



DAMBI DOLLO UNIVERSITY

COLLEGE OF BUSSINESS AND ECONOMICS

DEPARTMENT OF ECONOMICS

**ASSESSMENT OF FACTORS ASSOCIATED WITH SMALL-SCALE
COFFEE PRODUCTION AND ITS MARKETING IN SAYO DISTRICT,
OROMIA REGIONAL STATE, ETHIOPIA**

BY

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**A RESEARCH THESIS SUBMITTED TO DEPARTMENT OF ECONOMICS,
COLLEGE OF BUSSINESS AND ECONOMICS, DAMBI DOLLO
UNIVERSITY IN PARTIAL FULFILLMENT OF REQUIREMENT FOR THE
DEGREE OF MASTERS OF SCIENCE IN DEVELOPMENT ECONOMICS**

NOVEMBER, 2024

DAMBI DOLLO, ETHIOPIA

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DECLARATION BY STUDENT

I, the undersigned, declare that this thesis entitled as **“Assessment of Factors Associated with Small-Scale Coffee Production and Its Marketing in Sayo District, Oromia Regional State, Ethiopia”**, is my original work and has not been presented for a degree in any other university and that all sources of materials used for the thesis have been duly acknowledged.

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DECLARATION BY ADVISOR

This is to certify that the thesis prepared by Nagasu Ragasa Erana entitled as **“Assessment of Factors Associated with Small-Scale Coffee Production and Its Marketing in Sayo District, Oromia Regional State, Ethiopia”** and submitted in partial fulfillment of the requirements for the degree of Master of science in Economics compiles with the regulations of the university and meets the accepted standards with respect to originality and quality.

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POST GRADUATE PROGRAM

APPROVAL SHEET

We, the undersigned, members of the Board of Examiners of the thesis all have read and evaluated the thesis prepared by Nagasu Ragasa Irana under the title of “ **Assessment of Factors Associated with Small-Scale Coffee Production and Its Marketing in Sayo District, Oromia Regional State, Ethiopia**” and examined the candidate during open defense. This is, therefore, to certify that the thesis is accepted for fulfillment of the requirement for the degree of of **Masters of Science in Development Economics**.

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ABBREVIATIONS AND ACRONYMS

AD	Anno Domini
ADLI	Agricultural Development Led Industrialization
ANOVA	Analysis of variance
B	Billion
CBK	Central Bank of Kenya
CD	Cobb-Douglas
CI	Confidence interval
CIA	Central Intelligence Agency
CSA	Central Statistical Agency
DA	Development agency
DF	Degrees of freedom
ECX	Ethiopian Commodity Exchange
FAO	Food and Agricultural Organization
FAS	Foreign Agricultural Service
FC	Forest Coffee
GC	Garden Coffee
GDP	Gross Domestic Product
HH	Household
ICO	International Coffee Organization
Kg	Kilogram
KM	Kilometer
LR	Likelihood ratio
M	Million
MLE	Maximum likelihood estimator
MOAC	Ministry of Agriculture and Cooperatives
MoFED	Ministry of Finance and Economic Development

MT	Metric Tone
NTCDB	Nepal Tea and Coffee Development Board
OLS	Ordinary Least Square
OR	Odds ratio
Ref.	Reference category
SE	Standard error
SFC	Semi-managed Forest Coffee
SNNPR	Southern Nations, Nationalities, and Peoples Region
SURE	Seemingly unrelated regression
TV	Television
USDA	United States Development Agency
VIF	Variance inflation factor
WB	World Bank

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First and foremost, I want to express my appreciation to my wife, my daughter Nadhii, and my parents. This thesis is an expression of my family and friends' everlasting love and support during this difficult academic journey. My parents, who fostered my interest and encouraged my academic pursuits from the start, have my sincere appreciation.

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ABSTRACT

Coffee is a cash crop that is highly sought after worldwide and is often farmed by smallholder farmers. Because of this, bulk coffee manufacturing in particular requires maintaining coffee's quality in order to stay competitive in the global, national, and local markets. One of the main income crops for Sayo district's smallholder farmers is coffee. The objective of this article is to examine the factors that influence the production and sale of small-scale coffee in Sayo district, Kellem Wollega zone, Oromia Regional State. In order to accomplish the study's goals, two distinct response variables as well as fifteen explanatory variables—eight of which were continuous and seven of which were dummy variables—are generally used. 375 household heads who were actively involved in coffee cultivation were chosen for this study using a basic random selection technique in the Sayo district. A questionnaire was utilized to collect primary data for the study, which also included secondary data. Data of this study was analysed by using both descriptive analysis and econometric and inferential models and tests.

Key words: coffee production; market participation; Cobb-Douglas function; logit model

CHAPTER ONE INTRODUCTION

1.1. Background of the Study

The amount of coffee produced worldwide is predicted to rise from 6.9 million bags (60 kg) the year before to 171.4 million bags in 2023–2024. Increased output in Ethiopia, Brazil, and Colombia is expected to more than balance decreased production in Indonesia. Due mostly to strong shipments from Brazil, it is projected that worldwide coffee bean exports would rise by 8.4 million bags to 119.9 million. Global consumption is expected to hit a record 169.5 million bags, while ending stocks are expected to continue to decline to a 12-year low of 26.5 million bags (FAS, 2023).

During the coffee year 2022–2023, consumption did not quite follow the established trend because of the consequences of a protracted stock depletion, decreased disposable incomes, and a high cost of living. Even though coffee is a rather inelastic item, the challenging global economic situation would have had a negative impact on demand. At 4.9% at the end of September 2023, the average benchmark interest rate in the US, UK, and EU was at its highest since an average of 5.8% in 2000. In 2021, the worldwide inflation rate reached its highest point at 9.4%. According to the European Coffee Federation, there was a notable decrease in stock levels at the same time. The total amount of bags stored in the Intercontinental Exchange's warehouses in the USA decreased by 4.8 million, from 14.5 million to 9.8 million. This decrease would have reduced the need to purchase coffee from outside markets, which is probably why global coffee consumption rates in 2022–2023 were lower and less consistent (ICO, 2023).

