (*Corporate Finance Institute, 2021*). When using decimal version, a HHI of 0 indicates perfectly competitive industry while a HHI of 1 indicates monopolized industry. If decimal or percentage of a HHI is used the higher HHI represent stronger concentration in the market (*Evans and Anthony J. 2014*). This index may calculated by adding the square root of the percentage market share of each individual firm in the industry.

Gini-Coefficient (GC)

Originally thought of by Corrado Gini in 1912, it is most commonly used to measure income inequality. Gini coefficient is a statistical measure used to calculate inequality within a nation. It does so by calculating the wealth distribution between members of the population. It measures the size of firms ranked from the smallest to the largest as a percentage of the number of firms in the market, plotted against the cumulative output of these firms. It is the measurement of statistical dispersion or variability. Gini coefficient is the ratio of the areas on the Lorenz curve diagram. Lorenz curve is a curve connects the two tip of diagonal line of the square or called line of equality. It is calculated by dividing the area between Lorenz curve and diagonal line by the area under half of the square. The value of the measurement of Gini coefficient ranges from 0 to 1. At 1, the measurement would show that one person receives all the national income and a measurement of 0 would suggest that income is perfectly split between all members of society. In other word 0 = complete equality and 1 = complete inequality (*Times, 2021*).

Features of perfect competitive market: large number of buyer and sellers, homogeneous products, perfect mobility of factors of production, free entry and free exit of firms, perfect knowledge and no government intervention,

Features of monopolistic competition market: there are many/several number of sellers, heterogeneous and differentiated commodity, unrestricted entry and exit and different trade marks on the product.

Features of oligopoly market: few numbers of sellers, restricted entry and exit and similar or differentiated products.

Features of monopoly market: only one seller of the commodity, restricted or completely blocked entry and exit and unique product.

Barriers to entry

Barriers to market entry include a number of different factors that restrict the ability of new competitors to enter and begin operating in a given industry.

The six major sources of barriers to market entry are the economies of scale, Product differentiation, Capital requirements, Switching costs, Access to channels of distribution, and Government policy, (*Times, 2021*).

Vertical coordination/integration

It is how numbers of the industry linked together to other levels of marketing chains. It is delivering of commodity from one market to another to find good selling price.

B. Market Conduct

Market conduct refers to the patterns of behavior that traders and other market participants adopt to affect or adjust to the markets in which they sell or buy. Market conduct is about the behavior of the firms in the market, price taker or price maker of commodity in the market. These include price setting behavior, buying and selling practices. This can be either price taker or price maker. The features of market conduct are cooperation, integration, strategies and services.

The conduct of the market is characterized by the Pricing strategy, Product strategy, responsiveness to change, and research and innovation. Market conduct problems may be detected by the existence of formal and informal marketing groups that perpetuate such practice, formal and informal producer groups that affect bargaining power, the availability of price information and its impact on prevailing prices, the distance from the major market and its impact on prices; and feasibility of utilizing alternatives, (*Times, 2021*).

C. Market Performance

Market performance refers to the extent to which markets result in outcomes that are deemed good or preferred by society. Market performance is deals with the impact of structure and conduct on product prices, costs, volume and quality of output. It is how well the market fulfills certain social and private objectives. These include price level and price stability in the long and short term, profit levels, costs, efficiency and quantities and quality of food commodities sold (*FEWS, 2008*). Market performance may be defined as the composition of end results in the

dimensions of price, output, production cost, selling cost, product design, profits, margins and costs, volumes (quantity) and so forth which enterprises arrive at in any market as the consequences of pursuing whatever lines of conduct they espouse. It refers to the extent to which markets result in outcomes that are deemed good or preferred by society. Market performance is measured by calculating marketing cost and marketing margin.

Marketing Cost

Marketing cost means, the reasonable costs associated with promoting, selling, packaging, transferring titles and moving joint products to the customer and include direct costs and overhead costs (*Heltberg and Tarp, 2002*). Marketing cost can be calculated by adding all costs related to market starting from production up to reach final consumers. Marketing costs include: handling costs, packaging costs, transport costs, storage costs, processing costs, and capital costs.

2.1.4. Marketing Margin

Marketing Margin is the difference between price received by farmers and price paid by consumers (*Tomek and Kaiser, 2014*). A marketing margin is the difference between the value of a product or a group of products at one stage in the marketing process and the value of an equivalent product or group of products at another stage. Margin is influenced primarily by shifts in retail demand, farm supply and marketing input prices, time lags in supply and demand, market power, risk, technical change, quality and spatial considerations. Traders Gross profit, traders marketing margin, total gross marketing margin (TGMM) and producers' gross marketing margin (GMMp) are important measurements of vegetable market performance analysis used in this review.

According to (*Tomek and Kaiser, 2014*), marketing margin is calculated according to the following formulas.

Total Gross Marketing Margin (TGMM): it is the final price paid by the end consumer which is defined as a percentage. The TGMM can be calculated by the following formula.

$$TGMM = [CP] - [PP] / [CP] * 100$$

Where TGMM is total gross marketing margin, CP is consumer price and PP is producer price.

Gross Marketing Margin of Producer (GMMp): it is the proportion of the price paid by consumers that goes to the producers. Gross marketing margin of the producer can be calculated according to the following formula.

$$GMMp = [CP] - [GMM] / [CP] * 100$$

Where GMMp is gross marketing margin of producer, CP is consumer price and GMM is gross marketing margin and GMM is obtained by multiplying TGMM by CP.

Net Marketing Margin (NMM): is the difference between what a company/market pays for the product and what it charges for the product. It can be calculated by the following formula.

$NMM = [TGMM] - [MC] / [PC] * 100$ where NMM is net marketing margin, TGMM is total gross marketing margin, MC is marketing cost and PC is price of consumer.

2.1.5. Measures of Market Participation

Market participation is the ability of anybody to participate in a market in efficiency and effective way. In agricultural marketing, it is the ability of farmers to transform from subsistence to large market engagement where production and selling are commercialized. According to (Komarek, 2010) econometric models used to measure crop market participation are Heckman two stage models, double hurdle model and tobit model. Market participation is regarded as participation in any market related activity which encourages the sale of produce, as individual farming household's economic transactions with others in cash or kind or commercialization. Smallholder market participation is constrained by low access to land, credit, production and marketing skills, market information and infrastructure in poor countries. According to (Andaregie et al., 2021), in Ethiopia, market participation of smallholder farmers is constrained by many factors such as adverse climatic conditions, improper land usage, natural resource exploitation, low access to agricultural technologies, predominance of traditional farming system, low access to market, and absence of business oriented farming system. Market participation is most commonly calculated by using Heckman two-stage model. Heckman two-stage model is a model developed by Heckman in 1979. The first stage is equation for participation on market by using binary probit econometric model. The second stage is to identify by what extent the participation is, that means to estimate the volume of supply in the market. This equation is used to develop a selectivity term known as the "inverse mills ratio" which is added to the second stage outcome equation that explains factors affecting volume of supply. The inverse mills ratio is a variable for controlling bias due to sample selection. The second stage involves including the Mills ratio to the supply equation and estimating the equation using Ordinary Least Square (OLS), (Heckman, 1979).

2.1.6. Determinants of market supply

Determinants of market supply are any factors that affect market participation of any individuals or groups. These factors are Lack of full participation in markets prevents them from transiting into commercial farming and hence their low contribution to economic growth. They are constrained by a number of factors in marketing, making it difficult for them to commercialize; such as institutional, technical and socio-economic factors include lack of information, poor infrastructure, inability to have contractual agreements, lack of transport, poor organizational support, low access to extension agents, low use of improved seed and low use of fertilizer with relatively small marketable surplus (Osmani and Hossain, 2015). To analyze the determinants of vegetable market supply multiple linear regression model used by assumption of all farmers produce vegetable to the market. In this study, to analyze the determinants of vegetable market supply multiple linear regression model will be used by assumption of all farmers produce vegetable to the market.

2.2. Empirical Literature Review

2.2.1. Vegetable Market Performance Analysis

A study conducted on performance and challenges of vegetable market in Kombolcha district, East Hararghe zone, Oromia National Regional State, Ethiopia and found market concentration ratio of top four firms analysis indicate that the market structure of the study area of potato and cabbage is oligopoly market. The study result shows that the vegetable traders had no significant role in price setting. The survey result also shows that transportation cost was the highest for village collectors than other actors, (*Yohanes, 2015*). Another study conducted on Analysis of Vegetable Marketing Performance in Ethiopia, their survey result indicate that the structure of onion and tomato vegetable markets separately was analyzed in terms of degree of market concentration of onion and tomato found to be strongly oligopolistic. Their marketing margin analysis indicates that collectors and wholesalers were the dominants of buyers of onion and tomato respectively in terms of volume of onion supplied by producers to the market. Moreover, the lower quantity of tomato marketed through retailers to consumers, (*Endris et al., 2020*).

2.2.2. Marketing Margin Analysis

A study conducted on value chain Analysis of potato in Ethiopia, indicate that the result of margin analysis for actors involved in potato value chain show that the largest of market margin and profit margin respectively, was captured by small scale potato processors followed by farmers marketing margin and profit margin and the rest actors (retailers, wholesalers and collectors) obtain lowest marketing margin and profit margin respectively in the potato value chain. The highest cost is the cost incurred by processors in the study area (*Faris et al., 2018*).

2.2.3. Determinants of Market Participation

According to (*Rikitu et al., 2019*) studied on of smallholder farmers' decision to participate in vegetable marketing and the volume of sales in Ethiopia by applying two stage Heckman model and analyzed factors affecting the level of market participation these are sex of the household head, distance to farmers training center, land size, access to irrigation, application of pesticide and involving any civic organization (social capital) significantly affected the level of the vegetable marketed by household farmers.

A study conducted by (*Wosene et al., 2018*), on Analysis of Red Pepper Value Chain, the case of Wenberma district, West Gojam zone of Amhara national regional state, Ethiopia by applying 2SLS economic analysis method to identify factors affecting market participation by using multivariate probit (MVP) model and found that quantity produced of pepper, farming experience, lagged year price affect the quantity supplied to the market positively and significantly. Sex and total livestock owned affect quantity supplied to the market significantly and negatively. Here the author did not studied factors affecting markets linkages rather he gave attention to study marketing channels.

According to (*Megerssa et al., 2020*) conducted their study on Smallholder market participation and its associated factors: Evidence from Ethiopian and their descriptive result indicates that the

number of consumers was larger in non-participants than in market participants, the majority of non-market participants were far from the marketplace as compared to market participants, market participants had more enough labour force than non-market participants, market participants had access to market information than non-market participants, non-market participants had access to transport service than market participants, and market participants were more participating in off-farm activities than non-market participants in the study area.

Accordingly, age of household head, household family size, educational level, labour availability, market information and distance from market place were found to be statistically significant in the study area. On the other hand, demand for vegetables, transport access, off-farm income, extension and storage facility did not have a significant effect on farmers' market participation.

(Yohanes, 2015) done her study on performance and challenges of vegetable market in Kombolcha district, East Hararghe zone, Oromia National Regional State, Ethiopia using Heckman sample decision model and the result of the probit model shows that explanatory variables age, access to credit, total land owned, frequency of irrigation, education level of households, frequency of extension contact significantly and positively and non-farm income significantly and negatively affect producers' decision to sell vegetables. Here there are variables such as gender and market infrastructures that are not entered to the probit model which important in agricultural producers market participation decision and volume of supply determination. In addition to this she was not analyzed market orientation which also important to examine market performance of vegetables producers.

A study undertook in Gemechis district, West Hararghe zone, Ethiopia on Determinants of smallholder commercialization of horticultural crops by applying descriptive statistics analysis the result shows that farm size, household education, irrigation, livestock and gender has a positive and significant influence on farmers' likelihood to participate in horticultural crops market. Distance to the nearest market and household family size has negative affect on households' likelihood to sell horticultural crops and decisions to participate or not in horticultural crops market. (Tufa et al., 2014).

2.2.4. Determinants of Market Supply

A study conducted by (Wosene et al., 2018), on Analysis of Red Pepper Value Chain, the case of Wenberma district, West Gojam zone of Amhara national regional state, Ethiopia and the multiple regression model of econometric analysis used shows that experience in pepper production, year of schooling, land allocated to pepper production and credit taken affected positively and significantly quantity of pepper produced. On the other hand distance from the nearest market influence pepper production negatively and significantly. The result of his study also shows that quantity of pepper produced, farming experience, one year lagged price and family size influence market supply of pepper positively and significantly.

According to (Hailu, 2016), studied on value chain analysis of vegetables: the case of Ejere district, West Shoa zone, Oromia regional state of Ethiopia, by using two stage least square

(2SLS) method to identify factors affecting the volume of potato sold to the market by farmers. The result indicate that productivity, sex of households heads, distance from nearest market, off/non-farm income and land allocated for potato significantly and positively affect volume of potato supply to the markets.

(Yohanes, 2015) done her study on performance and challenges of vegetable market in Kombolcha district, East Hararghe zone, Oromia National Regional State, Ethiopia using Heckman two stage model and analyzed that the Frequency of irrigation affect the extent of potato market participation significantly and positively, while frequency of extension contact and market distance affect the extent of potato market participation significantly and negatively. On the other hand, total land owned and family size influence the extent of cabbage market participation significantly and positively, while market distance is the factor that influence the extent of cabbage market participation significantly and negatively.

2.3. Conceptual framework of vegetable market performance

According to (Rikitu *et al.*, 2019) studied on of smallholder farmers' decision to participate in vegetable marketing and the volume of sales and analyzed that sex of the household head, distance to farmers training center, land size, access to irrigation, application of pesticide and involving any civic organization (social capital) significantly affected the level of the vegetable marketed.

A study conducted by (Wosene *et al.*, 2018), on Analysis of Red Pepper Value Chain, and found that farming experience, lagged year price affect the quantity supplied to the market positively and significantly. According to (Megerssa *et al.*, 2020) conducted study on Smallholder market participation and its associated factors and illustrated that age of household head, household family size, educational level, labour availability, distance from market place, transport access, off-farm income, and extension contact were found to be statistically significant in the study area. (Yohanes, 2015) conducted study on performance and challenges of vegetable market and the analysis result showed that age, access to credit , total land owned, frequency of irrigation, education level of households, frequency of extension contact, and non-farm income significantly affect producers' decision to sell vegetables. (Tufa *et al.*, 2014), conducted study on Determinants of smallholder commercialization of horticultural crops and found that farm size, household education, irrigation access, gender, Distance to the nearest market and household family size had a significant influence on farmers' likelihood to participate in horticultural crops market. (Hailu, 2016), studied on value chain analysis of vegetables and found that sex of households heads, distance from nearest market, off/non-farm income and land allocated for potato significantly affect the volume of potato supplied to the market. The Conceptual framework (figure 1) indicates the summary of the literatures findings' highlight view of the relation between dependent variables and independent variables.

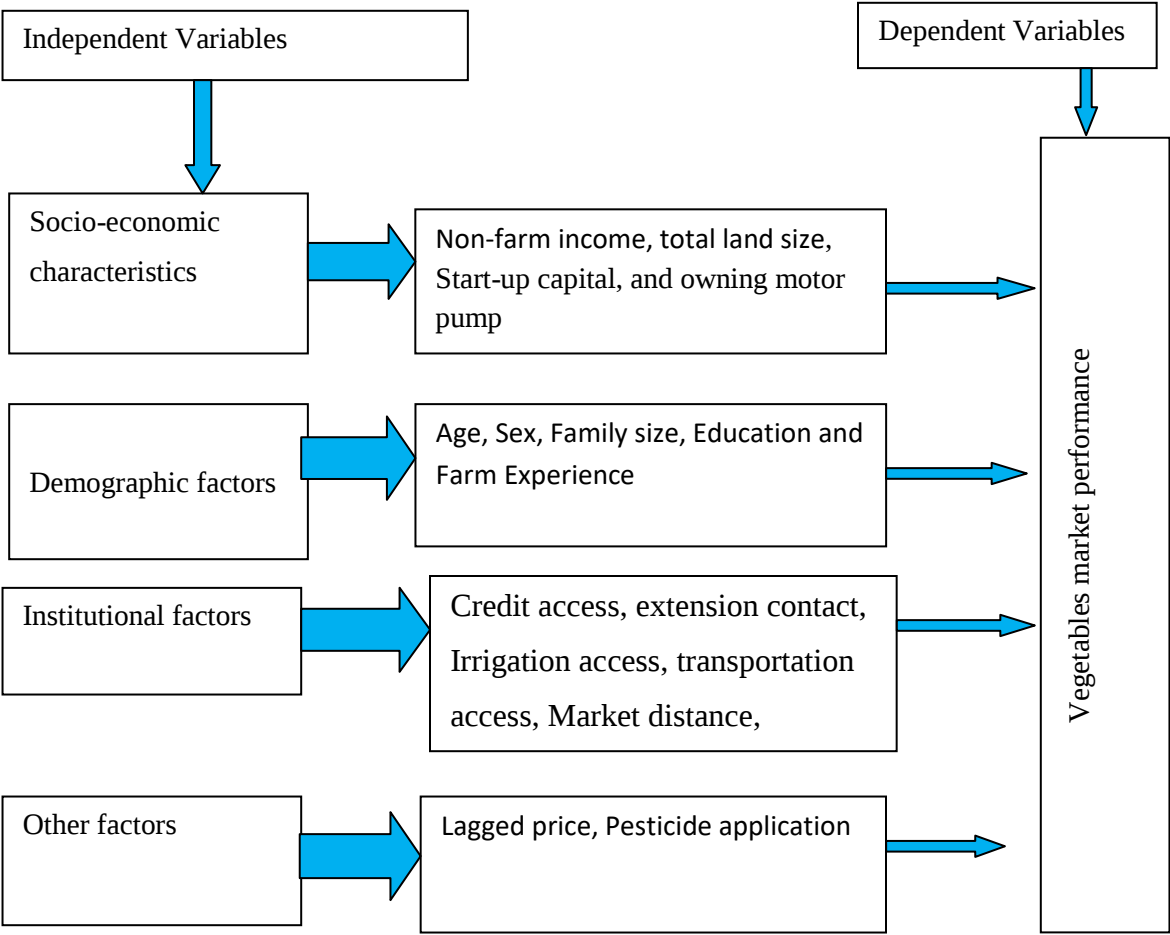


Figure 1: Conceptual framework

Source: literatures review

3. RESEARCH METHODOLOGY

In this chapter the description of the study area, research design, sources, types of data collection, method of data collection, sample size and sampling procedures (techniques), and data analysis method is discussed.

3.1. Description of the study area

This study was conducted in Kersa district, Jimma zone of Oromia Regional state, Ethiopia. The district is deliberately selected for its potential in vegetable production.

Kersa district is one of the twenty two districts found in Jimma zone of Oromia regional state, Ethiopia. The Kersa district is located at about 334 km southwest of the capital city of the Ethiopia, Addis Ababa and 20 km, at latitude 7° 44'.99" **N** and longitude 37° 04' 60.00" **E**, East of Jimma town, the capital of Jimma zone of Oromia regional state. The district is bordered on the Northeast by Nedhi gibe, on the Southeast by Omo Nada, on South by Dedo, on the Southwest by Seka chekorsa , on the West by Jimma town, on the Northwest by Mana and on the North by Limmu kossa districts of Jimma zone. The district composed of thirty rural kebeles and two urban kebeles. The estimated total population of the district is 329,629 of whom 162,690 are men and 166,969 are women; 165,083 or 50.08% of its population are urban dwellers. The estimated area is 978.6 square kilometers and population density of 336.8 people per square km (KDAO, 2023). The main road Addis Ababa to Jimma town cross the ten kebeles of the district including the two urban kebeles that made it good access to markets of that area.