Ethiopia, known for being the birthplace of coffee, holds the title of Africa's largest coffee producers. In terms of Arabica coffee production, Ethiopia ranks as the sixth largest producer globally. A significant portion of the population, nearly 20 percent, directly or indirectly relies on coffee for their livelihood, amounting to approximately 15 million people. The Southern Nations, Nationalities, and Peoples Region (SNNPR) and Oromia, which is in the country's center, are the main coffee-growing areas. It's

interesting to note that just 5% of coffee is produced on contemporary plantations, which are either privately or publicly held. Smallholder farmers grow the bulk of coffee, with private gardens accounting for around half of production (Abu, 2012).

It has established a long-term, strategic framework to improve the quality of traded commodities and agricultural goods, increase competition in the marketing sector, and reduce marketing expenses. Nonetheless, there is still volatility in the agricultural commodities market today. The reason for this is the lack of a comprehensive commodity marketing policy that includes facilities for transportation, grading, storage, and information for producers and consumers, as well as a well-equipped institutional establishment that can provide comprehensive marketing services to all market participants (Tesfaye, 2016).

Ethiopia's main export commodity is coffee, which supports the livelihood of over 15 million smallholders and other stakeholders in the coffee industry. Ethiopia's coffee production is expected to reach 8.25 million in the first half of the 2022/23 marketing year (October to September). Exports are expected to reach an all-time high of 4.72 million bags. In the first half of 2021/22, Ethiopia exported 4.70 million bags (282,000 MT). In 2020/21, Ethiopia's main export destinations were Germany, Saudi Arabia, United States, Belgium and Japan. And, also local consumption is expected to rise to 345 million bags (207,000 MT) in 2021/22 (FAS, 2022).

Coffee production in Ethiopia has a long history dating back several centuries. Ethiopia is the natural home of the coffee plant, Coffee Arabica (Thomas *et al.*, 2004). These days, the plant is grown all over the world, accounting for 17% of the global coffee market in Ethiopia alone. Coffee is a major contributor to Ethiopia's economy, accounting for between 30 and 35 percent of its foreign exchange earnings. It is estimated that 15 million people work in coffee-related jobs. Approximately, in 2013, coffee brought approximately \$300 million, or 24 percent of total exports (CIA, 2010).

The improved prices and simplicity of marketing that come with using ECX for trade have helped a lot of farmers. Nonetheless, some manufacturers and dealers have voiced their concerns. First; few growers dispute all coffee must be traded through ECX

by cooperation or a commercial enterprise in order to comply with legal requirements. (Sesame must also be exchanged through ECX; other crops may choose to use ECX). Second, growers (and buyers) of specialty coffees suffer because ECX handles coffee in a commodity manner (Hailu, 2020)

Commercial farms and some coffee cooperatives have benefited from this as they are able to market their coffee under brands like Yirgachefe or according to production methods like organic or bird-friendly, and may fetch premium prices without having to sell through ECX. To tackle this, ECX is now implementing measures, including a pilot project with Starbucks, to maintain the identity of specialty coffee (Abu Tefera, 2012).

1.2. Statements of the Problem

Ethiopian agriculture is mostly based on rain-fed, low-input, low-output subsistence farming. The use of artificial fertilizer and modified seeds is comparatively low, despite government initiatives to encourage the adoption of contemporary, intensive agricultural techniques. The primary reason of low agricultural output is poor land management practices that have led to significant land degradation. Smallholder farmers also have limited access to improved production technologies, irrigation, agricultural markets, and financial services (MoFED, 2012).

The coffee business is still in its infancy and cannot provide excess supply or additional economic leverage. Nonetheless, in the mid-hill region, it has supported many marginalized and rural people's means of subsistence. Ethiopia has given the agricultural sector top priority since the early 1990s, when the Agricultural Development Led Industrialization (ADLI) and related policy frameworks were adopted (FAO, 2014). The agricultural sector still employs more than 70% of Ethiopians. Agriculture's share of GDP decreased over a five-year period, from 44.7% in 2010–11 to 37.2% in 2015–16. Despite a decline in GDP over the last five years, agriculture remains the largest sector in terms of its total contribution to the national economy.

It is the key provider of primary commodities for export, raw materials for the nation's manufacturing sector, and food for domestic consumption (Edward et al., 2017).

Ethiopia's central, eastern, southern, and west regions are the primary producers of coffee (Melkamu, 2015). Plantation, semi-managed forest coffee (SFC), garden coffee (GC), and forest coffee (FC) are the four types of Ethiopian coffee production systems that may be separated according to vegetation, agronomic practices, management level, and structural complexity (Tadesse, 2015; Tesfu, 2012).

The number of smallholder coffee growers exceeds 4 million. Fruit-growing farmers are outnumbered by farmers who cultivate and produce stimulant crops like coffee (CSA, 2018). Approximately 15 million individuals, or 15% of the country's workforce, work for it at different points throughout the value chain. Slightly larger than half a hectare, tiny plots are used to raise around 95% of the crop. Ethiopia is the world's sixth-largest producer of coffee, accounting for 4% of global production. According to Francom (2018), it is the largest producer in Africa, accounting for about 40% of the continent's output.

According to the study of Degaga (2020), the number of coffee growers rose between 2012–2013 and 2016–17 before falling after that. The overall area of land set aside for coffee cultivation has grown over the years under consideration, albeit at varying rates.

As the report of Span Consultants Ltd released in 2009 shows, Sayo District's main cash crop is coffee. Furthermore, an analysis of the land in Sayo reveals that 55.2% of it is arable or farmed, 4.45% is grazing, 26.51% is forest, and 13.83% is infrastructure or other uses. Coffee plants are grown on more than 50 square kilometers. The District has potential arable land for additional production.

In the context of increased demand in global markets, the comparatively sluggish growth rate of organic coffee productivity made it an attractive subject for a comprehensive analysis of production management from farm to fork. Even so, coffee is the second most traded commodity after oil, and is therefore extremely important to the economies of both developed and developing nations. The most popular and exportable cash crop among agricultural products worldwide is coffee. However, because they did not adopt or have access to certain technologies, such as improved coffee plant seedling varieties and pruning techniques, proper use of natural fertilizer

(compost) on coffee farms, and low market participation, farmers in the study area produce low yields of coffee per hectare. It is necessary to ascertain the limiting constraints preventing smallholder farmers from producing and marketing coffee. Low crop productivity in the study area was largely caused by the production technique, which was still dominated by traditional methods. These included a lack of improved coffee plant seedlings, ignorance of the area's production techniques (such as pruning coffee plants), and a lack of knowledge and ability to use fertilizer (Wayback, 2016).

To solve problems with coffee production and marketing, the role of agricultural production and marketing is crucial. Consequently, the study was attempted to focus on the factors that influence Sayo District's coffee production and marketing using a Cobb Douglas Production function and logit model. Therefore, the current study focused on the factors that affect coffee sales and productivity for small scale growers in Sayo district. It was also examined potential growth areas for the coffee crop through the use of structured data, effective data collection techniques, and suitable data analysis methodology.

1.3. Research Questions

The following research issues were addressed in this study:

- ▶ What elements affect farmers' decisions about coffee production in the research area?
- ▶ What are the factors that influence smallholders' involvement in the marketing of coffee?
- ▶ What is the relationship between coffee production and marketing?

1.4. Objectives of the Study

1.4.1. General Objective

This study's primary goal was to evaluate the determinants associated with coffee production and marketing of smallholders in a case of Sayo district.

1.4.2. Specific Objectives

The specific objectives of the study were

- To evaluate the elements influencing coffee production within Sayo district
- To determine the factors impacting smallholders' involvement in coffee marketing, and
- To examine the connection between coffee production and marketing and put bench mark ideas for future studies

1.5. Significance of the Study

This study has a crucial role in

- Comprehending the role that is played in developing a market for agricultural producers and increasing agricultural production.
- To empower farmers in the region, it is crucial to support their coffee production and commercialization.
- The study's conclusions will help local partners—such as government representatives, nonprofit organizations, and community-based organizations—in their endeavors to enhance rural families' quality of life and investigate the factors that influence coffee production and selling in the research region.
- The study's findings will serve as a springboard for more empirical research and legislative initiatives aimed at enhancing smallholder farmers' resource use efficiency. It will serve as a starting point for individuals who wish to carry out an in-depth investigation of the manufacturing and marketing of coffee.

1.6. Scope and Delimitation of the Study

The study was conducted just in the Sayo district. During the research period, additional focus was placed on the variables affecting coffee production and marketing at the study site.

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This study identified the demographic and socioeconomic factors impacting smallholder farmers' production and sales of coffee in addition to investigating the connection between coffee production and marketing in the research region.

1.7. Limitations of the Study

The study's primary limitation was mostly associated with the narrow scope of the research area. Other difficulties facing this study were time constraints, political unrest in the region, respondent circumstances, and a lack of funding for data collection. However, the findings of this investigation could serve as a guide for other fields that are comparable.

1.8. Definition of Key Terms

Small scale holder: Knight (2022) defines small scale holder as farmer or producer that cultivate livestock, crops, or seafood on a small scale. Smallholder farmers are sometimes referred to as family farmers since they typically store some of their harvest for household consumption and rely on the work of their family to meet production demands. Often referred to as "small-scale farmers," smallholder farmers are those who work on land that is not theirs.

Small scale farms: are family-run enterprises that function on up to 10 hectares, or 24 acres, of land in underdeveloped countries, according to Knight (2022). The vast majority of smallholder farmers work less than two hectares, or five acres.

1.9. Organization of the Paper

There were five chapters in this study. The study's history, problem statement, aims, hypothesis, importance, scope and delimitation, and thesis arrangement were all discussed in the first chapter, which served as the introduction. The literature review was provided in Chapter 2, along with details on earlier studies and empirical data that had been appropriately sorted and taken into consideration. The data source, technique, and model formulation were introduced in Chapter 3. The study region, data sources, data collection techniques, and the theoretical and econometric models utilized to evaluate the data set were all described in this chapter. The study and interpretation of

descriptive and econometric analysis were covered in Chapter 4. Lastly, chapter five included recommendations and findings derived from the data analysis and policy implications.

CHAPER TWO

LITRATURE REVIEW

2.1. Theoretical Review

2.1.1. Coffee Production and Marketing's Historical Background

Ethiopia is the birthplace of the coffee plant, which was introduced to Yemen about 1000 years ago when the first bushes were grown in Islamic monasteries there. The monks would consume the entire berry to experience the stimulative effect, and they had to prevent dozing off during prayers. Coffee was first popularized and disseminated throughout the Middle East in the 16th century, when the Turks first came up with the notion of roasting the coffee beans before grinding them. The first coffee cup in history was created when hot water was added.

David Beatty describes in words and pictures how coffee derives its name from the Ethiopian province where Kaffa initially flourished. Arabica coffee, which is still found growing wild in Ethiopia's highland woods, is the coffee plant's native habitat. This is where the story of coffee began. Although the actual discovery of coffee as a beverage plant remains unknown, coffee is thought to have been cultivated and used in Ethiopia as early as the ninth century. Approximately 575 AD, according to some writers, is when it was first grown in Yemen. Although it started in Ethiopia, it moved about 600 years ago to Yemen before starting its global trip from Arabia (Selamta, 2014).

The story of Kaldi, an Ethiopian goatherd who lived around 850 AD, is among the most well-known tales regarding the origins of coffee. One day he noticed his goats bleating excitedly, jumping up on their hind legs, and bouncing in an oddly joyful manner. He noticed that the bright red berries that grew on the nearby green bushes were being eaten by them. Kaldi tried them and soon felt a sense of joy that she had never felt before. He stuffed the berries into his pockets and hurried home to inform his wife about his discovery. After saying that, he said that it was sent from heaven. It was once believed that Ethiopian monks would have been utilizing the berries as a stimulant for decades before boiling them into a hot beverage, and the story attempted to condense the discovery of coffee and its development as a beverage into a single narrative

(Selamta, 2014).

All stages of the coffee value chain's processing, with the exception of loading and unloading, are handled primarily by farmer groups led by women. Processing it raises its price and adds value to the chain. Collectors, neighborhood dealers, main cooperatives, cooperative unions, exporters, and customers, service providers, importers, and domestic wholesalers and retailers are its value chain actors. Its supply chain is intricate, with small farmers selling to local traders, local traders selling to large coffee millers and exporters, local traders selling to foreign exporters after processing, and main cooperatives buying a variety of coffees and selling them to cooperative unions (Alemayeu, 2014).