Agriculture is the main source of livelihood and income of the population in the district. Animal husbandry and crop production is the major economic income and sources of livelihood of the study area. Crop production is very common in the district and also known in fruit and vegetable production through rainfall dominantly and irrigation. The district is mostly known by cereal crop production such as maize, wheat, barley, teff, pulses and others. The district is also famous for its production of cash crop such as coffee and chat. Horticultural crops production is very common in the district next to grain crops (KDAO, 2023).

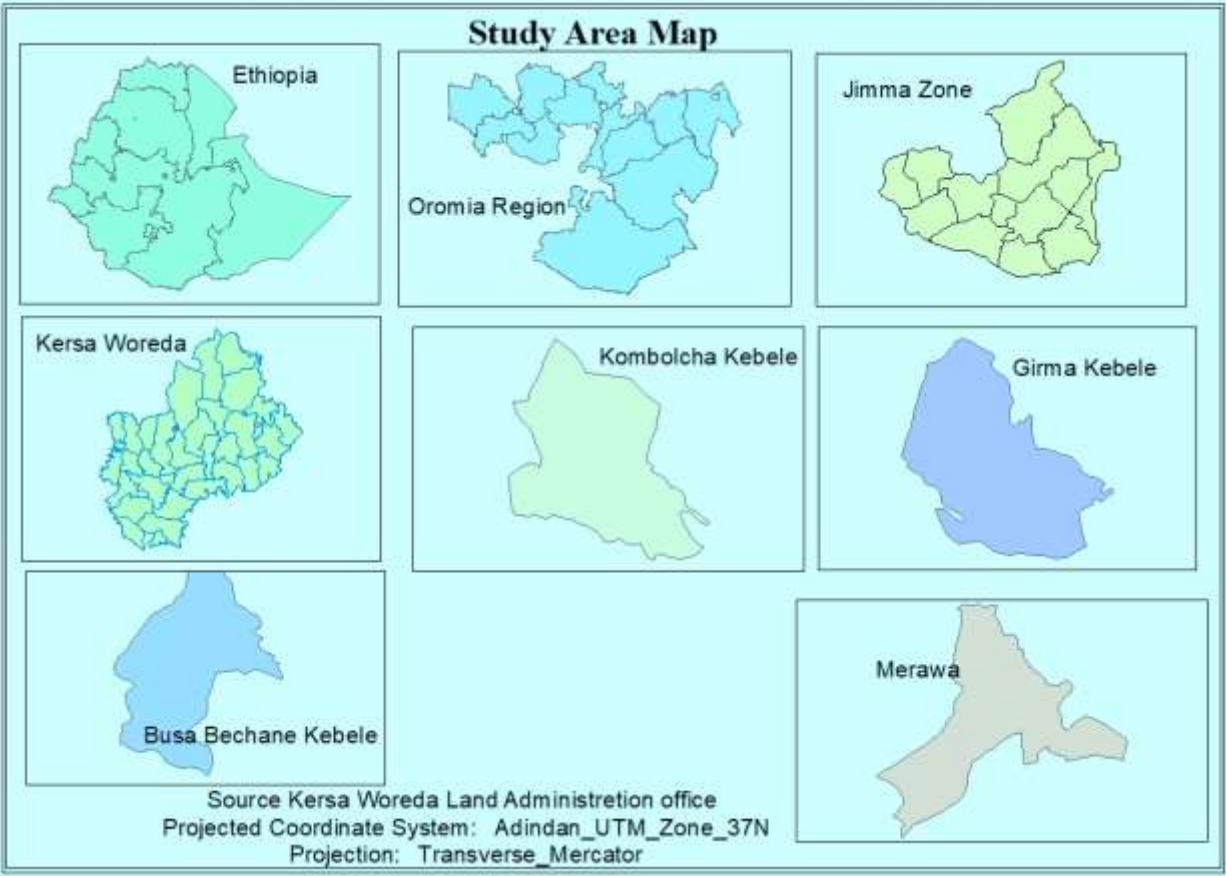


Figure 2.Map of Kersa district, Jimma zone, Oromia, Ethiopia.

Source: Kersa district land administration office, (2024)

3.2. Research Design

A cross- sectional research design method was used to investigate vegetables market performance through semi-structured questionnaire. The primary data was collected from 150 farmer respondents and 15 sample traders. Next to that the collected data was analyzed by descriptive and econometric analysis method.

3.3. Types and Sources of Data Collection

To accomplish this study a qualitative and quantitative data were collected from both primary and secondary data sources. Primary data on different variables such as socio-economic characteristics, institutional factors, demographic factors, and others would be collected from sample respondents. Additionally, primary data collected from 6 wholesalers, 2 processors, 3 Collectors and 4 retailers. Secondary data was collected from district Bureau of agriculture, and district bureau of trade from published and unpublished documents, and reports.

3.4. Sampling and Sample Size Selection Method

3.4.1. Farmer’s Sampling

To select a representative sample size for this study, a multi-stage sampling technique was used to select vegetable producer households. Firstly, Kersa district was selected for this study for its potential in vegetable production and marketing purposively through non-random probability sampling method. Secondly, out of 30 vegetable producer kebeles of the district four kebeles were randomly selected through probability random sampling technique. In the third stage,

among four kebeles selected, 570 farmers who produce vegetables (potato, head cabbage and tomato) were randomly identified and recorded. Finally, among vegetable producer farmers, 150 representative sample respondents proportion to the size of the producers are selected randomly through simple random sampling technique by using *Yamane (1967)* formula.

$$n = N / 1+N(e^2)$$

Where n= sample size, N=total number of population producing vegetables from four kebeles which is 570 according to source from Kersa district agriculture office and e= margin of error.

Table 1: sampling and sample size selection

Sample size proportion to size of population				
No	Name of kebeles	Population size	Population Sample size	Sample size
1	Girma	125	0.22	33
2	Kombolcha	175	0.307	46
3	Busa-Bachane	127	0.223	33
4	Marawwa	143	0.25	38
	Total	570	1.0	150

3.4.2. Trader’s Sampling

In addition, 15 number of sample respondents of vegetable traders were selected to fulfill the proposed objective of this study by consulting with district office of trade. There is no traders recorded list in the trade office of the district. Thus, due to unavailability of formally recorded traders list, by applying snow-ball sample selection method, 6 wholesalers, 3 collectors, 2 processor and 4 retailors of total 15 sample traders were selected purposively based on their total volume of sale and direct involvement in the vegetable marketing.

3.5.Data Collection Method

The data from primary source was collected by using prepared and tested structured questionnaire and interview method in the form of formal survey, and focal group discussion for vegetable producer, and trader respondents to get valid data related with the objective of the study. Socio economic factor, demographic characteristics and institutional factor related data was collected from 150 farmers selected. Primary data also collected from 15 sample traders through interview method. Focal group discussion was done during qualitative primary data collection. Document analysis was applied while collecting secondary data from published and unpublished materials, which support primary data and the survey data collected.

3.6. Data Analysis Method

To analyze the data collected from vegetable (potato, head cabbage and tomato) producers, traders and consumers were analyzed through both descriptive analysis, and econometric analysis method.

3.6.1. Descriptive Analysis Method

The primary data collected from samples of smallholder farmers and traders, was analyzed by using descriptive statistics such as means, frequency, percentages, standard deviation, and others. Also inferential statistics such as chi-square and t-test were applied to test significance of variables related with the objective of the study to test hypothesis. This method will be used to describe the socio-economic characteristics, institutional factors and demographic factors of sample households, market facilities, market intermediaries, market structure, conduct and performance.

Market structure analysis

To analyze vegetable market structure concentration ratio (CR) was used. This analysis method help to describe market organization behavior that it apply to influence the nature of competition and pricing strategies to exist and success in the market. This will be done by the following formula, (*Times, 2021*).

$CR_n = \sum_{i=1}^n S_i \dots\dots\dots (1)$

Where CR is concentration ratio, S_i is the percentage market share of ith firm, and n is the number of largest firms for which the ratio is to be calculated.

Market conduct analysis

Market conduct refers to the patterns of behavior that firms follow in adapting or adjusting to the markets in which they sell or buy. There are no agreed upon procedures for analyzing the elements of market conduct (*Pomeroy, 1989*). But, in this study, the manner, devices and mechanisms by which the different sellers coordinate their intrinsically rival decisions and actions, marketing strategies and the seller analyzed from primary data. Therefore, in this study market conduct determined based on pricing strategies, buying and selling practices of actors along the market channels.

Market performance analysis

Vegetable market performance analysis has done by using market costs and prices information. This was applied by evaluating marketing cost, marketing margin, producer’s share and net returns of all actors in the market channels.

Marketing Cost

Marketing cost means, the reasonable costs associated with promoting, selling, packaging, transferring titles and moving joint products to the customer and include direct costs and overhead costs(*Heltberg and Tarp, 2002*). Marketing margin is the price charged for one or collection of marketing services or the difference between prices at two market levels. Marketing margin is the difference between the price received by farmers and that paid by consumers (*Tomek and Kaiser, 2014*).Marketing margin will be analyzed by calculating total gross marketing margin, producers gross marketing margin, and other actors gross marketing margin exist in the market channels.

Total Gross Marketing Margin (TGMM): it is the final price paid by the end consumer which is defined as a percentage. The TGMM can be calculated by the following formula.

$$TGMM = [CP]-[PP] / [CP] *100.....(3)$$

Where TGMM is total gross marketing margin, CP is consumer price and PP is producer price.

Gross Marketing Margin of Producer: it is the proportion of the price paid by consumers that goes to the producers. Gross marketing margin of the producer can be calculated according to the following formula.

$$GMMp = [CP]-[GMM] / [CP] *100(4)$$

Where GMMp is gross marketing margin of producer, CP is consumer price and GMM is gross marketing margin.

$$NMM = [TGMM] - [MC] / [PC] *100.....(5)$$

Where NMM is net marketing margin, TGMM is total gross marketing margin, MC is marketing cost and PC is price of consumer.

3.6.2. Econometric method of data analysis

To investigate the causal relationship between dependent variable and explanatory variables econometric analysis was applied. In this study the effect of different types of regressor on vegetable market participation decision and volume of supply were analyzed. Also stata version13 software is used for econometrics analysis to analyze collected data.

To estimate determinants of vegetable market participation decision of farmers and level of participation or supply volume the Heckman two-stage model was used. The Heckman two stage estimation supports identifying and mitigating a potential selection bias. Heckman two-step procedure was identified as an appropriate model for such independent estimation. Heckman two- step model involved estimation of two equations: First, whether a household participated in the vegetables market or not, and the second is the extent of market participation. The proportion of vegetables sales were conditional on the decision to participate in the market (*Hoffman and Kassouf, 2005*). Heckman two-stage model was developed by Heckman (1979) and has been used extensively to correct for biases arising from sample selection. The Heckman procedure provides consistent and asymptotically efficient estimates for all the parameters (Heckman, 1979; Maddala, 1983; Amemiya, 1985). This model assumes that the missing value of dependent variable implies that the dependent variable is unobserved (not selected). Heckman’s model first uses a Probit regression with all variable data to estimate the probability of market participation. Then the inverse Mills ratio, computed from the Probit regression, is used with other explanatory variables to help explain variances to the continuous, non-zero dependent. To cater for the problem of selectivity bias and to relax the assumptions in the Tobit model, the study will therefore utilize a Heckman two-step procedure.

The model is preferred over double hurdle and tobit model due to its ability to address issue related to selection bias which occurs when the process that determines whether an observation is included in the sample is related to the outcome variable of interest by including a selection equation in the first stage of the model. This problem can be overcome using the Heckman sample selection model where a Probit model for the participation or 'selection' equation is estimated and OLS, which is corrected for selectivity bias, is specified to account for the level of the amount marketed. The Heckman model first uses a Probit regression with all variable data to estimate the probability of market participation.

Also, the Heckman two-stage model was favored to address endogeneity which arise when independent variables are correlated with the error term in the regression equation by incorporating instrumental variables or other techniques. The other reason why this model favored over the double hurdle and tobit model was its simultaneous modeling of selection and outcome process that provide a more comprehensive understanding of how selection into the sample may influence the outcomes being studied. Also the Heckman two-stage model was favored due to its flexibility in handling different data. It can be applied to various types of data including continuous, binary, and count outcomes. The first stage performs probit analysis on a selection equation. It is to identify whether farmers participate in vegetable market or not. The second stage analyzes an outcome equation based on the first-stage binary probit model that applied to predict the extent of every smallholder's participation in the vegetable market by using OLS regression, (Heckman, 1979).

In order to identify determinants of vegetable market participation decision and extent of participation Heckman sample selection model was used. In selectivity models, the decision to participate has been seen as a sequential two-stage decision-making process. In the first stage vegetable farmers make a dual decision whether to participate or not in vegetable market. In the second stage, farmers make continuous decision on marketed surplus. In the first stage a selection equation is estimated using a probit model which attempts to capture the factors that determine the likelihood of an individual household participate or does not in vegetable market. Since the probit parameter estimate does not show by how much a particular variable increases or decreases the likelihood of participating in vegetable market. Marginal effects of the independent variables on the probability of participating in vegetable market were considered (Habtamu, 2014).

Conditional on participation decision, the variables determining marketed surplus were modeled using the second-stage Heckman selection model. One problem with the two equations is that the two-stage decision-making processes are not separable due to unmeasured farmer variables determining both the discrete and continuous decision thereby leading to the correlation between the errors of the equations. If the two errors are correlated, the estimated parameters on the variables determining the marketed surplus is biased (Woodridge, 2002).

The probability of market participation and market share decision of probit equation is according to the following.

Vegetable market participation binary equation/binary probit model

$$Y_{1i} = \beta_1 X_{1i} + U_{1i}; U_{1i} \approx N(0,1) \dots \dots \dots (7)$$

VMP=1 if $Y_{1i} > 0$, when participate in vegetable market

VMP=0 if $Y_{1i} \leq 0$, when not participate in vegetable market

Where Y_{1i} is the dependent variable, which is not observed,

VMP is the probability of vegetable market participation,

X_{1i} is the probability of independent variable assumed to affect the vegetable market participation,

β_1 is a unknown parameter in market participation equation,

U_{1i} is unobserved residuals that are independently and normally distributed with 0 mean and constant variance.

Vegetable market volume of supply equation/OLS regression equation

$$Y_{2i} = \beta_2 X_{2i} + \alpha \lambda_i + U_{2i}; U_{2i} \approx N(0, \delta_2) \dots \dots \dots (8)$$

Where

VMS = 1 if Y_{2i} is observed

Y_{2i} is observed dependent variable

VMS is vegetable market supply

X_{2i} is the factors that assumed to affect vegetable market supply volume

β_2 is vector of unknown parameter in the vegetable market supply volume equation

U_{2i} is residuals in observed equation that are independently and normally distributed with 0 mean and constant variance δ_2 .

λ_i is mill's ratio which is $F(X_1 \beta_1) / 1 - F(X_1 \beta_1)$

$X\beta$ is a density function and

$X_1 \beta_1$ is distribution function

3.7. Definition of variables and hypothesis

3.7.1. Dependent variables

Decision to participate in selected vegetable market (PVM): it is dummy dependent variable that will be regressed by the first- stage of two-stage of Heckman model which implies the probability of smallholder farmer's participation in vegetable market. The value will be given for the smallholder farmer who participates in vegetable market is 1 and 0 otherwise.

Volume of vegetables (VVs): it is dependent variable that will be regressed by the second-stage of two-stage of Heckman model which represents the real amount of vegetables that produced to the market by smallholder farmers during the survey year 2023 in the study area. Its measurement is quintal.

3.7.2. Independent Variables

The independent variables that affect vegetable market participation and volume of the vegetable supply to the market were the following.

Education level of the household head (EDUC-HH): it is continuous variable and refers to the formal education of household respondents during the survey year. It is hypothesized that education has positive significance effect on vegetable market performance. A study analyzed that educational entitlement has supported the ability to acquire new idea in relation to market information and new technologies and education has positive and significant effect on the fruit volumes produced to the market. Thus, household who has formal education is hypothesized to have positive effect on all market participation, and volume of supply of vegetables in the study area, *Tadesse (2011)*.

Age of household head (AGE-HH): Age is continuous independent variable refers to the age of household in the study period. a study found that as age of the farmer increase the probability of market participation significantly and positively increase. Therefore, age of household hypothesized to have positive impact on market participation and market surplus, *(Yohanes, 2015)*, *(Farist et al, 2018)*, illustrated that as age of household increases the probability of participation in potato market would also decrease.

Sex of Household (SEX): sex is dummy independent variable. It takes the value of 1 if household is male and 0 if female. *(Rikitu et al., 2019)*, illustrated that sex has positive and significant effect on vegetable market participation. It is hypothesized to influence vegetable market participation negatively or positively.

Vegetable Farm Experience (VFE): experience is taken as continuous variable that refers the number of years that household participate in vegetable production. *(Wosene et al., 2018)*, as farmer experience increase in production, the market supply of red pepper, onion and potato increased respectively. Therefore, Household who has experience in vegetable production is hypothesized to affect positively both market participation, and volume of supply in the study area.

Distance to the nearest market (DM): it is continuous variable measured in kilometers or hours of walking time on foot. It refers to the distance of vegetable producer household residence from the nearest vegetable market where he/she sell his/her products. Distance to the nearest market has negative affect on households' likelihood to sell horticultural crops and decisions to participate or not in horticultural crops market. *(Tufa et al., 2014)*. Thus, market distance is hypothesized to affect vegetables market performance negatively.

Extension contact (EXT-CONT): It is dummy variable and refers to the probability of household to get extension contact or not while producing vegetable. The value of 1 would be given if household has extension contact and 0 otherwise. *Hegena and Teshome, (2022)*, found that extension access has positive and significant impact on vegetable quantity supplied to the market. As a result, the household who has extension contact, hypothesized to affect all market participation, and volume of supply positively.

Ownership of motor pump (OM): It is dichotomy variable implies whether the household has motor pump or not. It takes value of 1 if household has and otherwise 0. Therefore, household who has motor pump is hypothesized to have positive effect on both market participation, and market surplus of vegetable in the study area. *(Aliyi et al., 2021)*, illustrated that owing motor pump has positive and significant effect on the likelihood of vegetable market participation.

Credit access (CRA): This is dummy variable and refers to the probability of household farmers to has access to credit or not. It takes value of 1 if producer has access to credit and 0 otherwise. *(Faris et al, 2018)*, revealed that those who have got credit access would increase the marketed surplus of potato and increases the likelihood to participate in potato market. Having access to credit is expected to have positive effect on vegetables market performance.

Irrigation access (IA): It is dummy variable takes value of 1 if the producer has access to irrigation and otherwise 0. *(Yohanes, 2015)*, examined that increase in access to irrigation lead to increase the supply of potato and cabbage. Likewise, access to irrigation hypothesized to have positive impact on vegetable market participation, volume of vegetable supply and market orientation of vegetable in the study area.

Lagged price (LP): It is continuous variable implies the effect of one year previous price of vegetable on market participation and volume of supply. *(Wosene et al., 2018)*, analyzed effect of one year lagged price increment lead to increase volume of market supply of red pepper. But, *(Kassaw et al, 2021)*, examined decrease in one year lagged prices encourage farmer to reduce quantity of supply of potato to the market and change their decision to other type. Thus, lagged price is expected to affect market participation and volume of supply of vegetables either positively or negatively in the study area.

Non-farm income (NFI): It is continuous variable that affect the market participation and volume of supply of household and measured in birr. *Faris et al, (2018)*, illustrated that as non-farm income of house hold increases the probability of participation in potato market would also decrease. *Rehima (2006)*, illustrated that the quantity of pepper supplied to the market decreases as pepper producer engaged on non-farm income. It is expected that if household has income from other source it is hypothesized to affect either positively or negatively market participation, and volume of supply of vegetable in the study area.

Transport access (TRA): This is taken as dummy variable takes value of 1 if the household has access of transport services or 0 otherwise. According to *(Megerssa et al., 2020)*, access to transport services increase farmers participation on vegetables market. *Adenegen. et al (2013)*,

analyzed road infrastructure associated negatively with market orientation. That means when distance from the market increase and there is low in road infrastructure the market supply, volume and orientation decrease and vice versa. As a result, in this study the distance from the nearest market is hypothesized to have negative effect on market participation, and market surplus. Farmers who have access of transport services expected to increase the supply of vegetable and market participation. Thus, farmers who have access of transport services expected to have positive effect on both market participation, and volume of supply of vegetables in the study area.

Family size (FS): It is continuous variable refers to the amount of household respondent family and its effects on vegetable market participation and volume of supply. According to (Yohanes, 2015), increasing household size has significant and positive increase in extent of market participation of potato and cabbage. Family size expected to have negative or positive effect on market participation and volume of supply of vegetable in study area.

Land Size (LS): It is continuous variable refers to the total area of farm land that a farmer owns and measured in hectare. Land is very essential for farmer for production. It got value of 1 for owing and otherwise 0. It is hypothesized that increasing area of land lead to increase farm production, while decreasing area of land lead to decrease production. According to (Aliyi *et al.*, 2021), found that as farmers allocated a one hectare additional land for potato and cabbage production would increase the farmers' likelihood of market participation respectively. Thus, farm size for vegetable production is expected to have a positive effect on market participation, market share and market orientation of vegetables.

Start-up capital: It is dummy variable which uses to imply whether the farmer has enough capital to operate or produce vegetables in the study area. It takes the value of 1 if the farmer has operational cost and 0 otherwise.

Pesticide Application (PA): This is dummy variable refers whether the product is disease harmed or not. 1 represent for disease harmed vegetable and 0 otherwise. (Rikitu *et al.*, 2019), found that application of pesticide affect vegetable market participation significantly positively. Households who face vegetable disease hypothesized to have no market participation while, households who do not face vegetable disease hypothesized to ha market participation.

Table 2: Summary of hypothesis and variables relationships

Explanatory variables	Type of variable	Measurement	Dependent variable	
Education level	Categorical	Level of education	+	+
Age of household head	Continuous	Years of age	±	±
Vegetable farm experience	Continuous	Participation year on production	+	+
Market Distance	Continuous	Numbers of KM or walking	–	–
Extension contact	Dummy	1 = Yes, 0 otherwise	+	+
Ownership of motor pump	Dummy	1 = Yes, 0 otherwise	+	+
credit access	Dummy	1 = Yes, 0 otherwise	+	+
Pesticide Application	Dummy	1 = Yes, 0 otherwise	–	–
Start-up capital	Dummy	1 = Yes, 0 otherwise	+	+
irrigation access	Dummy	1 = Yes, 0 otherwise	+	+
Lagged price	Continuous	Birr/kg	±	±
Non-farm income	Dummy	1 = Yes, 0 otherwise	±	±
Transportation Access	Dummy	1 = Yes, 0 otherwise	+	+
Family size	Continuous	Number of family of HH	±	±
Land size	Continuous	Land area in hectare	+	+
Sex of household	Dummy	1=male 0=female	+	+

4. RESULTS AND DISCUSSION

This chapter deals with demographic, socio-economic and institutional characteristics of potato, head cabbage and tomato sample producers and traders are discussed in detail. Under this chapter, also analysis of the marketing margin of actors, structure, conduct and performance of potato, head cabbage and tomato market are presented. Moreover, the results of econometric analysis of potato, head cabbage and tomato market participation and market surplus of the sample producers in the study area are discussed in detail.

4.1. Characteristics of sample producers

4.1.1. Demographic, socio-economic and institutional characteristics of Sample producers by continuous variables

The study analyzes various demographic characteristics of the sample producers of potato, head cabbage and tomato, including age, educational level, farming experience, family size, land size owned, and market distance from the market center. The findings are presented in table 3, which provides a comprehensive overview of the results.

Potato producer's characteristics in terms of continuous variables

The average age of participating households is reported as 36.33 years, whereas non-participating households have an average age of 38.33 years. The age range for participants' falls between 24 and 60 years, while for non-participants, it ranges from 30 to 55 years. This difference in average age and age range indicating there is no a notable age distinction between the two groups.

Regarding educational level of producers, potato market participants had average educational level of 5.1 grades which ranges from 0 to 12 grades, while non-participants had average educational level of 4.11 grades which ranges from 0 to 10 grades. The t-value indicated that there was no big difference in educational levels between the two groups.

In terms of vegetable farming experience, participant farmers had an average experience of 4.76 years, ranging from 0 to 12 years. On the other hand, non-participants have an average experience of 0.49 years, ranging from 0 to 11 years. The t-value indicates that farming experience is statistically significant at 1% level with potato market participation. This implies that there are significant differences in farming experience between the two groups.

In terms of land size owned, participant households have an average land size of 2.31 hectares, ranging from 1 to 5 hectares. On the other hand, non-participants have an average land size of 1.87 hectares, ranging from 1 to 5 hectares. These differences between the two groups are statistically significant, highlighting contrasting levels of land size owned between the two groups.

Regarding family size, participating households have an average size of 4.24 members, ranging from 1 to 10. Non-participants, on the other hand, have an average family size of 3.31 members, ranging from 1 to 10. This difference in family size was statistically significant positively at 1% significance level, implying variations between the participant and non-participant households.

Moreover, the average distance of the participants from the nearest market was 3.5 kilometers which lies between 1 and 10 kilometers, while the non-participants average distance from the nearest market is 6.23 kilometers which lies between 1.5 and 15 kilometers. The t-value result along with p-value indicates distance to the nearest market has no significant difference between the two groups.

It is important to note that farming experience, family size, and land size had strong statistical significance on potato market participation. This indicates that there are substantial discrepancies between participants and non-participants in terms of these characteristics.

Head cabbage producers' characteristics in terms of continuous variables

The average age of participating households is reported as 36.6 years, whereas non-participating households have an average age of 38.33 years. The age range for participants' falls between 24 and 60 years, while for non-participants, it ranges from 30 to 55 years.

Regarding educational levels of produces, potato market participants had average educational level of 4.9 grades which ranges from 0 to 12 grades, while non-participants had average educational level of 4.45 grades which ranges from 0 to 10 grades.

In terms of vegetable farming experience, participant farmers had an average experience of 4.17 years, ranging from 0 to 12 years. On the other hand, non-participants have an average experience of 1.03 years, ranging from 0 to 10 years. The t-value indicates that farming experience had positive and significant relation with head cabbage market participation at 1% significance level. These indicates that the existence of differences between the two groups.

In terms of land size owned, participant households have an average land size of 2.24 hectares, ranging from 1 to 5 hectares. On the other hand, non-participants have an average land size of 1.97 hectares, ranging from 1 to 5 hectares. Again, the t-value is statistically significant at 1% level of significance positively. These indicate differences between the two groups.

Regarding family size, participating households have an average size of 4.05 members, ranging from 1 to 10. Non-participants, on the other hand, have an average family size of 2.81 members, ranging from 1 to 5. Family size had positive and significant relation with head cabbage market participation at 1% significance level. This implies variations between the participant and non-participant households.

Moreover, the average distance of the participants from the nearest market was 4.08 kilometers which lies between 1 and 15 kilometers, while the non-participants average distance from the nearest market is 5.45 kilometers which lies between 1.5 and 15 kilometers.

It is important to conclude that farming experience, family size, and land size, had strong statistical significance with head cabbage market participation. This indicates that there are substantial differences between participants and non-participants in terms of these characteristics.

Tomato producers' characteristics in terms of continuous variables

The average age of participating households is reported as 37.96 years, whereas non-participating households have an average age of 36.28 years. The age range for participants' falls between 27 and 60 years, while for non-participants, it ranges from 24 to 55 years.

Regarding educational levels of produces, potato market participants had average educational level of 5.05 grades which ranges from 0 to 10 grades, while non-participants had average educational level of 4.65 grades which ranges from 0 to 12 grades.

In terms of vegetable farming experience, participant farmers had an average experience of 1.7 years, ranging from 0 to 20 years. On the other hand, non-participants have an average experience of 6.09 years, ranging from 0 to 20 years. Farming experience had negative and significance relation with tomato market participation at 1% significance level. This indicates that there are differences between the two groups in terms of farming experience.

In terms of land size owned, participant households have an average land size of 1.98 hectares, ranging from 1 to 5 hectares. On the other hand, non-participants have an average land size of 2.3 hectares, ranging from 1 to 5 hectares. The t-value showed that land size owned had negative and significance association with tomato market participation at 1% significance level. This indicates statistical discrepancies between the two groups based on land size owned between the two groups.

Regarding family size, participating households have an average size of 3.7 members, ranging from 1 to 10. Non-participants, on the other hand, have an average family size of 4.13 members, ranging from 1 to 10. Family size had statistical significant and negative relation with tomato market participation at 1% significance level, implying variations between the participant and non-participant households.

Moreover, the average distance of the participants from the nearest market was 3.45 kilometers which lies between 1 and 8 kilometers, while the non-participants average distance from the nearest market is 3.86 kilometers which lies between 1 and 10 kilometers. The t-value result along with p-value indicates distance to the nearest market had negative and significant association with tomato market participation at 1% significant level or tomato market participation has strong relation with market distance.

It is important to suggest that farming experience, family size, land size, and market distance had strong statistical significance with a negative sign with tomato market participation. This indicates that there are substantial differences between participants and non-participants in terms of these characteristics.

Table 3: Demographic, socio-economic and institutional characteristics by continuous variables

Potato producers analysis by continuous									
Variables	Participant (105)				non-participant (45)				t-value
	Min	max	mean	std. Dev.	Min	Max	mean	std. Dev.	
Age	24	60	36.33	7.09	30	55	38.33	6.25	-1.64
Educational level	0	12	5.1	3.99	0	10	4.11	3.77	1.42
Farm experience	0	12	4.76	3.89	0	11	0.49	1.83	-7.03***
Total land size	1	5	2.31	1.09	1	5	1.87	0.92	-2.4***
Family size	1	10	4.24	2.32	1	10	3.31	1.86	-2.39***
Market distance	1	10	3.5	2.96	1.5	15	6.23	3.33	-4.97
Head cabbage producers analysis by continuous (participant = 117 and non-participant = 33)									
Age	24	60	36.6	6.89	27	55	38.12	6.87	-1.2
Educational level	0	12	4.9	3.96	0	10	4.45	3.89	0.58
farm experience	0	12	4.17	4	0	10	1.03	2.42	4.28***
Total land size	1	5	2.24	1.07	1	5	1.97	1.015	1.29*
Family size	1	10	4.05	2.29	1	5	2.81	1.59	2.9***
Market distance	1	15	4.08	3.48	1.5	15	5.45	3.156	-2.03
Tomato producers analysis by continuous (participant = 92 and non-participant = 58)									
Age	27	60	37.96	6.85	24	55	36.28	6.87	1.46
Educational level	0	10	5.05	3.87	0	12	4.65	3.99	0.6
Farm experience	0	20	1.7	4.2	0	20	6.09	6.46	4.6***
Total land size	1	5	1.98	0.96	1	5	2.3	1.1	-1.8***
Family size	1	10	3.7	1.92	1	10	4.13	2.4	1.13***
Market distance	1	8	3.45	2.19	1	10	3.86	3.09	-0.88***

Source = own survey 2023

4.1.2. Demographic, socio-economic and institutional characteristics of Sample producers by dummy variables

Potato producer’s characteristics in terms of dummy variables

The demographic, socio-economic and institutional characteristics of the sample producers by dummy variables, including sex, extension contact, credit access, transportation access, irrigation access, non-farm income, lagged price, start-up capital or operational cost, ownership of motor pump and pesticide application of potato sample producers are analyzed. The findings are presented in table 4, which provides a comprehensive overview of the results. The sex characteristics indicated that 81% of the participants were male, and 19% were female, while 71% of non-participants were male and 29% were female. The chi-square value indicated that sex is statistically not significant to potato market participation. That means market participation was not dependent on sex.

In terms of extension contacts, 79% of potato market participants had extension contact while, 21% of them had not and 11% of potato market non-participant had extension contact while, 89% of them had not. The chi-square result showed that extension contact influenced potato market participation positively at 1% significance level. That means market participation is strongly influenced by extension contact.

In terms of credit access, 63% of potato market participants had access to credit, while 37% of them had not and 11% of non-participants had access to credit, while 89% of them had not. The chi-square value indicated that credit access positively and significantly affected potato market

participation at 1% significance level, which means producers' potato market participation is strongly dependent on credit access.

Regarding transportation access, 50% of potato market participants had access to transportation, while 50% of them had not. In contrast, 33% of non-participants had transportation access, while 67% of them had not. The value of chi-square indicates a statistically positive and significant association between transportation access and market participation at 1% significance level. Therefore, it can be concluded that potato market participation is positively dependent on transportation access.

Similarly, for irrigation access, 45% of potato market participants had access to irrigation, while 55% had not. Among non-participants, 33% had access to irrigation, while 67% had not. The chi-square value showed that irrigation access and potato market participation had not significant association between them.

Again, in terms of non-farm income, 51% of the potato market participants responded that they had non-vegetable farm income and 49% of them responded they had not. On the other hand 53% of non-participants responded they had non-farm income while, 47% of them responded they had not. The chi-square result indicated that non-farm income was not statistically significant with potato market participation. This means market participation not dependent on non-farm income.

Furthermore, 61% of potato market participants replied that the vegetable price increased in relation to last year price, while 4% of them replied the same and 35% of them replied it decreased while, 64% of non-participants replied increased, 29% of them replied decrease and 7% of them replied it is the same. Also, the chi-square value indicated that lagged price had no significance relation with vegetable market participation. This indicates that potato market participation is not dependent on lagged price.

Regarding start-up capital, 54% of potato market participants replied they had start-up capital, while 46% of them replied they had not. On the other hand, 46% of the non-participants replied they had start-up capital while, 54% of them had not. The chi-square result indicated that start-up capital had no association with potato market participation.

Similarly, 58% of potato market participants sample producers replied they had their own motor pump while 42% of them replied they had not their own motor pump and 31% of potato market non participants replied they had their own motor pump while, 69% of them replied they had not. Also, potato market participation positively and significantly influenced by ownership of motor pump at 1% significance level.

Finally, 51% of potato market participants of sample producers responded that they applied pesticides to their crop while, 49% of them did not applied and 44% of non-participants of potato market responded that they applied pesticides to their potato crop while 56% of them responded they did not applied. The chi-square value indicated that pesticide application did not have significant effect on potato market participation.

It is important to conclude that, potato market participation was dependent on extension contact, credit access, transportation access, and ownership of motor pump. This indicates, there were divergence between market participant and non-participant in terms of these variables.

Table 4: Demographic, socio-economic and institutional characteristics of potato sample producers’ by dummy

Variables	Participant (105)			non-participant (45)		chi-2
	Value	Frequency	%	Frequency	%	
Sex	Male	85	81	32	71	1.78
	Female	20	19	13	29	
Extension contact	Yes	83	79	5	11	59.95***
	No	22	21	40	89	
Credit access	Yes	66	63	5	11	33.84***
	No	39	37	40	89	
Transportation access	Yes	53	50	15	33	3.73*
	No	52	50	30	67	
Irrigation access	Yes	47	45	15	33	1.47
	No	58	55	30	67	
Non-farm income	Yes	54	51	21	47	0.286
	No	51	49	24	53	
Lagged price	Increase	64	61	29	64	0.994
	Decrease	37	35	13	29	
	the same	4	4	3	7	
Start-up capital	Yes	57	54	20	44	1.221
	No	48	46	25	56	
Ownership of motor pump	Yes	61	58	14	31	9.17***
	No	44	42	31	69	
Pesticide application	Yes	54	51	20	44	0.32
	No	51	49	25	56	

Source: own survey (2023)

Head cabbage producer’s characteristics in terms of dummy variables

The demographic, socio-economic and institutional characteristics of the sample producers by dummy variables, including sex, extension contact, credit access, transportation access, irrigation access, non-farm income, lagged price, start-up capital or operational cost, ownership of motor pump and pesticide application of head cabbage sample producers are analyzed. The findings are presented in table 5, which provides a comprehensive overview of the results. The sex characteristics indicated that 78% of the participants were male, and 22% were female, while 79% of non-participants were male and 21% were female. The chi-square value indicated that sex is not statistically significant to head cabbage market participation. That means head cabbage market participation was not dependent on sex.

In terms of extension contacts, 71% of head cabbage market participants had extension contact while, 29% of them had not and 70% of potato market non-participant had extension contact while, 30% of them had not. The chi-square result showed that extension contact influenced head cabbage market participation positively at 1% significance level. That means head cabbage market participation is strongly influenced by extension contact.

In terms of credit access, 56% of head cabbage market participants had access to credit, while 44% of them had not and 15% of non-participants had access to credit, while 85% of them had not. The chi-square value indicated that credit access positively and significantly affected head cabbage market participation at 1% significance level, which means producers’ head cabbage market participation is strongly dependent on credit access.

Regarding transportation access, 49.6% of head cabbage market participants had access to transportation, while 50.4% of them had not. In contrast, 30% of non-participants had transportation access, while 70% of them had not. The value of chi-square indicates a statistically positive and significant association between transportation access and head cabbage market participation at 5% significance level. Therefore, it can be concluded that head cabbage market participation is positively dependent on transportation access.

Similarly, for irrigation access, 59% of head cabbage market participants had access to irrigation, while 41% had not. Among non-participants, 57.6% had access to irrigation, while 42.4% had not. The chi-square value showed that irrigation access and head cabbage market participation had not significant association between them.

Again, in terms of non-farm income, 49.6% of the head cabbage market participants responded that they had non-vegetable farm income and 50.4% of them responded they had not. On the other hand 15% of non-participants responded they had non-farm income while, 85% of them responded they had not. The chi-square result indicated that non-farm income was not statistically significant with head cabbage market participation. This means head cabbage market participation not dependent on non-farm income.