2.1.2. Global Coffee Production and Marketing

The coffee tree requires a lot of rain and can only be grown in warm climates free from frost or abrupt temperature changes. This explains why it is an inappropriate product for the rest of the world and a common export for nations in tropical regions. Nowadays, the majority of the world's coffee-producing and -exporting nations are located in Latin America and Africa, but several Asian nations—particularly Indonesia and Vietnam—are starting to become significant exporters of coffee. Approximately 90% of the world's coffee is produced in underdeveloped nations (Ayele *et al.*, 2021).

The two types of coffee cultivated for commercial use are Arabica and Robusta. Arabica is a fragile shrub with a softer flavor that thrives in tropical highlands or warm climates. Robusta is more durable and can be grown from sea level to 800 meters (Coste *et al.*, 2024).

Worldwide coffee production decreased 1.4% to 168.5 million bags in the 2022–2023 coffee year due to off-biannual production and bad weather in several significant sources. However, in 2022–2023, it is expected to rise by 1.7% to 171.3 million bags. Unfavorable weather and rising fertilizer prices worldwide are expected to significantly offset the positive impact on Brazil's biennial output, which accounts for the relatively moderate growth rate in the coffee business in 2022–2023 (ICO, 2023).

The biennial production is projected to have an impact on the outlook for Arabica, which is forecast to increase by 4.6% to 98.6 million bags in the coffee year 2022–2023, following a 7.2% decline in the previous coffee year. Due to the cyclical nature of Arabica's output, its share of total production is expected to increase from 55.9 in coffee year 2021–2022 to 57.5% (ibid).

This report shows that despite experiencing the biggest decline in coffee production in over two decades a 7.6% decline in coffee year 2021/22 South America continues to be the world's leading producer of the beverage. With the help of the biennial production, the coffee industry is predicted to rebound in 2022–2023 and increase output to 82.4 million bags, a 6.2% increase. And, the non-producing nations are predicted to be the source of the global slowdown. The growth rate of coffee consumption in Europe is believed to have slowed the most of any region, falling from 6.0% in the coffee year 2022–2022 to 0.1% in the coffee year 2022–2023.

One of the most significant commodities traded globally is coffee. The performance and trade structure of this sector have significant implications for poverty reduction and development because smallholders in developing countries with low incomes make up a considerable portion of the production. Changes in consumer preferences and a growing focus on product differentiation in importing nations are causing a rapid transformation of the global value chains associated with coffee. The demand for specialty and certified coffee is rising, and wealthy consumers are increasingly willing to pay for premium, superior coffee. Additionally, over the past ten years, there has been a notable fluctuation in the pricing of coffee on the global market; for example, prices in 2011 were five times greater than in 2002 (Ponte, 2012).

2.1.3. Africa's Coffee Production and Marketing

Twelve percent of the world's total coffee bean production is produced in Africa. Uganda (23%) and Ethiopia (39%) make up 62% of the distribution of coffee beans. Cote d'Ivoire comes in third place, generating 13% of coffee beans in the nation.

Six percent of coffee produced in Africa is produced in Tanzania. Kenya makes up an additional 5% of the effort. Moreover, these regions of Africa are the origin of the

uncommon peaberry coffee bean. Peaberry coffee beans only have one seed, as opposed to two, and are found in around 10% of coffee cherries harvested globally. However, most coffee estates are substantially smaller than those located in Asia and even Latin America, particularly those in East Africa. This could be the cause of the 12% global coffee production that comes from Africa. The expense of transporting coffee beans from nearby farmers to potential customers is substantial. The journey from the farm to the buyer's destination is rather far, and there may be numerous downpours during that time (Preuss, 2023).

2.1.4. Ethiopia's Coffee Production and Marketing

Ethiopia is widely recognized as the origin of coffee and is Africa's largest producer. Ethiopia is now the world's sixth-largest producer of Arabica coffee. Coffee is a direct or indirect source of income for over 15 million individuals, or about 20% of the global population. Coffee, also known as coffee Arabica, is the second most traded commodity after oil and comes from Ethiopia (Bekako and Gray, 2013).

As such, it is essential to maintaining a balance in trade between developed and developing nations. There have been occasional reports of fluctuations in coffee production throughout Africa. For example, it was discovered to vary between 0.84 and 1.14 million tons each year over a ten-year period. Coffee is a significant foreign currency commodity that raises national GDP in the countries that produce it to varying degrees (Patrica, 2011).

Gray *et al.*, (2013) study shows that coffee ensures that the producing nations' economic progress will have a strong foundation. In 25 African countries, nearly 33 million people rely on growing coffee on their home farms for their livelihoods; in Ethiopia, 15 million people either directly or indirectly earn less than \$1 per day from the coffee system, with 90% of coffee produced by small-scale farmers using a mixed agricultural system and the remaining 5% coming from plantation systems, forests, and semi-forests.

Small-scale farmers usually produce 500–600 kg of coffee per hectare, but state farms and commercial plantations may yield up to 1200 kg (Dejene, 2011).

Coffee is grown mostly in the Southern Nations, Nationalities and Peoples Region (SNNPR) and two major areas of Oromia (in the middle of the country). Today, just 5% of the world's coffee is grown on government-controlled or privately held farms. Smallholder farmers grow the remaining portion, with about half of their output occurring in gardens or backyards. In both scenarios (current plantations and smallholder farming), coffee is typically produced in shadow (Tesfahun, *et al.*, 2019)

2.1.5. Status of Ethiopia's Coffee Export

As the report of OEC (2024), coffee became the first exported agricultural production of Ethiopia, making it the seventh largest exporter of coffee in the world by making foreign exchange about \$1.55B. Ethiopia's top export destination in 2022 was Germany (\$229M), followed by Saudi Arabia (\$208M), the United States (\$195M), Japan (\$130M), and South Korea (\$111M). The countries with the fastest growth rates for Ethiopia's coffee exports between 2021 and 2022 were the United Arab Emirates (\$48.9M), Saudi Arabia (\$48.2M), and Japan (\$47.5M) (OEC, 2024).

Coffee is Ethiopia's primary export revenue source, accounting for between 30 and 35 percent of total export earnings, according to a May 2023 USDA Foreign Agricultural Service study. The arabica kind of coffee is only grown in Ethiopia. An estimated 8.35 million 60 kilogram bags (501,000 MT) would be produced total in 2023–2024. Ethiopia's economy, culture environment, and religious life are all based on the coffee industry. For 25% of the country's population, the coffee value chain will remain a significant source of income in the years to come. Ethiopia would produce 8.27 million 60-kilogram bags (496,200 MT) of coffee in May 2022–2023 (October–September), according to Post Addis.