Furthermore, 60% of head cabbage market participants replied that the vegetable price increased in relation to last year price, while 4% of them replied the same and 36% of them replied it decreased while, 70% of non-participants replied increased, 24% of them replied decrease and 6% of them replied it is the same. Also, the chi-square value indicated that lagged price had no significance relation with head cabbage market participation. This indicates that head cabbage market participation of producers did not dependent on lagged price.

Regarding start-up capital, 54% of head cabbage market participants replied they had start-up capital, while 46% of them replied they had not. On the other hand, 42.4% of the non-participants replied they had start-up capital while, 57.6% of them had not. The chi-square result indicated that start-up capital had no association with head cabbage market participation.

Similarly, 54% of head cabbage market participants sample producers replied they had their own motor pump while 46% of them replied they had not their own motor pump and 36% of head cabbage market non participants replied they had their own motor pump while, 64% of them replied they had not. Also, head cabbage market participation positively and significantly influenced by ownership of motor pump at 10% significance level. Therefore, head cabbage market participation was dependent on ownership of motor pump.

Finally, 51% of head cabbage market participants of sample producers responded that they applied pesticides to their crop while, 49% of them did not applied and 42.4% of non-participants of head cabbage market responded that they applied pesticides to their head cabbage crop while 57.6% of them responded they did not applied. The chi-square value indicated that pesticide application did not have significant effect on head cabbage market participation.

It is important to note that head cabbage market participation was dependent on extension contact, credit access, transportation access, and ownership of motor pump. This indicates, there were divergence between market participant and non-participant in terms of these variables.

Table 5: Demographic, socio-economic and institutional characteristics of head cabbage sample producers by dummy

Variables	Value	Participant (117)		non-participant (33)		chi-2
		Frequency	%	Frequency	%	
Sex	Male	91	78	26	79	0.15
	Female	26	22	7	21	
Extension contact	Yes	83	71	23	70	33.04***
	No	34	29	10	30	
Credit access	Yes	66	56	5	15	17.58***
	No	51	44	28	85	
Transportation access	Yes	58	49.6	10	30	3.86**
	No	59	50.4	23	70	
Irrigation access	Yes	69	59	19	57.6	0.21
	No	48	41	14	42.4	
Non-farm income	Yes	58	49.6	17	15	0.039
	No	59	50.4	16	85	
Lagged price	Increase	70	60	23	70	1.63
	Decrease	42	36	8	24	
	the same	5	4	2	6	
Start-up capital	Yes	63	54	14	42.4	1.34
	No	54	46	19	57.6	
Ownership of motor pump	Yes	63	54	12	36	3.15*
	No	54	46	21	64	
Pesticide application	Yes	60	51	14	42.4	0.8
	No	57	49	19	57.6	

Source: own survey (2023)

Tomato producer’s characteristics in terms of dummy variables

The demographic, socio-economic and institutional characteristics of the sample producers by dummy variables, including sex, extension contact, credit access, transportation access, irrigation access, non-farm income, lagged price, start-up capital or operational cost, ownership of motor pump and pesticide application of tomato sample producers are analyzed. The findings are presented in table 6, which provides a comprehensive overview of the results. The sex characteristics indicated that 77% of the participants were male, and 23% were female, while 79% of non-participants were male and 21% were female. The chi-square value indicated that sex is not statistically significant to tomato market participation. That means tomato market participation was not dependent on sex.

In terms of extension contacts, 84% of tomato market participants had extension contact while, 16% of them had not and 19% of potato market non-participant had extension contact while, 81% of them had not. The chi-square result showed that extension contact influenced tomato market participation positively at 1% significance level. That means tomato market participation is strongly influenced by extension contact.

In terms of credit access, 67% of tomato market participants had access to credit, while 33% of them had not and 15.5% of non-participants had access to credit, while 84.5% of them had not. The chi-square value indicated that credit access positively and significantly affected tomato

market participation at 1% significance level, which means producers' tomato market participation is strongly dependent on credit access.

Regarding transportation access, 46% of tomato market participants had access to transportation, while 54% of them had not. In contrast, 45% of non-participants had transportation access, while 55% of them had not. The value of chi-square indicated that there was no significant association between transportation access and tomato market participation. Therefore, tomato market participation was not dependent on transportation access.

Similarly, for irrigation access, 40% of potato market participants had access to irrigation, while 60% had not. Among non-participants, 43% had access to irrigation, while 57% had not. The chi-square value showed that irrigation access and tomato market participation had not significant association between them.

Again, in terms of non-farm income, 52% of the tomato market participants responded that they had non-vegetable farm income and 48% of them responded they had not. On the other hand 46.5% of non-participants responded they had non-farm income while, 53.5% of them responded they had not. The chi-square result indicated that non-farm income was not statistically significant with tomato market participation. This means market participation not dependent on non-farm income.

Furthermore, 56.5% of potato market participants replied that the vegetable price increased in relation to last year price, while 5.5% of them replied the same and 38% of them replied it decreased while, 70.6% of non-participants replied increased, 26% of them replied decrease and 3.4% of them replied it is the same. Also, the chi-square value indicated that lagged price had significance relation with tomato market participation positively at 10% significance level. This indicated that tomato market participation of producers was dependent on lagged price.

Regarding start-up capital, 53% of potato market participants replied they had start-up capital, while 47% of them replied they had not. On the other hand, 48% of the non-participants replied they had start-up capital while, 52% of them had not. The chi-square result indicated that start-up capital had no association with potato market participation.

Similarly, 55% of tomato market participants sample producers replied they had their own motor pump while 45% of them replied they had not their own motor pump and 41% of tomato market non participants replied they had their own motor pump while, 59% of them replied they had not. Also, tomato market participation positively and significantly influenced by ownership of motor pump at 10% significance level. Therefore, tomato market participation was dependent on ownership of motor pump.

Furthermore, 48% of tomato market participants of sample producers responded that they applied pesticides to their crop while, 52% of them did not applied and 45% of non-participants of tomato market responded that they applied pesticides to their potato crop while 55% of them responded they did not applied. The chi-square value indicated that pesticide application did not have significant effect on tomato market participation.

It is important to illustrate that tomato market participation was dependent on extension contact, credit access, lagged price, and ownership of motor pump. This indicates, there were divergence between market participant and non-participant in terms of these variables.

Table 6: Demographic, socio-economic and institutional characteristics of tomato sample producers by dummy

Variables	Value	Participant (92)		non-participant (58)		chi-2
		frequency	%	frequency	%	
Sex	Male	71	77	46	79	0.095
	Female	21	23	12	21	
Extension contact	Yes	77	84	11	19	13.64***
	No	15	16	47	81	
Credit access	Yes	62	67	9	15.5	38.4***
	No	30	33	42	84.5	
Transportation access	Yes	42	46	26	45	0.01
	No	50	54	32	55	
Irrigation access	Yes	37	40	25	43	0.122
	No	55	60	33	57	
Non-farm income	Yes	48	52	27	46.5	0.45
	No	44	48	31	53.5	
Lagged price	Increase	52	56.5	41	70.6	5.26*
	Decrease	35	38	15	26	
	the same	5	5.5	2	3.4	
Start-up capital	Yes	49	53	28	48	0.354
	No	43	47	30	52	
Ownership of motor pump	Yes	51	55	24	41	2.81*
	No	41	45	34	59	
Pesticide application	Yes	44	48	26	45	0.768
	No	48	52	32	55	

Source: own survey (2023)

4.2. Descriptive analysis of sample traders

4.2.1. Demographic characteristics of sample traders.

The study analyzes various demographic characteristics of the sample traders participating in the vegetable market. These characteristics include age, sex, education level, and years of trading experience. The findings provide valuable insights into the trader profile within the market. The findings are presented in table 7 and 8, which provide valuable insights into the sample trading.

Regarding age, the study reveals that the average age of participating traders is about 32 years of age. The age range for traders falls between 25 and 40 years, indicating a diverse age distribution within the sample.

In terms of years of trading experience, the average experience of trading years of traders was 5 years. The range falls between 2 and 8 years. This indicates that there is significant diverse of trading experience with in the sample traders.

Moreover, the average educational level of sample traders was 5.46 grades of school which the ranges from 0 to 10 grades of school. This showed that there was significance difference with in the sample traders in terms of educational level.

Table 7: Age and experience status of traders

Variables	N	Minimum	Maximum	Mean	Std. Deviation
Age	15	25	40	31.734	5.175
Experience	15	2	8	4.8	1.69
Educational level	15	0	10	5.46	1.92

Source: own survey 2023

Regarding to the sex, the study reveals that male is 40% and female is 60% for traders. This indicates that there is numerical imbalance between traders’ sex.

Table 8: sex characteristics of sample traders.

Traders’ demography			
		Frequency	Percent
Sex	Male	6	40
	Female	9	60
	Total	15	100

Source: own survey 2023

4.2.2. Marketing channels

A marketing channel consists of the people organizations, activities necessary to transfer the ownership of goods from the point of production to the point of consumption. It is the way products get to the end user, the consumer, and is also known as a distribution channel, (American Marketing Association). Analysis of marketing channel is important to provide necessary knowledge to know the flow of products and services from the place of production to the place of end users. In this study, marketing channels of the study area analyzed by interviewing the traders and by focal observation. Also data obtained from trade office of the district. In this study, the marketing actors participates in the marketing channels of potato, head cabbage and tomato in the study area are producers, local collectors/assemblers, wholesalers, processors, retailers, and consumers. We discussed the general overview of these actors deeply as follows:

Producers:- producers are the actors produce, harvest and sell their vegetables. They transport their produces to local markets, district markets and secondary market Jimma on foot over a distance of 2 kilometers on average, by equine and cars or at farm gate to local collectors who collect from farmers. The farmers or producers also sell their products to wholesalers, processors retailers, and consumers at destination market. Village markets are the marketing places nearest to the farmers and where the huge amount of vegetables (potato, tomato and head cabbage) sold at lower price than district and secondary market.

Local collectors: local collectors or assemblers are the marketing actors who collect vegetables directly from the farmers at low prices and move it district market and secondary markets. They

sell to wholesalers, retailers and consumers by obtaining certain amount of profit. Most of the time farmers are not prefer to sell to local collectors, because of selling price cheating.

Wholesalers: wholesalers are those who buy a large amount of vegetables from local collectors and farmers and resell to retailers and processors rather than to the final consumers. In this study area wholesalers buy large volume of vegetables and resell to Jimma and Addis Abeba cities market.

Processors: processors in the study are those who buy bulk amount of vegetables from wholesalers and producers and add some value to it processing and directly sell to consumers. These are roadside sellers and restaurants at Kersa district and Jimma city market.

Retailers: these are the actors who buy bulk products from wholesalers and local collectors and resell directly to consumers in the study area. These actors are who found in local markets, primary markets and secondary markets and directly contact with end users.

The study finding of the market channels presented according to the following:

Potato marketing channels

The total quantity of potato produced to the market and flows in the marketing channel is 5516 quintal. The high percentage of the quantity moves in the second channel of the market which starts from producers and end at consumers in Jimma city.

- I: Producers ➡ local collectors ➡ retailers in Jimma city ➡ consumers in Jimma city (18%)
- II: Producers ➡ local collectors ➡ wholesalers ➡ processors ➡ consumers in Jimma city (17%)
- III: Producers ➡ wholesalers ➡ retailers in Jimma city ➡ consumers in Jimma city (33%)
- IV: Producers ➡ retailers ➡ consumers (12%)
- V: Producers ➡ consumers (11%)
- VI: Producers ➡ retailers ➡ processors ➡ consumers (9%)

Head cabbage marketing channels

The total quantity of head cabbage produced and supplied to the market and flows in the marketing channel is 7196 quintal. The high percentage of the quantity moves in the first channel of the market which starts from producers and end at consumers which is 40% of the produce in Addis Abeba city market. The longest channel in this study area is laid in the second channel which starts from producers and ends at consumers in Addis Abeba city market.

- I: Producers ➡ wholesalers ➡ retailers in Addis Abeba market ➡ consumers (40%)
- II: Producers ➡ local collectors ➡ wholesalers ➡ retailers in Addis Abeba market ➡ consumers (22%)
- III: Producers ➡ local collectors ➡ retailers ➡ consumers in Jimma city (9%)
- IV: Producers ➡ retailers ➡ consumers in Serbo (13%)
- V: Producers ➡ retailers in Jimma city ➡ consumers in Jimma city (8.2%)
- VI: Producers ➡ consumers in Serbo (7.8%)

Tomato marketing channels

The total quantity of head cabbage produced to the market and flows in the marketing channel is 1831 quintal. The high percentage of the quantity moves in the first channel of the market which starts from producers and end at consumers which is 49% of the produce in Serbo market.

I: Producers ➡ retailers ➡ consumers (49%)

II: Producers ➡ retailers ➡ processors ➡ consumers (25%)

III: Producers ➡ consumers (26%)

Source: own survey 2023

Hint: Serbo is the capital city of Kersa district.

4.2.3. Market Structure

Market structure is a decision of the number and nature of participants in the market. Market structure consists of the relatively stable features of the environment that influence the behavior and rivalry among the buyers and sellers operating in a market (Pender *et al.*, 2004). Some examples of market structure include the number of buyers and sellers, the number of sellers of agricultural inputs such as fertilizer and veterinary drugs, barriers to entry into the market and the nature of trading relations. In this study, market structure of vegetable market measured by identifying market concentration and degree of transparency.

A. Degree of market Concentration

Market concentration is a function of the number of firms and their respective shares of the total reserves in a market (*Times*, 2021). Market concentration is closely associated with market competitiveness (*Harvard Business Review* 2016). There are various factors that affect market concentration. These are barriers to entry (high start-up costs), economies of scale, brand loyalty, industry size and age, product differentiation and current advertising levels, firms specific factors (research and development levels) and human capital requirements (*Junashvili and David*, 2002).

In this study, market concentration measured calculating concentration. Market concentration ratio is the measurement of the concentration of the top firms in the market (*Times*, 2021). Concentration ratio is used as an indicator of the relative size of the firm in relation to the whole. Market share is used as a reference to formulate. If the top firms keep on gaining market share, then we say that the industry has become highly concentrated. Concentration ratio is the proportion of industry output accounted for by n largest firms. These can be calculated by collected individual market agents annual average quantity of market share. To calculate concentration ratio, we need to first determine the total market share of a specified number of firms in a particular industry. The concentration ratio is typically expressed as a percentage and can be calculated using the following formula:

$CR_n = \sum_i^n Si * 100$ where, CR_n is concentration ratio of n^{th} firms Si the market share of firm i and n is total number of firms in the market. But market share of individual firm can be calculated by the formula:

$S_i = Q_i / \sum Q$ where Q_i is the quantity of output produced by firm i, S_i is market share of firm i and $\sum Q$ is the total quantity of output produced by certain market.

Market concentration ratio is a measure of the degree of competition in a market based on the market share of the largest firms in the industry. The concentration ratio helps identify the market structure, which can be categorized into four main types: perfect competition, monopolistic competition, oligopoly, and monopoly.

Here is how you can determine the market structure based on the market concentration ratio:

1. Calculate the Market Concentration Ratio: The market concentration ratio is typically calculated using the following formula:

Market Concentration Ratio = Sum of Market Shares of Top 'N' Firms

Where: N represents the number of firms included in the calculation

Table 9: Vegetable Market volume shares of actors in quintals.

N	Wholesalers				Retailers					
	Potato		Head cabbage		Potato		Head cabbage		tomato	
	Volume of shares	%	Volume of shares	%	Volume of shares	%	Volume of shares	%	Volume of shares	%
A	760	16.7	1813	18.7	444	32.2	1623	25	213	25
B	815	17.9	1740	18	325	23.6	1730	27	251	29
C	711	15.7	1712	17.7	320	23.2	1565	24	204	24
D	518	11.3	1522	15.7	290	21	1534	24	184	22
E	869	19	1308	13.5						
F	888	19.4	1584	16.4						
Total	4561	100	9679	100	1379	100	6452	100	852	100

Source: own survey (2023)

The top four firms market share concentration ratio (CR4) calculated from data collected on market shares presented in table 10 below.

Table 10: Concentration ratio of market agents

Vegetable type	Traders	Market share in quintal	Concentration ratio
Potato	Wholesalers	3330	73%
Head cabbage	Wholesalers	6849	71%

Source: own survey 2023

Market shares are expressed as percentages of total market sales.

Uhl and Kohl (1985) proposed a new measure of market concentration. This is based on the idea that market concentration is not only determined by the number of firms in the market, but also by the distribution of market shares among those firms. They proposed a new classification of market structures. They divided markets into four categories. Accordingly;

Low Concentration (Perfect Competition): If the market concentration ratio is low (e.g., below 40%), it indicates a high level of competition with many small firms operating in the market. This is characteristic of a perfectly competitive market structure.

Moderate Concentration (Monopolistic Competition): A moderate concentration ratio (e.g., between 40% and 60%) suggests a moderate level of competition with a few dominant firms alongside smaller competitors. This aligns with a monopolistic competition market structure.

High Concentration (Oligopoly): A high concentration ratio (e.g., above 60%) indicates a high level of concentration in the market, with a few large firms dominating the industry. This is typical of an oligopoly market structure.

Very High Concentration (Monopoly): In extreme cases where one firm has a dominant market share (e.g., close to 100%), it signifies a monopoly market structure where a single firm controls the entire market.

Analyze Market Structure Implications:

Perfect Competition: Firms in a perfectly competitive market have limited pricing power and compete solely based on product differentiation and non-price factors.

Monopolistic Competition: Firms in monopolistic competition differentiate their products to gain a competitive edge, but they still face some price competition due to the presence of substitutes.

Oligopoly: Oligopolies are characterized by interdependence among firms, strategic pricing decisions, and potential collusion or competition based on non-price factors.

Monopoly: In a monopoly, the dominant firm has significant market power, potentially leading to higher prices, reduced consumer choice, and limited competition.

By analyzing the market concentration ratio and understanding its implications on market structure, businesses can make informed decisions regarding pricing strategies, competitive positioning, and overall market dynamics, (Chat GPT& Midjourney /AI bot).

In general, market concentration ratio is used to assess the level of competition in a market, and different ranges of concentration ratios can be associated with various market structures.

In this study, the concentration is calculated by taking the sample traders annual sold during 2023 production season by applying the largest four firm's method criteria (table:12). By applying the market structure criteria suggested by *Uhl and Kohls 1985*, the market structure of the vegetables namely potato, and head cabbage is analyzed. The highest concentration ratio for

potato is 73%, and head cabbage is 71% indicates that the market structure of potato and Head cabbage is controlled by strong oligopoly market type in the study area. Remind that one drawback of since *Uhl and Kohls 1985*, market structure classification criteria is it is difficult to apply it when the size of the firms in the market is a few or small. In this study, four retailers were selected for market analysis and this made difficult calculation concentration ratio of retailers since the value became 100%. Again concentration ratio for tomato is not calculated. Because, there is no tomato wholesaler found in the study area.

B. Degree of Market transparency

Among the vegetable market agents, 73.3% got market information, while 26.7% of them do not. 26.7%, 33.3% and 40% of traders got market information from mobile phone, own observation and fellow traders respectively. 26.7% of traders got credit access, while 73.3% of them did not. Regarding initial capital 33.3%, 26.7% and 40% of traders got their initial capital from own, credit and gift respectively. 86.7% of traders reported that they faced barriers to entry and 13.3% of them reported not faced.

Similarly, 56%, 24%, 9% and 11% of information on supply of vegetables obtained from fellow farmers, development agents, personal observation and mobile phone respectively.

4.2.3. Vegetable Market conduct

Among sample traders 66.7% of them reported that they decide their price setting based on market price and 33.3% of sample traders reported they decide their price setting based on negotiation with other fellow traders. 6.7% of retailers buy potato and cabbage from wholesalers and 46.7% of consumers buy from retailers. 80%, 6.7% and 13.3% of retailers buy potato and cabbage from producers, wholesalers and collectors respectively. About 46.7% of traders purchase vegetable by giving better rice relate to others, while 53.3% of reported they purchase by giving fair scaling and weighing. 13.3%, 26.7% and 60% of sample traders reported they accept their selling price after some hour of sale, after some time, on the other day and at selling time respectively. 73.3% of sample traders pay price of their purchase in cash while 26.7% were buy in credit to pay back after one or two days. Around 73.3% of sample traders use traditional weighing materials when buying and selling vegetables while 26.7% of them use modern weighing system (kg).

4.2.4. Market Performance

Market performance is deals with the impact of structure and conduct on product prices, costs, volume and quality of output. It is how well the market fulfills certain social and private objectives. These include price level and price stability in the long and short term, profit levels, costs, efficiency and quantities and quality of food commodities sold (*FEWS, 2008*).

4.2.5. Marketing cost and profitability analysis

Profitability analysis involves assessing a company's ability to generate profits relative to its costs and expenses.

Marketing profitability analysis done by recording all average costs per quintal of vegetables related with trading of vegetables potato, cabbage and tomato in this study with respective to average selling price and computing marketing margin. Marketing cost and profitability analysis presented as follows:

Table 11: Average marketing cost and profitability analysis for wholesalers

<i>Components</i>	<i>Potato</i>	<i>Head cabbage</i>
Average Purchase price	2526	850
Average Labor for packing/quintal	10	10
Average Loading/unloading/ quintal	15	15
Average Transportation fee / quintal	30	200
Average Storage cost/ quintal	11	11
Average Cost for sack	25	25
Loss in transport and storage/ quintal	40	80
Average other costs / quintal	20	80
Average marketing cost/ quintal	151	411
Average Selling price/ quintal	3020	1650
Gross marketing margin/ quintal	494	800
Net Profit (loss)/ quintal	343	389

Source: own survey 2023

According to table 11, the average marketing cost per quintal gained from potato starting from purchasing area to selling place was 151 birr for wholesalers, while the average marketing cost per quintal of head cabbage was 411birr. The net profit per quintal gained from potato is 343 birr for wholesalers, while the net profit per quintal gained from head cabbage was 389 birr.

Table 12: Average marketing cost and profitability for analysis retailers

<i>Components</i>	<i>Potato</i>	<i>Head cabbage</i>	<i>Tomato</i>
Average Purchase price	2690	900	2800
Average Labor for packing/quintal	10	20	20
Average Loading/unloading/ quintal	20	30	30
Average Transportation fee / quintal	35	80	80
Average Storage cost/ quintal	20	31.5	31.5
Average Cost for sack	25	30	50
Loss in transport and storage/ quintal	80	100	200
Average other costs / quintal	80	90	80
Average marketing cost/ quintal	190	381.5	411.5
Average Selling price/ quintal	3120	1680	3450
Gross marketing margin/ quintal	620	780	650
Net Profit (loss)/ quintal	430	398.5	238.5

Source: own survey 2023

According to table 12, the average marketing cost per quintal from potato, head cabbage and tomato starting from purchasing area to selling place were 190, 381.5 and 411.5 birr respectively

for retailers. The net profit per quintal gained from potato, head cabbage and tomato were 430, 398.5 and 238.5 birr respectively for retailers.

Table 13: Average marketing cost and profitability analysis for local collectors

<i>Components</i>	<i>Potato</i>	<i>Head cabbage</i>	<i>Tomato</i>
Average Purchase price	2426	700	2600
Average Labor for packing/quintal	10	10	10
Average Loading/unloading/ quintal	20	20	30
Average Transportation fee / quintal	100	100	100
Average Storage cost/ quintal	-	-	-
Average Cost for sack	25	25	25
Loss in transport and storage/ quintal	60	-	200
Average other costs / quintal	50	-	-
Average marketing cost/ quintal	265	155	365
Average Selling price/ quintal	3050	1100	3250
Gross marketing margin/ quintal	624	780	650
Net Profit (loss)/ quintal	359	245	285

Source: own survey 2023

According to table 13, the average marketing cost per quintal from potato, head cabbage and tomato starting from purchasing area to selling place were 265, 155.5 and 365 birr respectively for local collectors. The net profit per quintal gained from potato, head cabbage and tomato were 359, 245 and 285 birr respectively for local collectors.

Table 14: Average marketing cost and profitability analysis for processors

<i>Components</i>	<i>Potato</i>	<i>Head cabbage</i>	<i>Tomato</i>
Average Purchase price	2900	1000	2800
Average Labor for packing/quintal	-	-	-
Average Loading/unloading/ quintal	10	10	10
Average Transportation fee / quintal	-	-	-
Average Storage cost/ quintal	10	10	10
Average Cost for sack	25	25	25
Loss in transport and storage/ quintal	30	40	200
Average other costs / quintal	150	120	110
Average marketing cost/ quintal	255	205	355
Average Selling price/ quintal	3500	1600	3500
Gross marketing margin/ quintal	600	600	700
Net Profit (loss)/ quintal	375	395	345

Source: own survey 2023

According to table 14, the average marketing cost per quintal from potato, head cabbage and tomato starting from purchasing area to selling place were 255, 205 and 355 birr respectively for processors. The net profit per quintal gained from potato, head cabbage and tomato were 375, 395 and 345 birr respectively for processors.

Table 15: Average production and marketing cost and profitability analysis producers

Components	Potato	Head cabbage	Tomato
Average production cost	1100	292	1107
Average Labor for packing/quintal	10	20	10
Average Loading/unloading/ quintal	10	10	10
Average Transportation fee / quintal	100	100	100
Average Storage cost/ quintal	-	-	-
Average Cost for sack	25	25	25
Loss in transport and storage/ quintal	30	30	200
Average other costs / quintal	30	30	30
Average marketing cost/ quintal	205	215	587
Average Selling price/ quintal	2526	1000	2800
Gross marketing margin/ quintal	1426	708	1193
Net Profit (loss)/ quintal	1221	493	1106

Source: own survey 2023

According to table 15, the average marketing cost per quintal from potato, head cabbage and tomato starting from purchasing area to selling place were 205, 215 and 587 birr respectively for producers. The net profit per quintal gained from potato, head cabbage and tomato were 1221, 493 and 1106 birr respectively for producers.

4.2.6. Marketing Margin Analysis

A marketing margin is the percentage of the final weighted average selling price taken by each stage of the marketing chain. The total marketing margin is the difference between what the consumer pays and what the producer or farmer receives for the product he provides.

Calculating marketing margin involves determining the difference between the selling price of a product or service and the cost of producing or acquiring that product or service. The marketing margin represents the portion of revenue that covers marketing expenses and contributes to profit. Here is a general formula to calculate marketing margin:

Marketing Margin = Selling Price - Cost of Goods Sold (COGS) - Marketing Expenses

1. Determine the Selling Price: The selling price is the price at which you sell your product or service to customers.
2. Calculate the Cost of Goods Sold (COGS): COGS includes all direct costs associated with producing or acquiring the product. This can include raw materials, labor, manufacturing costs, and any other expenses directly related to production.
3. Determine Marketing Expenses: Marketing expenses are the costs incurred to promote, advertise, and sell the product. This can include advertising costs, sales commissions, promotional expenses, and other marketing-related expenditures.
4. Subtract COGS and Marketing Expenses from the Selling Price: Subtract the total cost of goods sold (COGS) and marketing expenses from the selling price to calculate the marketing margin.

Table 16: Marketing margins of traders in different marketing channels

Marketing margins	Potato marketing channels					Head cabbage marketing channels				Tomato marketing channels	
	I	II	III	IV	V	I	II	III	IV	I	II
TGMM	16.65	26.5	13.27	11	16.67	50	61.1	41.67	18.18	9.68	15.15
TGMM _{pd}	84.35	73.5	86.73	89	83.33	50	38.9	58.33	81.82	90.32	84.85
TGMM _c	10.43	7.6					11.1	25			
TGMM _r	5.22		6.4	11	6.67	16.67	33.33	16.67	18.18	9.68	
TGMM _w		6.8	6.87			33.33	16.67				
TGMM _{pc}		12.12			10						15.15
NMM _{pc}		7.57			10					10.6	
NMM _w		3.45	5.2			16.67	16.67				
NMM _r	6.95		6.4	8.93	5.83	19.44	19.44	16.67	18.18	8	
NMM _c	8.69	6.36					5.55	12.5			

Source: own survey 2023

In this study, the examined potato, head cabbage and tomato marketing margin in different channels presented in table 16.

In terms of potato, the total gross marketing margin is highest in channel II which accounts 26.5%. The producers share in consumer’s price is highest in all channels lead by channel IV which accounts for 89%. Among all potato traders, only processors get the highest marketing margin and net marketing margin which is 12.12% and accounts 10%.

Regarding to head cabbage traders marketing margin, the total gross marketing margin is highest in channel II which accounts 61.1%.the producers share in consumer’s price is highest in channel IV which accounts for 81.82%, followed by channel III which accounts for 58.33%. The highest gross marketing margin and net marketing margin is incurred by retailers in channel II accounts for 33.33% and 19 .44% respectively.

Towards tomato marketing margin, the highest total marketing margin goes to channel II by a value of 15.115%. The producers share in consumers price goes to channel I accounts for 90.32%. The highest marketing margin and net marketing margin is incurred by processors which accounts 15.15% and 10.6% respectively.

4.3. Econometric Analysis

4.3.1. Heckman two stage model analysis method

Vegetable market participation analysis

First data estimation was undertaken by double hurdle model. Then, the result was become insignificant. This shows sample selectivity bias problem. Best fit model was undertaken by using likelihood ratio test. Ho=represent double hurdle model and H1=Heckman two stage model. Calculated value of (LR chi2 = 2154.38 with Prob > chi2 = 0.000) for potato, (LR chi2 = 1674.74 with Prob > chi2 = 0.000) for head cabbage, (LR chi2 = 64.51 with Prob > chi2 = 0.000) for tomato, indicating a strong ability of independent variables to explain the outcome variables. Therefore, there is enough evidence to test reject Ho and Accept H1. This indicates that

Heckman two stages model was preferable. Heckman two stages model is statically significant at 1% as a whole. Therefore, assumption of null hypothesis is rejected.

In order to identify determinants of vegetable market participation decision and extent of participation Heckman two-stage selection model was used. In selectivity models, the decision to participate has been seen as a sequential two-stage decision-making process. In the first stage vegetable farmers make a dual decision whether to participate or not in vegetable market. In the second stage, farmers make continuous decision on marketed surplus. In the first stage a selection equation is estimated using a probit model which attempts to capture the factors that determine the likelihood of an individual household participate or does not in vegetable market. Since the probit parameter estimate does not show by how much a particular variable increases or decreases the likelihood of participating in vegetable market. Marginal effects of the independent variables on the probability of participating in vegetable market were considered (Habtamu, 2014).

Table 17: Probit estimation of vegetable market participation

The first stage of Heckman two stage model analysis result presented under this topic. It is probit analysis of potato, head cabbage and tomato producer’s analysis whether they participate in marketing or not in terms of the mentioned crops. The amount of change in dependent variables when there is change in independent variables can be determined by calculating its marginal effect because the probit result cannot determine it. The p-value associated with the probit analysis result is attached at the end of this paper for these crops correspondingly.

	Potato			Head Cabbage			tomato		
variables	coef.	std.err.	dy/dx	coef.	std.err.	dy/dx	coef.	std.err.	dy/dx
Age	-0.01	0.032	-0.0021	-0.014	0.03	-0.08	0.027	0.294	0.006
Sex	0.157	0.399	0.003	-0.532	0.386	0.09	0.674*	0.359	0.015
Education	0.07	0.067	0.0087	0.067	0.065	0.019	0.112**	0.057	0.009
FE	0.272***	0.1	0.037	0.088	0.087	-0.08	-0.051	0.043	0.01
EC	1.92***	0.498	0.02	1.732***	0.577	0.076	-0.368	0.323	0.02
CRA	1.075	0.678	0.013	-0.648	0.679	-0.1	1.974***	0.504	0.04
TRA	0.333	0.438	0.03	1.17**	0.506	0.4	0.072	0.397	-0.06
LS	-0.17	0.297	-0.001	-0.097	0.277	-0.04	0.045	0.27	0.003
IRA	-0.12	0.412	0.01	1.162**	0.539	0.023	0.102	0.417	0.013
FS	-0.09	0.141	-0.005	0.0996	0.132	-0.17	0.058	0.115	0.02
NFI	-0.03	0.476	0.009	0.843*	0.501	0.061	0.379	0.425	-0.024
MD	-0.14**	0.068	-0.04	-0.004	0.054	0.006	-0.284***	0.082	-0.005
LP	0.867*	0.514	0.02	1.263**	0.571	0.05	0.365	0.312	-0.001
SUC	0.313	0.587	0.013	1.012*	0.548	0.04	-0.125	0.467	0.019
OMP	0.109	0.44	-0.05	0.386	0.412	0.053	-0.565	0.394	-0.018
PA	-0.6	0.496	-0.023	1.172**	0.591	0.18	-0.312	0.45	0.039
_cons	1.7	1.946		-3.956**	1.951		-2.7	1.66	
Lambda (λ)	-7.05**	4.97		-12.3***	8.42		2.676*	3.4	
Rho	-0.96			-1			0.725		
Sigma	7.354			12.26			3.719		
No. of obs.	150			150			150		
Wald chi2(16)	2154.38			1674.7			64.52		
Log likelihood	-39.94			-56.25			-34.78		
LR chi2	90.48				50.73			86.53	
Prob > chi2	0.0000				0.0000			0.0000	

***: at 1% significant level; **: at 5% significant level; *: at 10% significant level

Note: Dependent variables is vegetable (potato, head cabbage and tomato) market participation

Source: survey result 2023.

Potato

Vegetable Farming Experience: Vegetable farming experience affects the likelihood of potato market participation positively and significantly at 1% significance level. An increase of farming experience by one year, lead to increases the likelihood of potato market participation by 3.7% holding all other variables constant. This implies that the farmer who has more experience in potato production can participate to the market more than inexperienced. This result is in line with (Wosene et al., 2018), who found that farming experience of the household significantly and

positively affected market supply of pepper, (*Hailu, 2016*), who illustrated that vegetables farming experience of households has significant effect on onion quantity sold with positive sign.

Extension contact: Extension contact of the farmer on vegetable production has positive and significant impact on potato quantity supplied to the market at 1% significance level. An increase in extension contact by one time, lead to increase the probability of potato market participation by 2% all other factors held constant. This implies that as if one gets extension contact on production, marketing and information on know how its ability of production of more potato volume to the market increases. This result is in line with (*Hegena and Teshome, 2022*), who found that extension access had positive and significant impact on vegetable quantity supplied to the market.

Market Distance: Market Distance from the market center has negative and significance effect at 5% significance level on the probability of potato market participation. This implies, increasing a distance in one kilometer from the market center decreases the probability of potato market participation by 4%, keeping all other factors constant. This finding is in line with (*Yohanes, 2015*), who found that distance to the market has significant and negative influence on extent of potato and cabbage supplied to the market.

Lagged price: the current price of potato in relation to previous year price is influence the market participation positively and significantly at 10% significance level. An increase in present price relation to previous price lead to increase the probability of the farmers' participation in potato market participation by 0.02, all other factors held constant. This is concurs with (*Yayo, 2016*), who illustrated that lagged price has positive and significance influence on the probability of onion and tomato market participation.

The coefficient of Inverse Mills ratio (Λ) in Heckman two-stage estimation is significant at 5% probability level. This indicates sample selection bias, existence of some unobservable household characteristics affecting the likelihood to participate in potato market and thereby affecting volume of supply which justifies the appropriateness of the model used.

Head Cabbage

Extension contact: Extension contact of the farmer on vegetable production has positive and significant impact on farmers' likelihood to participate to head cabbage market at 1% significance level. An increase in extension contact by one time, lead to increase the probability of potato market participation by 7.6% all other factors held constant. This implies that as if one gets extension contact on production, marketing and information on know how its ability of production of more head cabbage to the market increases. This result is in line with (*Yohanes, 2015*), who found that extension access had positive and significant impact on vegetable quantity supplied to the market and (*Yayo, 2016*), who suggested that extension service had positive and significance impact on the probability of onion and tomato market participation.

Transportation access: Transportation access has positive and significance influence on the probability of head cabbage market participation at 5% significance level. This means an

increase of one unit transportation access lead to an increase of the farmers' participation on head cabbage market by 40%, all factors held constant. This finding is similar with (Amare, 2019), who illustrated that vehicle ownership affects both potato market participation decision and supply volume positively and significantly.

Irrigation access: A farmer who has irrigation access on head cabbage production has the probability of market participation positively and significantly at 5% significance level. A house hold that has irrigation access has the likelihood of vegetable market participation of around 54% holding all other factors constant. This finding result is in line with (Tufa *et al.*, 2014), who found that irrigation had positive and significant impact on the horticultural crops market participation.

Non-farm income: Non-vegetable farm income has positive and significance impact on the likelihood of the household's participation on head cabbage market at 10% significant level keeping all factors constant. An increment in non-vegetable farm income by one birr increases the head cabbage market participation by 6.1% all the other factors held constant. This indicates that farmers who have non-vegetable farm income has a chance of investing on head cabbage production and as a result increase market participation in relation to the farmer that who do not has, because the farmer who has non-farm income may has access in operational costs and may employ other person on production that come to the market. This result is in line with the study of (Hailu, 2016), who illustrated that non-farm income has positive and significant influence on potato volume sales to the market.

Lagged price: the current price of head cabbage in relation to previous year price is related with vegetable market participation positively and significantly at 5% significance level. An increase in previous price lead to increase the probability of the farmers' participation on head cabbage market participation by 5%, all other factors held constant. This is concurs with (Wosene *et al.*, 2018), who illustrated that lagged price has positive and significance influence on red pepper surplus to the market and (Yayo, 2016), suggested that lagged price affect the probability of onion and tomato market participation positively and significantly.

Start-up capital: capital access of the farmers has positive and significant influence on the probability of head cabbage market participation at 10% significance level. This result implies that the farmers who have access in initial capital or operational cost on production and marketing of head cabbage have the probability of market participation 4% than the farmers who do not have start-up capital holding all others factors constant. This finding result relate with (Haile, 2022), who found that amount of credit received positively and significantly affect maize market participation decision. This indicates that credit received is important to purchase farm inputs to operate vegetable production and as a result participate in market.

Pesticide application: Pesticide application has positive and significant effect on head cabbage market participation at 5% significance level. This means farmers who apply pesticide on head cabbage produce has the likelihood of market participation in relation to who do not apply by 18% keeping all factors constant. This indicates that pesticide application control head cabbage deceases and as a result increases productivity and then increase the probability of market

participation. This result is in line with (*Rikitu et al., 2019*), who suggested that pesticide application had significant and positive impact on vegetables market participation.