2.2. Empirical Research on the Production and Marketing of Coffee

Getu (2011), states that issues caused by societal and environmental factors, including deforestation, land degradation, climate change, illnesses, crop replacement, and gene pool erosion, pose difficulties to Ethiopia's coffee production and quality improvement. Inadequate market promotion and incentive systems, a predominance of archaic production methods that fail to use suitable coffee technologies, and poor

stakeholder links obstacles. A lack of sustainability and competitiveness in the coffee sector, insufficient price shares and advantages for farmers, growing production, processing, and marketing expenses, and a shortage of services (loans, inputs, and equipment) made coffee productivity low.

Using the profit function approach and analytical tools such as seemingly unrelated regression (SURE), Lemma (2013) compared the economic efficiency of conventional and organic coffee farming systems in Moshi rural district, Tanzania. The results of the study indicate that the gross profit made by organic coffee farms per acre was 65% lower than that of conventional coffee farms, while the cost of physical inputs for organic coffee was 45% lower. The Cobb-Douglas profit function calculation revealed that the profit function model's coefficients for land, capital, extension services, and education were all positive and statistically significant. The results of an efficiency analysis utilizing the profit function and the wage share equation together show that conventional farms were able to achieve greater technical and economic efficiencies.

Research on the variables contributing to Kenya's diminishing coffee output trend, specifically in Nyeri County, was conducted by Wangechi (2014). Descriptive statistics were used in the assessment, and an OLS model was employed to examine the potential influences on coffee production. Thirty farmers were interviewed for the study, and primary data were obtained from them. The study's findings indicated that the primary variables that significantly impacted coffee production were produce price, loan accessibility, market distance, and extension officers' visits. The study provided recommendations on how to address the aforementioned problems in order to support a reversal of the trend in coffee output.

The study done in southern part of Ethiopia using a multiple linear regression model depicts that from a total of 124 farmers are involved; of these, 70 (56.5%) are men and 54 (43.5%) are women. The oldest coffee grower is 59 years old, while the youngest is 26 years old. It was estimated that coffee producers had eight years and five months of experience on average. The analysis of multiple linear regression model shows that coffee output is influenced by a number of factors, including farmers' overall income ($\beta = 0.0001$), farm size ($\beta = 5.663$), varieties of coffee ($\beta = -1.104$), and education level

+25191045235214

($\beta = 0.903$). Conversely, coffee output is not significantly impacted by sex, farmer age, fertilizer usage, coffee pruning techniques, irrigation use, or tree shadow (Bekele and Guade, 2020).

Another study conducted in Jimma zone using a Cobb-Douglass production function results indicate that the following factors tend to increase coffee productivity: more years of farming experience (0.159 times), the number of coffee trees per plot of land (0.303 times), membership in cooperatives (0.243 times), farmers' literacy (0.127 times), and the use of organic fertilizers (0.229 times). However, huge coffee farms (0.339 times), remote locations (0.121times), and age of coffee (0.392 times) tends to lower coffee yield. Finally, the findings show that higher levels of coffee productivity will be the outcome of policies that improve farmers' capacity to run their coffee farms, their participation in cooperatives, the equitable distribution of resources for coffee production, and the use of technology to optimize farm operations (Kudama, 2019).

According to the results of study conducted in Dairi district, Indonesia using a Cobb-Douglass production function, the production of arabica coffee on smallholder plantations is positively and significantly impacted by the number of plants ($\beta = 0.774$), age of plants ($\beta = 0.196$) and fertilizer ($\beta = 0.187$) at the same time. On the other hand, the labor force and pesticide amount have a positive but not significant impact (Rahmanta *et al.*, 2019).

One of the main income crops for Sayo district's smallholder farmers is coffee. Additionally, the district has potential arable land for additional output. In the production year 2014–15, the research area's average yield, or productivity, was low. Conventional methods continued to dominate the production technique. Insufficient soil fertility, insufficient supply of inputs, and insufficient knowledge and ability to use fertilizer for coffee production are the other main variables contributing to low crop output in the research region. In order to accomplish the study's goals, two distinct response variables as well as fifteen explanatory variables—eight of which were continuous and seven of which were dummy variables—are generally used.

2.3 Conceptual Framework

The study uses a conceptual framework, as shown below, to illustrate the link between explanatory and response variables.