The coefficient of Inverse Mills ratio (Lambda) in Heckman two-stage estimation is significant at 1% probability level. This indicates sample selection bias, existence of some unobservable household characteristics affecting the likelihood to participate in head cabbage market and thereby affecting volume of supply which justifies the appropriateness of the model used.

Tomato

Sex: sex of a household has significant and positive impact on the probability of tomato market participation at 10% significance level. The chance of tomato producer is being male, lead to the likelihood of market participation to increase by 1.5% holding all other variables constant. This indicates that the probability of female participation on vegetable market has no big difference in relation to male. This finding result agree with (*Aliyi et al., 2021*), who found that sex found to be positive and statistically significant influence on potato and tomato market participation.

Education: Education of the household head positively and significantly influenced tomato market participation at 5% significant level. As an education level of the household increase by one grade, the probability of tomato market participation increases by 1.5%, all other factors held constant. This means an increase of education level of the household bring knowledge of applying agricultural technology and increase productivity of the tomato and probability of market participation than not educated household head. It enables the farmer to get new idea on market information, applying productivity increment mechanizations such as improved seed, fertilizers, production harvesting methods, reducing postharvest loss and careful farm treatment.

The finding result is concurs with that of (*Aliyi et al., 2021*), who illustrated that education had positive effect on potato and tomato market participation and (*Megerssa et al., 2020*), who illustrated that education had positive and significance impact on vegetable supply to the market.

Credit access: The household's credit access has positive and significance effect on the likelihood of tomato market participation at 1% significance level. An increase of household's credit access by one unit lead to increase the likelihood of tomato market participation by 4% holding all other factors constant. This implies that household who got credit invests on tomato production and good yield and then sold. This finding is in line with (*Faris et al., 2018*), who suggested that credit access had positive and significance effect on potato surplus to the market.

Market Distance: Market Distance from the market center has negative and significance impact on the probability of tomato market participation at 1% significance level. This implies, increasing a distance by one kilometer from the market center decreases the probability of tomato market participation by 0.5%, keeping all other factors constant. This finding is in line with (*Yohanes, 2015*), who found that distance to the nearest market has significant and negative influence on extent of tomato and cabbage supplied to the market.

The coefficient of Inverse Mills ratio (Lambda) in Heckman two-stage estimation is significant at 10% probability level. This indicates sample selection bias, existence of some unobservable

household characteristics affecting the likelihood to participate in potato market and thereby affecting volume of supply which justifies the appropriateness of the model used.

Vegetables market supply volume analysis

The second stage of Heckman two stage model analysis results is about vegetables market supply volumes. It is supply volume analysis of potato, head cabbage and tomato. The result is presented in table 18. The analysis result is attached at the end of this paper for these crops correspondingly.

Table 18: The extent of market participation

	Potato		Head Cabbage		Tomato	
Variables	coef.	std.err.	coef.	std.err.	coef.	std.err.
Age	0.052	0.134	0.109	0.219	0.054	0.125
Sex	-0.079	2.1	-1.49	3.21	1.19	1.566
Education	-0.216	0.286	-0.26	0.47	0.084	0.28
Experience	9.42***	0.596	11.02***	0.795	0.89***	0.24
Extension Contact	-4.43	4.54	-1.06	5.6	7.36***	2.1
Credit Access	-2.99	3.27	10.18**	4.6	12.99***	4.65
Transportation Access	-0.73	2.03	-4.99	4.1	-0.54	1.378
Land Size	2.66*	1.52	4.84*	2.5	0.27	0.82
Irrigation Access	-2.41	1.8	-0.314	4.18	1.34	1.561
Family Size	1.4**	1.52	2.32**	0.998	0.199	0.439
Non-Farm Income	-0.233	1.8	6.83**	3.77	-2.3	1.617
Market Distance	1	0.65	-0.008	0.52	-0.484	0.554
Lagged Price	0.599	2.7	6.17	4.47	-0.128	0.989
Start-up Capital	-2.78	2.62	4.72	4.43	1.768	1.46
Ownership of motor Pump	1.29	1.97	-0.73	3.24	-1.721	1.61
Pesticides Application	3.63*	2.18	-2.46	4.15	4.16***	1.55
_Cons	-3.22	9.48	-12.8	18.04	-18.62*	9.9
Number of obs	150		150		150	
Prob > chi2	0.0000		0.0000		0.0000	
Pseudo R2	0.671		0.6289		0.7277	
R-Squared	0.894		0.7482		0.6987	
Adjusted R-Squared	0.723		0.70112		0.6489	

***: at 1% significant level; **: at 5% significant level; *: at 10% significant level

Note: Dependent variables are potato, head cabbage and tomato quantity supplied to the market

Source: survey result 2023

Potato

Vegetable Farming Experience: Vegetable farming experience affect the volume of potato supply to the market positively and significantly at 1% significance level. An increase of farming experience by one year, the potato supplied to the market increases by 9.42 quintal, holding all other variables constant. This implies that the farmer who has more experience in potato production can supply more amounts to the market. This result is in line with (Wosene et al., 2018), who found that farming experience of the household significantly and positively affected market supply of pepper, (Hailu, 2016), who illustrated that vegetables farming experience of households has significant effect on onion quantity sold with positive sign.

Land size: Land size owned by the farmers has positive and significant impact on potato quantity supplied to the market at 10% significance level. An increase of land size by one hectare increases the level of potato market participation by 2.66 quintals held all factors constant. This means the farmer who had large area of land produces big amount of potato and brought to the market. This finding is concurs with (*Yayo, 2016*), who illustrated that total land size found to be positive and significant determinant of onion and tomato quantity supplied to the market.

Family size: family size of the household head has positive and significant influence on potato market participation probability at 5% significant level. This implies as family size increase by one person the probability of participating in potato market increases by 1.4 quintal, all other factors held constant. This relationship concurs with (*Yohanes, 2015*), who illustrated that household size significantly and positively influences market participation of potato and cabbage, (*Wosene et al., 2018*), who illustrated that family size have a positive and significant effect on market supply of red pepper and (*Hegena and Teshome, 2022*), who found that family size had positive and significant impact on probability of vegetable market participation.

Pesticide application: Pesticide applying to potato has positive and significance effect on the extent of market participation at 10% significance level. Increasing pesticide application by one time lead to increase the volume of potato supplied to the market by 3.63 quintals held all factors constant. This means a farmer who apply pesticide to potato crop gets high surplus than who do not apply pesticides because pesticide application avoid plant diseases that can be a reason to minimize yield and as a result increase productivity. This result is in line with (*Rikitu et al., 2019*), who suggested that pesticide application had significant and positive impact on vegetables surplus sold to the market.

Head Cabbage

Vegetable Farming Experience: Vegetable farming experience affect the extent of head cabbage supplied to the market positively and significantly at 1% significance level. An increase of farming experience by one year, the head cabbage supplied to the market increases by about 11 quintals, held all other variables constant. This implies that the farmer who has more experience in head cabbage production can supply more amounts to the market. This result is in line with (*Wosene et al., 2018*), who found that farming experience of the household significantly and positively affected market supply of red pepper, (*Hailu, 2016*), who illustrated that vegetables farming experience of households has significant on onion quantity sold with positive sign.

Credit access: The household's credit access has positive and significance effect on the extent of head cabbage market participation at 5% significance level. An increase of household's credit access by one unit lead to increase the level of head cabbage market participation by 10.18 quintals holding all other factors constant. This implies that household who got credit invests on tomato production and good yield and then sold. This finding is in line with (*Faris et al., 2018*), who suggested that credit access had positive and significance effect on head cabbage volume supplied to the market.

Land size: Land size owned by the farmers has positive and significant impact on potato quantity supplied to the market at 10% significance level. An increase of land size by one hectare increases the level of potato market participation by 4.84 quintals held all factors constant. This means the farmer who had large area of land produces big amount of potato and brought to the market. This is in line with (*Faris et al., 2018*), who found that land size allocated to potato has significance and positive effect on potato surplus to the market.

Family size: family size of the household head has positive and significant influence on potato market participation probability at 5% significant level. This implies as family size increase by one person the probability of participating in potato market increases by 2.32 quintal, all other factors held constant. This relationship concurs with (*Yohanes, 2015*), who illustrated that household size significantly and positively influences market participation of potato and cabbage, (*Wosene et al., 2018*), who illustrated that family size have a positive and significant effect on market supply of red pepper and (*Hegena and Teshome, 2022*), who found that family size had positive and significant impact on probability of vegetable market participation.

Non-farm income: Non-vegetable farm income has positive and significance impact on the extent of head cabbage market participation at 5% significance level. A farmer who had non-farm income of 1000 birr supplied 6.83 more quintals of head cabbage to the market than the farmers who had not all factors held constant. This indicates that farmers who had non-vegetable farm income increase the head cabbage quantity supplied to the market than who do not had, because the farmer who had non-farm income invest on vegetable production by buying improved seed, fertilizers and others. This result is consistence with the study of (*Hailu, 2016*), who illustrated that non-farm income has positive and significant influence on potato volume sales to the market.

Tomato

Vegetable Farming Experience: Vegetable farming experience affect the extent of tomato supply to the market positively and significantly at 1% significance level. An increase of farming experience by one year, the tomato supplied to the market increases by 0.89 quintal, holding all other variables constant. This implies that the farmer who has more experience in tomato production can supply more amounts to the market. This result is in line with (*Wosene et al., 2018*), who found that farming experience of the household significantly and positively affected market supply of red pepper, (*Hailu, 2016*), who illustrated that vegetables farming experience of households has significant on onion quantity sold with positive sign.

Extension contact: Extension contact of the farmer on vegetable production has positive and significant impact on tomato quantity supplied to the market at 1% significance level. An increase in extension contact by one time, lead to increase tomato quantity supplied to the market by 7.36 quintals all other factors kept constant. This implies that as one get extension access on production, marketing and information on know how its ability of production of more tomato volume to the market increases. This result is in line with (*Hegena and Teshome, 2022*), who

found that extension access had positive and significant impact on vegetable quantity supplied to the market.

Credit access: The household's credit access has positive and significance effect on the extent of tomato market participation at 1% significance level. An increase of household's credit access by one unit lead to increase the level of tomato market participation by about 13 quintals holding all other factors constant. This implies that household who got credit invests on head cabbage production and harvest good yield and then sold it. This finding is in line with (*Faris et al., 2018*), who suggested that credit access had positive and significance effect on tomato surplus to the market.

Pesticide application: Pesticide applying to tomato has positive and significance effect on the extent of market participation at 1% significance level. As pesticide application increase by one litter the volume of tomato supplied to the market increase by 4.16 quintal held all factors constant. This means a farmer who apply pesticide to potato crop gets high surplus than who do not apply pesticides because pesticide application avoid plant diseases that can be a reason to minimize yield and as a result increase productivity. This result is in line with (*Rikitu et al., 2019*), who suggested that pesticide application had significant and positive impact on vegetables surplus sold to the market.

5. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1. Summary

The aim of this study was analyzing vegetables market performance in Kersa district, Jimma zone, Ethiopia, with specific objective of investigating vegetables structure, conduct and performance; and analyzing vegetable market participation decision and its supply volumes. A multi-stage sampling procedure was applied to collect data from 150 vegetable producer farmers and additional data from 15 vegetable traders was collected in the study area. In this study, both qualitative and quantitative data was collected from primary and secondary data sources through questionnaire, interview and FGD method. Both descriptive and econometric data analysis method were applied to analyze vegetable market performance.

Descriptive analysis result indicates that, among 150 sample farmers males were 117 and females were 33. Among 150 sample respondents, 105 are participants while 45 are non-participants for potato, 117 are participants while 33 are non-participants for head cabbage, and 92 are participants while 58 are non-participants for tomato.

From the variables entered to the software for descriptive analysis, farming experience, family size, and land size had positive and significance association with potato and head cabbage market participation decision, while farming experience, family size, land size, and market distance had negative and significance association with tomato market participation. Extension contact, credit access, transportation access, and ownership of motor pump had positive and significance association with potato and head cabbage market participation, while extension contact, credit access, lagged price, and ownership of motor pump had positive and significance association with tomato market participation. In terms of market structure, potato and head cabbage market were controlled by strong oligopolistic wholesalers with concentration ratio of 71% 73% respectively.

In terms of market transparency, 73% of traders got market information, while 27% of them did not; 27% of traders get credit access, while 73% of them did not and 87% faced barriers to entry and 13% did not. Regarding marketing conduct; 67% of traders Price setting decision based on market price, and 33% of them based on negotiation with fellow traders, 47% Traders purchase decision is based on giving better rice relate to others while, 53% is based on giving fair scaling and weighing, 73% of traders pay purchase price in cash, and 27% buy in credit.

Similarly, the vegetable market profitability, the net profit per Qt gained from potato is 343birr for wholesalers, while the net profit per Qt gained from head cabbage was 389birr, the net profit per Qt gained from potato, head cabbage and tomato were 430, 398.5 and 238.5birr respectively for retailers, the net profit per Qt gained from potato, head cabbage and tomato were 359, 245 and 285birr respectively for local collectors, the net profit per Qt gained from potato, head cabbage and tomato were 375, 395 and 345birr respectively for processors, and the net profit per Qt gained from potato, head cabbage and tomato were 1221, 493 and 1106birr respectively for producers.

Regarding marketing margin, the TGMM and NMM of potato are highest in channel II w/c accounts about 26.5%, and 10% respectively; TGMM and NMM for head cabbage are the highest in channel II w/c accounts about 61%, and 19 % respectively; and TGMM and NMM for tomato is the highest in channel I w/c 15.115% and 10.6% respectively.

Moreover, the Heckman first stage probit analysis result indicates that farming experience, extension contact and lagged price were the variables determined potato market participation decision positively and significantly, while market distance was the variable determine negatively and significantly; extension contact, transportation access, irrigation access, non-farm income, lagged price, start-up capital and pesticide application were influenced head cabbage market participation decision positively and significantly; and sex, educational level, and credit access affect tomato market participation decision positively and significantly, while market distance affect negatively and significantly.

Finally, the Heckman second stage supply volume analysis result indicates that farming experience, total land size, family size and pesticide application affected the quantity of potato supplied to the market significantly and positively; farming experience, credit access, total land size, family size and non-farm income affected the quantity of head cabbage supplied to the market significantly and positively; farming experience, extension contact, credit access, and pesticide application affected the volume of tomato supplied to the market significantly and positively.

5.2. Conclusion

The analysis result of the study indicates that among 150 sample farmers males were 117 and females were 33. Among 150 sample respondents, 105 are participants while 45 are non-participants for potato, 117 are participants while 33 are non-participants for head cabbage, and 92 are participants while 58 are non-participants for tomato.

Similarly, farming experience, family size, and land size had positive and significance association with potato and head cabbage market participation decision, while farming experience, family size, land size, and market distance had negative and significance association with tomato market participation. Extension contact, credit access, transportation access, and ownership of motor pump had positive and significance association with potato and head cabbage market participation, while extension contact, credit access, lagged price, and ownership of motor pump had positive and significance association with tomato market participation. In terms of market structure, potato and head cabbage market were controlled by strong oligopolistic wholesalers with concentration ratio of 71% 73% respectively.

In terms of market transparency, 73% of traders got market information, while 27% of them did not; 27% of traders get credit access, while 73% of them did not and 87% faced barriers to entry and 13% did not. Regarding marketing conduct; 67% of traders Price setting decision based on market price, and 33% of them based on negotiation with fellow traders, 47% Traders

purchase decision is based on giving better rice relate to others while, 53% is based on giving fair scaling and weighing, 73% of traders pay purchase price in cash, and 27% buy in credit.

Similarly, the vegetable market profitability, the net profit per Qt gained from potato is 343birr for wholesalers, while the net profit per Qt gained from head cabbage was 389birr, the net profit per Qt gained from potato, head cabbage and tomato were 430, 398.5 and 238.5birr respectively for retailers, the net profit per Qt gained from potato, head cabbage and tomato were 359, 245 and 285birr respectively for local collectors, the net profit per Qt gained from potato, head cabbage and tomato were 375, 395 and 345birr respectively for processors, and the net profit per Qt gained from potato, head cabbage and tomato were 1221, 493 and 1106birr respectively for producers.

Regarding marketing margin, the TGMM and NMM of potato are highest in channel II w/c accounts about 26.5%, and 10% respectively; TGMM and NMM for head cabbage are the highest in channel II w/c accounts about 61%, and 19 % respectively; and TGMM and NMM for tomato is the highest in channel I w/c 15.115% and 10.6% respectively.

Moreover, the Heckman first stage probit analysis result indicates that farming experience, extension contact and lagged price were the variables determined potato market participation decision positively and significantly, while market distance was he variable determine negatively and significantly; extension contact, transportation access, irrigation access, non-farm income, lagged price, start-up capital and pesticide application were influenced head cabbage market participation decision positively and significantly; and sex, educational level, and credit access affect tomato market participation decision positively and significantly, while market distance affect negatively and significantly.

Finally, the Heckman second stage supply volume analysis result indicates that farming experience, total land size, family size and pesticide application affected the quantity of potato supplied to the market significantly and positively; farming experience, credit access, total land size, family size and non-farm income affected the quantity of head cabbage supplied to the market significantly and positively; farming experience, extension contact, credit access, and pesticide application affected the volume of tomato supplied to the market significantly and positively.

5.3. Recommendations

Depending on the result of this study, it is recommended that the extension access, transportation access and credit access are recommended to concerned bodies including, district's agriculture office and district road authority to be improved to increase the quantity of vegetable production to the market.

Assigning efficient irrigation access, updating the producer's knowledge and skill with improved production, promoting farmers training on product and productivity increasing, supporting production by necessary inputs and marketing systems that enable to increase benefits of

producers and utility of customers is recommended to district concerned offices of the study area.

Regarding the market structure and conduct, it is recommended to concerned bodies to encourage competition and reduce market concentration by promoting the entry of new market participants and supporting small-scale farmers and traders, facilitate information sharing and transparency among market participants to improve market conduct and reduce information asymmetry, establish mechanisms for resolving disputes and addressing unfair trading practices, and ensuring a fair and equitable trading environment.

In terms of total land size, enhancing and training farmers on land allocation for potato, head cabbage to increase productivity as a result, increase supply volume potato and head cabbage is recommended to district agriculture and land administration offices.

Initiating and orienting farmers to actively engage family labor on potato and head cabbage production and market participation is recommended to district agriculture office and concerned organizations to increase production and marketed surplus of these crops.

Lastly, investing in market infrastructure and developing market linkages to improve market access for farmers, supporting the development of farmer organizations to enhance their bargaining power and access to inputs and markets, conducting research on value addition to increase the value of vegetable products, and strengthening extension services to provide farmers with access to technical knowledge and support is strongly recommended to Oromia government.

6. REFERENCES

- ALIYI, I., FARIS, A., AYELE, A., OLJIRRA, A. & BAYESSA, M. 2021. Profitability and market performance of smallholder vegetable production: evidence from Ethiopia. *Heliyon*, 7, e08008.
- ANDAREGIE, A., ASTATKIE, T. & TESHOME, F. 2021. Determinants of market participation decision by smallholder haricot bean (*phaseolus vulgaris* l.) farmers in Northwest Ethiopia. *Cogent Food & Agriculture*, 7, 1879715.
- BEKELE, M., FEYISA, K. & GETU, S. 2016. Challenges and opportunities of marketing fruit and vegetables at Logia, northeastern Ethiopia. the case of onion, tomato and banana. *Journal of marketing and consumer research*, 22, 51-58.
- EMANA, B., KETEMA, M., MUTIMBA, J. K. & YOUSUF, J. 2015. Factors affecting market outlet choice of potato producers in Eastern Hararghe Zone, Ethiopia. *Journal of Economics and Sustainable Development*, 6, 159-172.
- ENDRIS, E., HAJI, J. & TEGEGNE, B. 2020. Factors affecting vegetable producers market outlet choice in case of Habru District, North Wollo Zone, Ethiopia. *European Business and Management*, 6, 1-9.
- FARIS, A., SHUMETA, Z. & MUCHE, M. 2018. Value chain analysis of Potato in Dedo district of Jimma zone, Ethiopia. *Int. J. Bus. Manag. Tomorrow*, 2, 43-49.
- FERRIS, S., ROBBINS, P., BEST, R., SEVILLE, D., BUXTON, A., SHRIVER, J. & WEI, E. 2014. Linking smallholder farmers to markets and the implications for extension and advisory services. *MEAS Brief*, 4, 13-14.
- FEWS, N. 2008. Structure-Conduct-Performance and food security. *Fews Net Markets Guidance*.
- GEBRU, K. M., LEUNG, M., RAMMELT, C., ZOOMERS, A. & VAN WESTEN, G. 2019. Vegetable business and smallholders' food security: empirical findings from Northern Ethiopia. *Sustainability*, 11, 743.
- HAILE, K., GEBRE, E. & WORKYE, A. 2022. Determinants of market participation among smallholder farmers in Southwest Ethiopia: double-hurdle model approach. *Agriculture & Food Security*, 11, 18.
- HAILU, A. 2016. *Value chain analysis of vegetables: The case of Ejere district, West Shoa zone, Oromia national regional state of Ethiopia*. Haramaya University.
- HEGENA, B. & TESHOME, A. 2022. Vegetable market supply by small holder farmers in Ethiopia. *Cogent Social Sciences*, 8, 2057058.
- HELTBERG, R. & TARP, F. 2002. Agricultural supply response and poverty in Mozambique. *Food policy*, 27, 103-124.
- HUNDE, N. F. 2017. Opportunity, problems and production status of vegetables in Ethiopia: a review. *J Plant Sci Res*, 4, 172.
- KDAO, 2023. Kersa district agriculture office 2023 annual report.
- KOHL, R. & UHL, J. 1985. *Marketing of agricultural product* Macmillan Publishing company Inc.

- KOMAREK, A. 2010. The determinants of banana market commercialisation in Western Uganda. *African Journal of Agricultural Research*, 5, 775-784.
- KOTLER, P. 2012. *Kotler on marketing*, Simon and Schuster.
- KOTLER, P., BURTON, S., DEANS, K., BROWN, L. & ARMSTRONG, G. 2015. *Marketing*, Pearson Higher Education AU.
- MIRDHA, N. R. 1976. Report of the National Commission on Agriculture, 1976.
- OSMANI, A. G. & HOSSAIN, E. 2015. Market participation decision of smallholder farmers and its determinants in Bangladesh. *Економика пољопривреде*, 62, 163-179.
- REGASA MEGERSSA, G., NEGASH, R., BEKELE, A. E. & NEMERA, D. B. 2020. Smallholder market participation and its associated factors: Evidence from Ethiopian vegetable producers. *Cogent Food & Agriculture*, 6, 1783173.
- RIKITU, A., EMANA, B., HAJI, J. & BEKELE, K. 2019. Smallholder Farmers' Decision to Participate in Vegetable Marketing and the Volume of Sales in West Shewa Zone of Oromia National Regional State, Ethiopia. *Sustainable Agriculture Research*, 8, 48-60.
- TIMES, E. 2021. What is Gross Domestic Product? Definition of Gross Domestic Product, Gross Domestic Product Meaning. The Economic Times. Retrieved March.
- TOMEK, W. G. & KAISER, H. M. 2014. *Agricultural product prices*, Cornell University Press.
- TUFA, A., BEKELE, A. & ZEMEDU, L. 2014. Determinants of smallholder commercialization of horticultural crops in Gemechis District, West Hararghe Zone, Ethiopia. *African journal of agricultural research*, 9, 310-319.
- WONDIM, D. 2021. Value chain analysis of vegetables (onion, tomato, potato) in Ethiopia: A review. *International Journal of Agricultural Science and Food Technology*, 7, 108-113.
- WOSENE, G., KETEMA, D. & ADEME, A. 2018. *ANALYSIS OF RED PEPPER VALUE CHAIN: THE CASE OF WENBERMA DISTRICT, WEST GOJAM ZONE OF AMHARA NATIONAL REGIONAL STATE, ETHIOPIA*. Haramaya university.
- YOHANES, M. 2015. *Performance of vegetable market: The case of Kombolcha district, East Hararghe Zone of Oromia National Regional State, Ethiopia.[MSc Thesis]*. Haramaya, Ethiopia: Haramaya University. Haramaya University Haramaya, Ethiopia.
- Gurung, B., Thapa, R.B., Gautam, D.M., Karki, K.B. and Regmi, P.P., 2016. Commercial vegetable farming: an approach for poverty reduction in Nepal.
- Silva Dias, J., 2010, August. World importance, marketing and trading of vegetables. In *XXVIII International Horticultural Congress on Science and Horticulture for People (IHC2010): International Symposium on 921* (pp. 153-169).
- Elolu, S., Byarugaba, R., Opiyo, A.M., Nakimbugwe, D., Mithöfer, D. and Huyskens-Keil, S., 2023. Improving nutrition-sensitive value chains of African indigenous vegetables: current trends in postharvest management and processing. *Frontiers in Sustainable Food Systems*, 7, p.1118021.
- Okello, J.J., Narrod, C. and Roy, D., 2007. *Food safety requirements in African green bean exports and their impact on small farmers*. Intl Food Policy Res Inst.
- Maertens, M., Minten, B. and Swinnen, J.F., 2009. Growth in high-value export markets in Sub-Saharan Africa and its development implications.

APPINDEX

Questionnaires

Title: Analysis of vegetables market performance in Kersa district, Jimma zone, Ethiopia

Producers' Survey Questionnaires

Instructions for data collectors

- ✓ Make brief introduction before starting any question, introduce yourself to the farmers, greet them in local ways, and make clear the objective of the study.
- ✓ Please fill the interview schedule according to the farmers reply.
- ✓ Please ask each question clearly and patiently until the farmer gets your points.
- ✓ Please do not use technical terms and do not forget local units.
- ✓ Fill the answers on the space provided.
- ✓ Please make sure you fill all the questionnaires correctly and properly before parting the farmers.

1. Household characteristics

- 1.1.Name of household head -----
- 1.2.Sex of household head 1. Male 0. Female
- 1.3.Marital status of household head 1.Married 2.Single 3. Divorced 4.Widowed (Widower)
- 1.4.Family size. Male -----Female -----Total -----
- 1.5.Age of household head -----years.
- 1.6.Educational level of household head----- (years of school)
- 1.7. Religion of household head 1. Muslim 2. Orthodox 3. Protestant 4. Catholic 5. Other (specify)

2. Resource ownership

2.1. Land owned and usage during production year 2022

Land usage	Cultivated land size	Uncultivated land size
Own land used in hectare		
Rented in land in hectare		
Rented out land in hectare		
Farm size for vegetable production (irrigation + non-irrigation)		

2.2. How many workers do you have at the vegetable farm?

2.2a. Type of employment	2.2b. Male (No. of	2.2c. Female (No.	2.2d. Total (No.
--------------------------	---------------------	--------------------	-------------------

	persons)	of persons)	of persons)
Self-employed or unpaid workers (family members)			
Paid workers			
How much is a worker paid in a month? (birr/person)			

2.3. Do you have your own transportation during the production year 2022? 1. Yes 2. No

2.4.If your answer for 2.3 is yes, what type of transportation? 1.Vehicle 2.Transport animals 3.
Cart 4. Others (specify)-----

3. Vegetable crops production and input used

3.1.What production method do you apply for potato, head cabbage and tomato? 1. Irrigation

2. Rain fed 3. Both

3.2. If you use irrigation, what is the area under irrigation for vegetables in

Hectares-----

What is the estimated production and Marketing cost for potato, head cabbage and tomato last year?

Type of vegetable	Production cost			Marketing cost		
	Fixed cost (birr)	Variable cost (birr)	Total cost (birr)	Fixed cost (birr)	Variable cost (birr)	Total cost (birr)
Potato						
Cabbage						
Tomato						

3.3 What is vegetable (potato, head cabbage and tomato) production last year 2022?

Vegetable Crop	Production by rain (ha)	Vegetable farm size (ha)	Yield from production by rain (qt)	Production by irrigation (ha)	Vegetable farm size (ha)	Yield from production by irrigation (qt)
Potato						
cabbage						
Tomato						

3.4 How long have you practiced production of potato? -----Years.

3.5 How long have you practiced production of head cabbage? -----Years.

3.6 How long have you practiced production of tomato?-----Years.

4 Vegetable production and marketing in 2022

Vegetable	Area in ha	Quantity produced(qt)	Quantity consumed(qt)	Quantity sold(qt)	Price per (qt)
Potato					
Head cabbage					
tomato					

4.1. what is your vegetable production and input supply cost last year (2022)?

Vegetable	Labor cost (birr)	Input type	Source	How	input Cost (birr)	Total cost (birr)
Potato		1.Improved seed 2. Fertilizer 3.Pesticidie/ Herbicides 4.Farm Implements 5. Others (specify)		1.Union market 2.Local markets 3. Illegal 4. Cooperatives 5.NGOs 6.Research centers 7. JU 8. Others(specify)		1.purchase 2.credit 3.gift 4.others (specify)
Head cabbage		1.Improved seed 2. Fertilizer 3.Pesticidie/ Herbicides 4.Farm Implements 5.others (specify)		1.Union market 2.Local markets 3. Illegal 4. Cooperatives 5.NGOs 6.Research centers 7. JU 8. Others(specify)		1.purchase 2.credit 3.gift 4.others (specify)
Tomato		1.Improved seed 2. Fertilizer 3.Pesticidie/ Herbicides		1.Union market 2.Local markets 3. Illegal 4. Cooperatives 5.NGOs		1.purchase 2.credit 3.gift 4.others

		4.Farm Implements 5.others (specify)		6.Research centers 7. JU 8. Others(specify)		(specify)
--	--	---	--	---	--	-----------

5 Access to extension services

5.1. Did you have extension contact in relation to vegetable (potato, head cabbage and tomato) during 2022? 1. Yes 0. No

5.2. If yes in Q.5.1.how often did you meet the extension expert in 2022? -----

6. Access to credit services

6.1. Did you need credit in 2022? 1. Yes 0. No

6.2. Did you take credit for the purpose of vegetable production in 2022? 1. Yes 0. No

6.3. If yes in Q.6.2. from whom did you get credit? 1. Relative 2.Bank

3. Micro finance institution 4.Traders 5. NGO 6. Government 7. Other (specify)-----

6.4. If yes in Q.6.2. how much did you borrow last year ?----- Birr

6.5. If yes in Q.6.2. What is the interest rate? ----- %

7. Access to market and market information

7.1. Did you get the nearby market price information before you sold potato? 1. Yes 0. No

7.2. Did you get the nearby market price information before you sold head cabbage? 1.Yes 0. No

7.3. Did you get the nearby market price information before you sold tomato? 1. Yes 0. No

7.4. If yes, on above question how did you get information on supply, demand & price of vegetable in other market?

Vegetable	Information on		Source of information	
Potato	1.Demand 2.Supply 3.Price		1.mobile phone 2. Radio 3. TV 4. Broker 5. Government 6.Trader 7.fellow farmers 8. Others (specify)	
Head cabbage	1.Demand 2.Supply 3.Price		1.mobile phone 2. Radio 3. TV 4. Broker 5. Government 6.Trader 7.fellow farmers 8. Others (specify)	
Tomato	1.Demand 2.Supply 3.Price		1.mobile phone 2. Radio 3. TV 4. Broker 5. Government 6.Trader 7.fellow farmers 8. Others (specify)	

7.5. Was the information you get is accuracy? 1. Yes 2. No

8. Selling information

8.1. Did you participate in vegetable (potato, head cabbage and tomato) marketing last year? 1. Yes 0. No

8.2. Did you sell potato to the market last year? 1. Yes 0. No

8.3. If yes, how many times did you sell potato last year? -----

- 8.4. Did you sell head cabbage to the market last year? 1. Yes 0. No
- 8.5. If yes, how many times did you sell cabbage last year?-----
- 8.6. Did you sell tomato to the market last year? 1. Yes 0. No
- 8.7. If yes, how many times did you sell cabbage last year? -----
- 8.8. How far is the village market from your residence?----- minutes (hrs) of walking
- 8.9. How far is the nearest main market from your residence?----- minutes(hrs) of Walking
- 8.9. Did you face perishablity of vegetable last year? 1. Yes 0. No
- 8.10. On average how long did it take you to sale your potato? -----
- 8.11. On average how long did it take you to sale your head cabbage? -----
- 8.12. 8.11. On average how long did it take you to sale your head cabbage?----- 8.13. To where market did you sell vegetable (potato, head cabbage and tomato) in the last year? 1. Farm-gate 2.local market 3. Serbo market 4. Jimma market
- 8.14. To whom (agent) you sold your vegetable last year?

Vegetable	Where you sold (market)	To whom you sold (agent)	Quantity sold (qt)	Term of sale
Potato				
Head cabbage				
Tomato				

8.15. To where market did you sell vegetable last year according to your preference?

Vegetable	Name of the market	Average quantity (qt)	Average price (birr)
Potato			
Head cabbage			
Tomato			

- 8.16. why did you prefer to sale potato to that market? lower transportation cost 2. better price 3. Fair scaling and measuring 4. loose transport 5. Other (specify)-----
- 8.17. why did you prefer to sale head cabbage to that market? lower transportation cost 2. better price 3. Fair scaling and measuring 4. loose transport 5. Other (specify)-----

- 8.18. why did you prefer to sale tomato to that market? lower transportation cost 2. better price 3. Fair scaling and measuring 4. loose transport 5. Other (specify)-----
- 8.19. what relationship did you have with your preferred market agent?-----
- 8.20. How did you sale your produce last year? 1. Direct to the purchaser 2. Through commission man to purchaser 3. Through broker 4. Other (specify)-----
- 8.21. Was a protection, to sell potato in market? 1. Yes 0. No
- 8.22. If yes on Q.8.21.,what was the reason? 1. Lack of customers 2. No license to sell 3. Traders were not allow to enter 4.Other (specify)-----
- 8.23. Was a protection, to sell head cabbage in market? 1. Yes 0. No
- 8.24. If yes on Q.8.23.,what was the reason? 1. Lack of customers 2. No license to sell 3. Traders were not allowed to enter 4.Other(specify)-----
- 8.25. Was a protection, to sell tomato in market? 1. Yes 0. No
- 8.26. If yes on Q.8.25.,what was the reason? 1. Lack of customers 2. No license to sell 3. Traders were not allowed to enter 4.Other (specify)-----
- 8.27. was a difficult to get buyers to sell your vegetable produce? 1. Yes 0. No
- 8.28. If yes, in Q.8.27., why? 1. In accessibility of market 2. Low price offer 3.Lack of information 4. Other (specify)-----
- 8.29. What did you do, when the potato you offered to the market was not sold?1. Took back home 2. Took to another market day 3. Sold at lower price 4. Sold on other market day
- 8.30.What did you do, when the head cabbage you offered to the market was not sold?1. Took back home 2. Took to another market day 3. Sold at lower price 4. Sold on other market day
- 8.31. What did you do, when the tomato you offered to the market was not sold? 1. Took back home 2. Took to another market day 3. Sold at lower price 4. Sold on other market day
- 8.32. Who set your selling price for potato last year? 1. Yourself 2. Buyers 3. Set by demand and supply 4. Negotiation 5. Other (specify) -----
- 8.33. Who set your selling price for head cabbage last year? 1. Yourself 2. Buyers 3. Set by demand and supply 4. Negotiation 5. Other (specify) -----
- 8.34. Who set your selling price for tomato last year? 1. Yourself 2. Buyers 3. Set by demand and supply 4. Negotiation 5. Other (specify)-----
- 8.35. If you decided on the selling price, how did you set the price? 1. Individually 2. coordinating with other farmers 3. Other (specify)-----
- 8.36. When did you get the money after sale? 1. As soon as you sold 2. After some hours 3. Other day after sale 4. Other (specify)-----

9. Non-farm income

- 9.1. did you participate on other source of income in addition to vegetables? 1. Yes 0.No
- 9.2. If yes what type of job activities? 1. Trading 2. Renting land 3. Animal selling 4. Grain selling 5.Other (specify)
- 9.3. What amount of your household expenditure was covered by off farm incomes?-----

10. lagged price and production

- 10.1. What was farm gate lagged year (2021) average selling price of potato? -----Birr/qt

- 10.2. What was farm gate lagged year (2021) average selling price of head cabbage?-----Birr/qt
- 10.3. What was farm gate lagged year (2021) average selling price of tomato? -----Birr/qt
- 10.4. How is the trend of price per unit of sales of vegetables during the last 3 years?

Vegetable	Increasing	Decreasing	The same
Potato			
Head cabbage			
Tomato			

- 10.5. If increasing, why? -----
- 10.6. If decreasing why?-----
- 10.7. How was your production trend of vegetables during the last 3 years? (√)

Vegetable	Increasing	Decreasing	The same
Potato			
Head cabbage			
Tomato			

- 10.8. If increasing why?-----
- 10.9. If decreasing why?-----

11. vegetables marketing constraints

- 11.1. What are the vegetables marketing constraints? (Rank constraints)

Constraints	Vegetable types		
	Potato	Head cabbage	Tomato
Lack of credit			
High interest rate			
Lack land			
Low access to extension			
Perishablity of the crop			
Storage problem			
Low market access			
Lack of transportation			
Low market information			
Low price			
Long distance from market			
Low demand			
Price setting problem			
Brokers entrance			
Lack of road			
Other (specify)			
1.severe 2. More severe 3. Most severe			

12. Farmers production and marketing activities

12.1. do you allocate land for vegetable production 1.Yes 0. No

12.2. If yes for Q. 12.1. how much?

Vegetable	Total land cultivated	Land allocated for vegetable	Total quantity of vegetable produced (qt)	Total quantity of vegetable sold (qt)
potato				
Head cabbage				
tomato				

12.3. On which basis do you decide what kinds and varieties of vegetables will be grown?

1.Experience 2.Market 3.Merchant Ability 4.Quality 5. Experiments 6.other(specify)-----

12.2.What was your source of information for potato, head cabbage and tomato production and marketing? 1.market 2.friends 3.traders 4.social media 5. Other (specify)-----

12.3. If social media for Q.12.2.do you receive information about the technology or production over the Internet? 1. YES 0.NO

12.4. Do you analyze the needs of consumers? 1. YES 0. NO

12.5. Do you monitor changes in the market environment? 1. YES 0. NO

12.6. Do you have a constant supplier of raw materials? 1. YES 0.NO

12.7. What are the reviews of the biggest problems in business? 1. Market 2. Placement 3.Lack of working capital 4.Low profit 5.Transportation 6. Other (specify)-----

12.8. Are you a member of an association of agricultural producers? 1.YES 0.NO

12.9. Did you specialize in any market segment? 1. YES 0. NO

12.10. Is agricultural production your main activity? 1.YES 0.NO

12.11. Do you have a contract for production with a famous customer? 1.YES 0. NO

12.12. Do you need the Internet or a computer? 1.YES 0.NO

12.13. What is more difficult for you, production or sale? 1.Production 0.sale

12.14. How do you contact customers or suppliers? 1. MARKET 2. JOINED 3. Mobile phone 4.other (specify)-----

12.15. what were the types of information that you are looking for on the Internet? 1. Weather Forecast 2. Production Of Technology 3.New Machines 4. News For Seed 5. Experiences 6. News For Vegetables 7. Other (Specify)-----

Thank you for your respond to the question!!