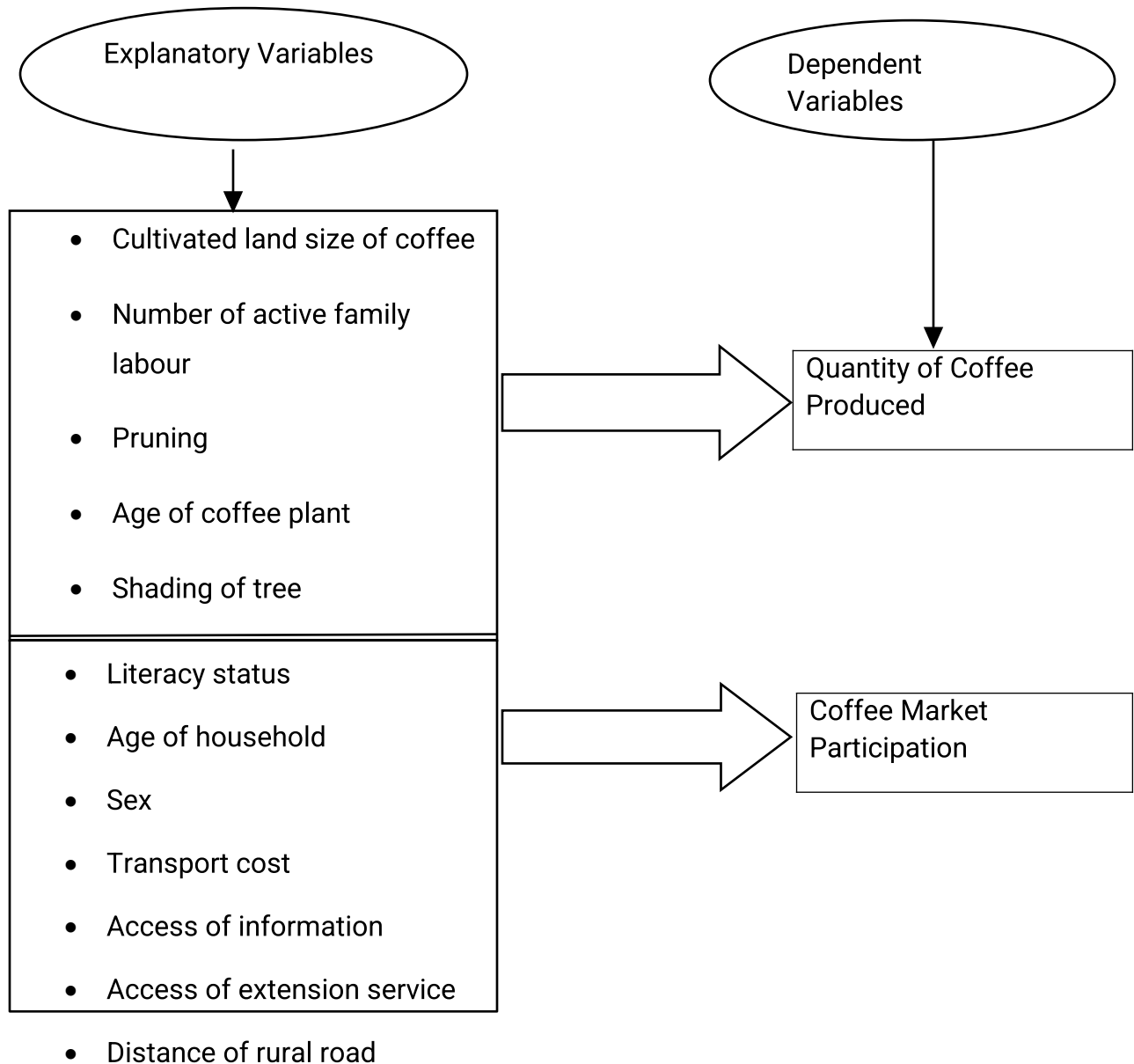


Figure 1: Conceptual frameworks of the Study

CHAPTER THREE

RESEARCH METHODOLOGY

3.1. Study Area

This study was carried out in the Sayo district's Kellem Wollega Zone in Western Oromia. Oromia Regional State includes Sayo as one of its districts. The district's principal town, Dambi Dollo, is located in the Kellem Wollega zonal administrative area and is around 652 kilometers from Addis Ababa. Dambi Dollo, a distinct district that is now a part of the Kellem Wollega Zone, got its name from the name of the Oromo tribe (Sayyoo') that was the first to establish in this area. With 26 rural villages and 3 urban villages, Sayo district is bounded to the south by the Gambela Region, to the west by Yemalogi Welele, to the north by Hawa Gelan, and to the east by the Birbir River, which divides it from the Illubabor Zone. According to the 2007 national census, there were 116,631 people living in this district, with 58,268 men and 58,363 women. No one lived in an urban area. Protestants made up the majority of the population (56.1%), followed by Ethiopian Orthodox Christians (25.72%), Muslims (10.83%), and Catholics (5.84%) (Census, 2007).

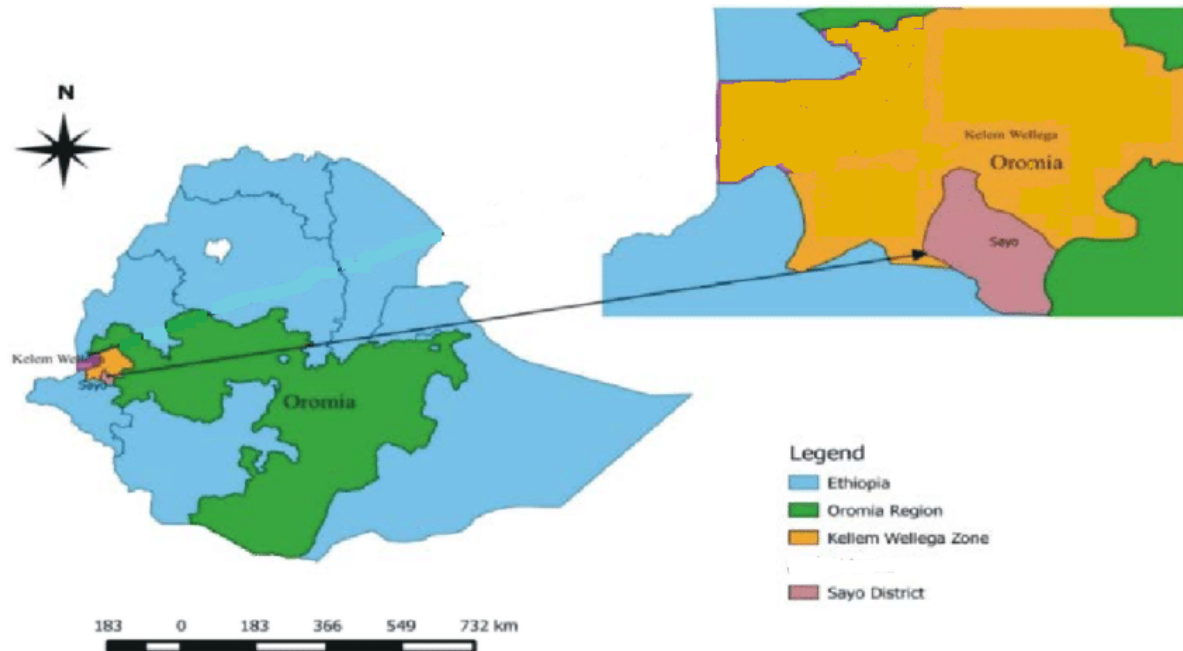


Figure 2: Sayo district map

Source: Google map

3.2. Research Design

This research was based on a quantitative method. It was used for the survey design which involves the collection data of farmers or coffee growers regarding to the factors related to their production and marketing participation status. Production amount and marketing practice were the component of this survey. In addition, by filling questionnaires information was found about demographical and socio-economic factors that affect the responses of this study.

3.2.1. Data of the Study

Both primary and secondary data sources provided information for this investigation. A

household survey in the Sayo district's farmer communities was used to gather primary data. Primary information was gathered on coffee production methods, related farm and farmer characteristics, institutional factors, and other pertinent variables such as the inputs used in coffee production, their costs, the area of coffee yield per hectare, and the price of the final product. In order to augment main data, secondary data was extracted from the sources.

3.2.2. Sample Size and Sampling Techniques

Simple random selection was used to choose the necessary sample, which served as the study's population (coffee farmers) were believed to be a homogenous population as they are in the same climate, and gain similar rain amount annually and administrated under similar agricultural system and etc. Cochran (1963) developed the sample size determination formula that is used to select a sample from a normal population and large, is given as:

$$n = \frac{n_0}{1 + \frac{n_0 - 1}{N}}, \text{ where } n_0 = \frac{z_{\alpha/2}^2 PQ}{d^2}$$

$N = 14,600$ is the total target population or the Sayo district habitants that grow coffee (The Sayo district agricultural office, 2024)

$z_{\alpha/2} = 1.96$ with $\alpha = 0.05$ is the critical value for 95% confidence level with normal distribution,

$d = 0.05$ is the desired level of precision (i.e. the margin of error),

$P = 0.5$ is the (estimated) proportion of the population which has the attribute in question,

$Q = 0.5$ means $1 - p$

Hence, by substituting the given values in the formula we get

$$n_0 = \frac{(1.96)^2(0.5)(0.5)}{(0.05)^2} = \frac{0.9604}{0.0025} = 385$$

$$n = \frac{385}{1 + \frac{385-1}{146,00}} = 375$$

Henceforth, in this study 375 farmers from Sayo district were involved.

3.2.3. Method of Data Collection

The necessary information was gathered by employing enumerators with training who are conversant in the local tongue, customs, and language. Utilizing standardized questionnaires, household surveys served as the primary means of gathering primary data. Reviewing various publications and unpublished documents sourced from government sectorial offices was used ways to gather secondary data.

3.2.4. Method of Data Analysis

Descriptive statistics and econometric models were used as data analysis methods in the study. The data on livelihood assets, household demographic and socioeconomic variables, and other comparable quantitative data produced by the survey were summarized using descriptive statistics. The correlations between dependent and independent factors, which determine coffee production and commercialization in the research area, were examined using econometrics modelling.

3.3. Model Specification

3.3.1. Determinants of Coffee Production

The collected data for the analysis after collection was entered into the computer software package. Its analysis was done using STATA software version 13.0. To determine the impact of socioeconomic, technological, and institutional factors on farmers' coffee production and marketing, the investigation employed the proper methods and processes.

In addition to being computed for certain quantitative explanatory factors, descriptive statistical measures of the production quantity and marketing status include means, standard deviation, percentages, ratios, etc. In contrast, the Cobb-Douglas production function analysis was used to address the study objectives. We used this function to

analyze the main factors influencing coffee productivity and production in the research region. An economic production function that characterizes a firm's output and has two or more variables (inputs) is called the Cobb-Douglas (CD) production function. Capital (K) and labor (L) are examples of typical inputs. Utility maximization is sometimes referred to by this term. However, we shall discover how to solve a minimization issue with the CD production function as a constraint in this case (Cobb, 1928). This function is expressed as follows:

$$Y_i = AK^\alpha L^\beta \dots\dots\dots 1$$

Where, Y_i is the output; K is capital; and L is labour input

$\beta = 1 - \alpha$, stands for the elasticity of output with respect to labour

α Stands for the elasticity of output with respect to capital

This means that the relationship between the output and the two inputs is non-linear, and then the linear form of this function is given as:

$$\log(Y) = \log(A) + \beta \log(L) + \alpha \log(K) \dots\dots\dots 2$$

The Cobb-Douglas production function can be interpreted as follows. Partial elasticity of output with respect to labor input is the percentage change in production for a 1% change in labor input, for instance, while keeping a constant capital input. The other is the elasticity of the output with respect to the capital input and the labor input maintained constant. Finally, the return to scale, or how the output reacts to a proportional change in the inputs, is shown by the sum (+). The returns to scale are said to be constant if the sum equals 1. The (partial) elasticity of the dependent variable Y with respect to each of the X factors is measured by the coefficient of each X variable in the log-linear regression model, which can involve any number of variables.

Accordingly, we have estimated the following the Cobb-Douglas production equation as follows:

$$\ln Y_i = \beta_0 + \beta_1 \ln X_{1i} + \beta_2 \ln X_{2i} + \beta_3 \ln X_{3i} + \dots + \beta_{10} \ln X_{10i} + \mu \dots\dots\dots 3$$

Where β_0 is the constant term and $X_{i,s}$ are the explanatory variables.

3.3.2. Determinants of Market Participation

The participation of coffee growers in market industry is a binary response which is categorized as 'participate' or 'not participate'. Because the outcome is a probability, the dependent variable is bounded either 0 or 1. Thus, the *logit* model was important to fit this data type (Glantz and Kissel, 2014). The model is given as below. Assuming the participation of the farmers in marketing is considered as a success denoted by p , then

$$\text{Logit}(p) = 1/(1 + \exp(-p_i))$$

This model is not linear. The linear form of this model is given as

$$\ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_k X_k \dots \dots \dots 4$$

3.3.3. Variables of the Study

Dependent variable

Quantity of coffee produced (QUTY- PROD): This dependent variable is likewise continuous and quantified in quintals. Additionally, it shows how much coffee each home produced throughout the designated production year (the 2015/16 EC cropping year).

We looked at the variables affecting smallholder farmers' coffee output using the Cobb-Douglas production function as the dependent variable.

Independent variables of Quantity of coffee produced

Cultivated Land size of coffee (CULT_LSIZE): This continuous variable, expressed in hectares, shows how much land producer farmers allotted to coffee production in a given year.

Number of active family labour (FAM_LABR): The continuous (discrete) variable, expressed in number of person do per hectare. We define active family labour in this study as the ability of a household member to engage in agricultural activities.

Pruning (PRUNING): This is a dummy variable; if the farmer trimmed his/her coffee plant when it was older, the value would be 1, and if not, it would be 0.

Age of coffee plant (AGE_COFF): This is a reference to the age of coffee plants, which may affect coffee output. This continuous variable, is measured in years, indicates the age of coffee production by producer farmers in a given year.