II. Traders’ Questionnaire

Title: Analysis of vegetable market performance in Kersa district, Jimma zone, Ethiopia

By: Ibrahim Gali

1. General Information

- ❖ Name of market 1. Village market 2. Serbo market 3. Jimma market
- ❖ Name of trader-----
- ❖ Age of the trader -----year
- ❖ Sex of trader 1. Male 2. Female
- ❖ Religion of trader 1.Muslim 2.Orthodox 3.Protestant 4.Catholic 5.other (specify)-----
- ❖ Marital status of trader 1. Single 2.Married 3.Divorced 4. Widowed(widower)
- ❖ Total family size -----
- ❖ Educational level of trader 1. Illiterate 2. Read and write 3.Religious schools 4.Certificate 5. -----years of formal education 6. Other (specify)

2. Marketing activities

- 2.1.what is your type of business 1.Wholesalers 2.Retailers 3.Collectors 4.Brokers 5.Cooperatives 6.Exporters 7.Institutions/Hotels 8.Processor 9. others(specify)-----
- 2.2.How long you involved in business? 1. A year ago 2. More than one year 3. Other (specify)
- 2.3.When you trade vegetable? 1. Year round 2.When purchase price becomes low 3. During high supply 4.Other (specify)-----
- 2.4.What type of trade you drive? 1.Alone 2.Partnership 3.other -----
- 2.5.How many marketing days were there in a week?-----
- 2.6.What is your source of initial capital? 1.Own 2.Credit 3.Gift 4.Share 5.Others (specify) -----
- 2.7.If your answer for Q.1.6. is credit, from where you get? 1. family / Relative 2. Friend 3.Other traders 4.Micro finance institution 5. Bank 6. Others (specify)
- 2.8.Was there barriers to entry the market? 1. Yes 2. No
- 2.9.If yes for Q.1.8 what type of barriers? 1.Legal barriers 2.Social barriers 4.Financial barriers 5.Administrative problems 6.unlicensed traders competition 7.Others(specify)-----

3. Capital activities

- 3.1.What was the amount of initial capital when you start this business? -----birr
- 3.2. What was the amount of your capital in 2023?-----birr

- 3.3.What was the source of your initial capital in when you start this business? 1. Own 2. credit
3. Gift 4. Friend 6. Family/relative 7. Other (specify)-----
- 3.4.If it was credit, from where did you borrow? 1. relative/family 2.Other traders
3. Microfinance institutions 4. Bank 6. NGO 7. Friends 8.Other(specify)-----
- 3.5.How much was the rate of interest? -----birr for formal-----for informal

4. Cost activities

4.1.what is your average cost incurred per quintal in the trading process of vegetables

Components	Cost incurred per qt for all vegetable types		
	Potato	Head cabbage	Tomato
Purchase price			
Labor for packing			
Loading/unloading			
Transportation fee			
Sorting			
Storage cost			
Lost in transport and storage			
Lost due to perishability			
Processing cost			
Telephone cost			
Watching and warding			
Other personal expenses			
License and taxes			
Other cost (specify)			
Total cost			
Selling price			
Revenue			

5. Selling activities

5.1. To Where market and whom did you sell vegetables?

	vegetable			1. Wholesalers Processers 2.Retailers 3. Consumers 4.Brokers 5. Exporters 6.Cooperatives 7.Hotels and organization 8.Others (specify)
	Potato	Head cabbage	Tomato	
What was your marketing type in the market channel?				
From where did you buy your products				
What was the amount of vegetable you purchased in kg				
Average price/kg				
To whom do you sell?				
Average quantities sold (qt)				
Average price/kg				

How many weeks did you operate in this market in a month?				
Average terms of price /qt sell 1.cash				
2.credit				
3.advance service				

- 5.2.When did you get the money after sale? 1.As soon as I sold 2.After some hours 3.On the other day after sale 4.Others (specify) -----
- 5.3.Do you know the market prices in different markets before you sold your vegetables? 1.Yes 2.No
- 5.4.What is your source of information? -----
- 5.5.What percent of the total purchased is sold on district market? Potato-----%, head cabbage-----%, and tomato-----%
- 5.6.What percent of the produce is sold to domestic market (Jimma)? Potato -----%, head cabbage -----% , and tomato-----%
- 5.7.Do you have other branch shops/ shades to sell your vegetables? 1.Yes 2. No
- 5.8.What are prices of Vegetables during scarce and abundant seasons?

Price	Potato		Head cabbage		Tomato	
	Max	min	max	Min	max	min
Purchasing price						
Selling price						

- 5.9. Is vegetable trading in your area need licensing? 1. Yes 2. No
- 5.10. If yes, did you have vegetable trading license? 1.Yes 2. No
- 5.11. Do you want to expand vegetables trading? 1.Yes 2.No
- 5.12. If your answer to Q.5.9. is yes, why? -----
- 5.13. If your answer to Q.5.9. is No, why? -----
- 5.14. Are there problems on vegetables marketing? 1.Yes 2.No
- 5.15. If your answer to Q.5.14 is yes, what are the problems?

Problems	potato	Head cabbage	Tomato
Lack of Credit			
Price setting			
Supply shortage			
Storage problem			
Lack of demand			
Inadequate information			
Quality problem			
Administrative problem			
Capital shortage			
Infrastructure problems			
competition with unlicensed traders			

Farmers resultant to sell at local market			
Others (specify)			

6. Purchasing activities

- 6.1.3.1. How did you attract your suppliers? 1.by giving better price relate to others 2. by fair scaling weighing 3. Other (specify) -----
- 6.2.How did you attract you buyers? 1. by giving better price relate to others 2. by fair scaling 3. Quality of your product 4.by giving credit 5. Other (specify) -----
- 6.3.From where market did you buy vegetable last year? Rank according to the order of your preference

Vegetable	From market 1.Village market 2.Serbo market 3.Jimma market 4. Other (specify)	From sellers 1.Farmers 2.Retailers 3.Wholesalers 4.Collectors 5.Cooperatives 6.Other (specify)	Average quantity (qt) of markets in a week	Average price per (qt)/kg	Number of marketing days in a week	Terms of payment 1.cash 2.credit
Potato						
Head cabbage						
Tomato						

- 6.4.Why did you prefer this market(s)? 1. Better quality 2. High supply 3. Short distance 4. Other (specify) -----

- 6.5. How many regular suppliers do you have for vegetables last year?

Suppliers/agent	Vegetables		
	Potato	Head cabbage	Tomato
Farmers			
Assemblers			
Rural wholesalers			
Urban wholesalers			
Rural retailers			
Urban retailers			
Collectors			
Other (specify)			

- 6.6. Who set the purchase price last year? 1. My Self 2. By the market 3. Negotiation 4. The seller
4. Other (specify)-----
- 6.7. If you decide on the purchasing price, how did you set it? 1. Individually 2. Agreeing With
other traders 3. Other (specify) -----
- 6.8. When did you set the purchasing price? 1. One day before the market day 2. One week
before the market day 3. Early in the morning of the market day 4. At the time of purchase
5. Other (specify) -----
- 6.9. Did you use brokers to purchase Vegetables? 1. Yes 2. No
- 6.10. If yes for Q.6.9., what problems did they create? 1. Cheating quality 2. Wrong price
information 3. Cheating scaling (weighing) 4. Charged high brokerage 5. Other (specify) -----

- 6.11. What was the advantage of using brokers? 1. You could get buyers and sellers easily 2.
Reduce transaction costs 3. Purchased at lower price 4. Save your time 5. Sell at higher price
6. Other (specify)-----
- 6.12. At which season of the year was preferable to purchase vegetables in terms of price?
Lowest price for potato-----months, for Head cabbage-----months,
for tomato-----months
- 6.13. How do you measure your purchase? (✓) 1. By weighing (kg) 2. By traditional weighing
materials 3. Other (specify)-----
- 6.14. Have you ever stopped purchasing due to lack of supply? 1. Yes 2. No
- 6.15. If your answer to Q.12 is Yes, for how long?-----

Thank you for your respond to the question!!

Heckman Two Stages Regression Analysis Results

```
. heckman PQ Age Sex Edu VFE EA CRA TRA TLS IRA FS NVFI MD LP SUC OMP PA, twostep select(PP = Age Sex Edu VFE
> EA CRA TRA TLS IRA FS NVFI MD LP SUC OMP PA) rhosigma
```

Heckman selection model -- two-step estimates

(regression model with sample selection)

Number of obs = 150

Censored obs = 45

Uncensored obs = 105

Wald chi2(16) = 2154.38

Prob > chi2 = 0.0000

		Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
PQ	Age	.0521146	.1340937	0.39	0.698	-.2107043	.3149335
	Sex	-.0793976	2.099614	-0.04	0.970	-4.194566	4.035771
	Edu	-.2164231	.2861693	-0.76	0.449	-.7773046	.3444584
	VFE	9.417136	.5966328	15.78	0.000	8.247757	10.58651
	EA	-4.432529	4.538471	-0.98	0.329	-13.32777	4.462712
	CRA	-2.994813	3.274994	-0.91	0.360	-9.413683	3.424057
	TRA	-.7285551	2.029495	-0.36	0.720	-4.706293	3.249183
	TLS	2.665307	1.52662	1.75	0.081	-.3268129	5.657427
	IRA	-2.411508	1.805808	-1.34	0.182	-5.950827	1.12781
	FS	1.405351	.6513439	2.16	0.031	.1287403	2.681961
	NVFI	-.233411	2.178983	-0.11	0.915	-4.504139	4.037317
	MD	1.002033	.6213847	1.61	0.107	-.215859	2.219924
	LP	.5996405	2.700689	0.22	0.824	-4.693613	5.892894
	SUC	-2.780846	2.61771	-1.06	0.288	-7.911464	2.349772
	OMP	1.295723	1.975796	0.66	0.512	-2.576765	5.168211
	PA	3.628678	2.184947	1.66	0.097	-.6537387	7.911094
	_cons	-3.225066	9.482398	-0.34	0.734	-21.81022	15.36009
PP	Age	-.005937	.0316349	-0.19	0.851	-.0679403	.0560662
	Sex	.1571945	.3996822	0.39	0.694	-.6261682	.9405573
	Edu	.0703054	.0675378	1.04	0.298	-.0620662	.202677
	VFE	.2728391	.1007335	2.71	0.007	.0754051	.4702731
	EA	1.91989	.4982506	3.85	0.000	.943337	2.896443
	CRA	1.075531	.6784137	1.59	0.113	-.2541351	2.405198
	TRA	.3333462	.4386805	0.76	0.447	-.5264517	1.193144
	TLS	-.1716606	.2972372	-0.58	0.564	-.7542349	.4109136
	IRA	-.1202167	.4121989	-0.29	0.771	-.9281117	.6876783
	FS	-.0874278	.1411154	-0.62	0.536	-.3640845	.1892288
	NVFI	-.026819	.4762111	-0.06	0.955	-.9601757	.9065376
	MD	-.1369856	.0680211	-2.01	0.044	-.2703044	-.0036668
	LP	.8671967	.5142363	1.69	0.092	-.1406878	1.875081
	SUC	.3132069	.5871743	0.53	0.594	-.8376336	1.464047
	OMP	.1086509	.4403586	0.25	0.805	-.7544361	.9717379
	PA	-.6001286	.4961325	-1.21	0.226	-1.57253	.3722731
	_cons	-1.700931	1.946464	-0.87	0.382	-5.515931	2.114068
mills							
	lambda	-7.045655	4.971839	-1.42	0.156	-16.79028	2.698971
	rho	-0.95807					
	sigma	7.3540354					

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. heckman HCQ Age Sex Edu VFE EA CRA TRA TLS IRA FS NVFI MD LP SUC OMP PA, twostep select(HCP = Age Sex Edu VF
> E EA CRA TRA TLS IRA FS NVFI MD LP SUC OMP PA) rhosigma
note: two-step estimate of rho = -1.0044554 is being truncated to -1

Heckman selection model -- two-step estimates

(regression model with sample selection)

Number of obs = 150

Censored obs = 33

Uncensored obs = 117

Wald chi2(16) = 1674.74

Prob > chi2 = 0.0000

		Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
HCQ	Age	.1092115	.2191775	0.50	0.618	-.3203686	.5387915
	Sex	-1.491329	3.213112	-0.46	0.643	-7.788913	4.806255
	Edu	-.2591166	.4717731	-0.55	0.583	-1.183775	.6655417
	VFE	11.02028	.7950792	13.86	0.000	9.46195	12.5786
	EA	-1.065131	5.605549	-0.19	0.849	-12.05181	9.921544
	CRA	10.18105	4.607836	2.21	0.027	1.149854	19.21224
	TRA	-4.996018	4.106082	-1.22	0.224	-13.04379	3.051755
	TLS	4.846605	2.505354	1.93	0.053	-.0637992	9.757009
	IRA	-.3144612	4.178953	-0.08	0.940	-8.505059	7.876137
	FS	2.321368	.9983565	2.33	0.020	.3646248	4.27811
	NVFI	-6.83341	3.774242	-1.81	0.070	-14.23079	.5639682
	MD	-.008047	.5205988	-0.02	0.988	-1.028402	1.012308
	LP	6.173159	4.476492	1.38	0.168	-2.600603	14.94692
	SUC	4.724243	4.436811	1.06	0.287	-3.971746	13.42023
	OMP	-.7248628	3.241936	-0.22	0.823	-7.078941	5.629216
	PA	-2.459528	4.156683	-0.59	0.554	-10.60648	5.687421
	_cons	-12.80699	18.0469	-0.71	0.478	-48.17826	22.56428
HCP	Age	-.0139607	.0302904	-0.46	0.645	-.0733289	.0454074
	Sex	-.5323279	.3867385	-1.38	0.169	-1.290321	.2256656
	Edu	.0675193	.065264	1.03	0.301	-.0603958	.1954344
	VFE	.0887275	.0874017	1.02	0.310	-.0825766	.2600316
	EA	1.731137	.577064	3.00	0.003	.6001125	2.862162
	CRA	-.6488588	.6798086	-0.95	0.340	-1.981259	.6835417
	TRA	1.170794	.5062523	2.31	0.021	.1785575	2.16303
	TLS	-.097848	.277627	-0.35	0.725	-.6419869	.4462909
	IRA	1.162712	.5397973	2.15	0.031	.1047289	2.220696
	FS	.0996714	.1322953	0.75	0.451	-.1596226	.3589653
	NVFI	.8433782	.5010567	1.68	0.092	-.1386749	1.825431
	MD	-.0041688	.0544571	-0.08	0.939	-.1109028	.1025652
	LP	1.263972	.5719009	2.21	0.027	.1430664	2.384877
	SUC	1.012056	.548131	1.85	0.065	-.0622612	2.086373
	OMP	.3866126	.4126135	0.94	0.349	-.422095	1.19532
	PA	1.172041	.591996	1.98	0.048	.0117503	2.332332
	_cons	-3.956109	1.951901	-2.03	0.043	-7.781766	-.1304529
mills	lambda	-12.26673	8.421045	-1.46	0.145	-28.77168	4.238214
	rho	-1.00000					
	sigma	12.266731					

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Heckman selection model -- two-step estimates	Number of obs	=	150
(regression model with sample selection)	Censored obs	=	92
	Uncensored obs	=	58
	Wald chi2(16)	=	64.52
	Prob > chi2	=	0.0000

	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
TQ						
Age	.0543915	.1250278	0.44	0.664	-.1906586	.2994416
Sex	1.189623	1.566327	0.76	0.448	-1.880322	4.259567
Edu	.084347	.2804608	0.30	0.764	-.465346	.63404
VFE	.8905403	.2407132	3.70	0.000	.4187512	1.362329
EA	7.361199	2.103681	3.50	0.000	3.23806	11.48434
CRA	12.99837	4.649815	2.80	0.005	3.884902	22.11184
TRA	-.5396543	1.378358	-0.39	0.695	-3.241185	2.161877
TLS	.2707165	.8201958	0.33	0.741	-1.336838	1.878271
IRA	1.342945	1.561677	0.86	0.390	-1.717886	4.403777
FS	.1995859	.4390087	0.45	0.649	-.6608554	1.060027
NVFI	-2.308225	1.617292	-1.43	0.154	-5.478059	.8616096
MD	-.4848422	.5545934	-0.87	0.382	-1.571825	.6021409
LP	-.1285294	.9896794	-0.13	0.897	-2.068265	1.811207
SUC	1.768765	1.465223	1.21	0.227	-1.103019	4.640548
OMP	-1.721384	1.614381	-1.07	0.286	-4.885512	1.442744
PA	4.160069	1.549005	2.69	0.007	1.124075	7.196064
_cons	-18.61955	9.909197	-1.88	0.060	-38.04122	.8021136
TP						
Age	.0278147	.0294358	0.94	0.345	-.0298785	.0855079
Sex	.6743296	.3592422	1.88	0.061	-.0297721	1.378431
Edu	.1120947	.0571999	1.96	0.050	-.0000151	.2242045
VFE	-.0518443	.0432862	-1.20	0.231	-.1366838	.0329951
EA	-.3685821	.3231778	-1.14	0.254	-1.001999	.2648346
CRA	1.9739	.5041216	3.92	0.000	.9858401	2.9619361
TRA	.0724913	.3976689	0.18	0.855	-.7069255	.8519081
TLS	.0459319	.2701792	0.17	0.865	-.4836096	.5754734
IRA	.1022018	.4176823	0.24	0.807	-.7164404	.9208441
FS	.0580701	.1156292	0.50	0.616	-.168559	.2846993
NVFI	.3790744	.4258787	0.89	0.373	-.4556325	1.213781
MD	-.2847372	.0821755	-3.46	0.001	-.4457982	-.1236762
LP	.3648532	.3121203	1.17	0.242	-.2468914	.9765978
SUC	-.1259134	.4678701	-0.27	0.788	-1.042922	.7910951
OMP	-.5653993	.3947757	-1.43	0.152	-1.339146	.2083469
PA	-.3127872	.4504037	-0.69	0.487	-1.195562	.5699878
_cons	-2.700633	1.664234	-1.62	0.105	-5.962471	.5612044
mills						
lambda	2.696835	3.40316	0.79	0.428	-3.973236	9.366906
rho	0.72507					
sigma	3.7193892					

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