Shading of tree (SHADING): It is a categorical variable that takes on the value of 1 if the farmer grows coffee shades on his land and 0 otherwise.

Access of DA officers (DA): A categorical variable takes on the value of 1 if the farmer gets development agency officers' advice on how to grow and produce coffee or 0 otherwise.

Coffee production experience (FARM_EXP): Is a continuous independent variable represents the head of the household's years of experience producing coffee.

Number of Coffee plant planted on the farm (COFF_PLANT): This continuous variable shows the number of coffee plants utilized by household heads per acre. Most crucial agricultural input used for raising farmers' output and productivity.

Market participation experience (MKT -EXP): One more dependent variable was this one. It is a categorical variable takes on a value of 0 if the household does not involve in local coffee marketing throughout the study year, and 1 if they do. Using a *logit* model, we used this variable as the dependent variable to investigate the determinants that influence smallholder farmers' sales of coffee.

Independent Variables of Coffee Marketing

Literacy status of farm household head (READ_WRITE): This is a dummy independent variable, with a value of 0 otherwise and a value of 1 if the head of the family is literate (able to read and write).

Age of the household (AGE-HH): This is the age at which the head of the household engages in marketing.

Sex of the household (SEX-HH): This is a dummy variable, meaning that it accepts a value of 0 for a female household and 1 for a male home.

Transport Cost (TRAN_COST): This continuous variable, expressed in birr, relates to the marketing-related transportation expenses that coffee producers and farmers bear. In this analysis, the cost of delivering coffee to the market is referred to as the "transport cost."

Access of Information (INFORMA): This is a dummy independent variable, with 1 denoting ownership of a mobile device, radio or TV and 0 otherwise for the sample household head. A mobile phone, radio or TV is also essential for quickly obtaining the most recent market information.

Access of Extension services (ACC_EXS): This variable is a dummy takes a value of 1 if the families have access to training for participation in the coffee market, and 0 otherwise.

Distance of rural road (DIST_RR): The distance (in kilometres) between residence and the closest country road is a continuous variable for this.

3.4. Ethical Consideration

Adhering to research ethics was crucial when performing a study. As a result, the researcher had to adhere to the ethical research guidelines. As a result, the study's goals were made explicit to the respondents in a straightforward manner. The research's goals, the confidentiality of the whole questionnaire administration procedure, and the fact that the study would only be utilized for academic purposes were then explained to the respondents.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1. Introduction

This chapter presents the descriptive analysis of demographic factors, coffee production and coffee marketing. It also present the analysis of information gathered using graphs, charts, tables and the inferential analysis of production of coffee which was analyzed by Cobb-Douglas production function and the logit analysis of participation of coffee producers in local market.

4.2. Descriptive Analysis of Variables

4.2.1. Descriptive Analysis of Categorical Variables

The results study was presented in this chapter, beginning with descriptive statistics. The Statistical Package for Social Science (SPSS) version 25 enabled data analysis for descriptive statistics. Furthermore, STATA V.13 was used to fit the econometric model.

To reflect a sample of the Sayo district coffee growers, 375 respondents from were chosen. Thankfully, every respondent received a response and completed the questionnaires.

As stated in the literature part, this study looks at the certain independent components that are taken into account according to the conceptual framework in order to determine the factors that influence the production and marketing of coffee in Sayo district. For analysis, 375 questionnaires in all were distributed and gathered. As a result, the coded and analysed questionnaire showed a 100% response rate. This high response rate increases trust in the generalizability of the study's conclusions.

Table 1: Descriptive analysis of categorical variables

Variables	Category	Frequency	Percentage
Pruning	Not prune	297	79.2
	Prune	78	20.8
	Total	375	100
Shading	No shade	254	67.7
	Shading	121	32.3
	Total	375	100
Accessing DA	No access	296	78.9

	Access	79	21.1
	Total	375	100
Market participation	Not participate	358	95.5
	Participate	17	4.5
	Total	375	100
Literacy	Illiterate	99	26.4
	Literate	276	73.6
	Total	375	100
Sex	Male	324	86.4
	Female	51	13.6
	Total	375	100
Market info	Not access	309	82.4
	Access	66	17.6
	Total	375	100
Extension	Not access	111	29.6
	Access	264	70.4
	Total	375	100

We can see from this table that a greater proportion of growers do not prune their coffee, even as it ages. Therefore, of the 375 coffee producers in the sample, only 78 (20.8) prune the older coffee plants to increase productivity, while 297 (79.2%) of them continue to use older coffee, which is thought to have lower production.

Another significant element that clearly differs in practice is shading the coffee plant (land). Only 121 (32.3%) of the farmers surveyed said they covered their coffee field with shade, while 254 (67.7%) said they did not think about doing so. When questioned why, they said that it's because it's not done and, on rare occasions, naturally occurring shadows blanket the crops.

When asked about their access to the guidance of development agency (DA) staff, the respondents stated that 79 (21.1%) of them received help on how to grow and/or produce coffee, regardless of the age of the plants. However, 296 (78.9%) of the respondents claimed they had never received any advice about growing coffee from DA officers. They justify this by citing the area's stability and serenity, and they mostly concentrate on farming crops like maize and livestock for a living.

Based on the rate of market engagement, the majority of respondents don't even engage in local marketing. Out of them, just 17 (4.5%) sell their produce to farmers unions or local markets. Out of the sample, 358 people (95.5%) claimed that the ease of

selling their coffee to individual coffee sellers in their villages or nearby areas is the reason they don't sell their products to the local market.

It was also looked into how well the responders could write and read. This study indicates that 276 (73.6%) of the respondents can read and/or write, while 99 (26.4%) are illiterate, meaning they cannot read or write.

When we take into account the gender disparity among the farmers, 324 (86.4%) of the respondents were male, and 51 (13.6%) were female. The gender of the house heads who are currently engaged in Sayo district coffee cultivation was gathered for this survey.

Possessing knowledge about coffee or researching the coffee market locally, nationally, or worldwide was thought to vary physically. As a result, 66 participants (17.6%) possess knowledge about the price of coffee before selling it, whereas the remaining 309 participants (82.4%) do not search for information on a national or worldwide level.

Accordingly, 264 growers (70.4%) have access to the extension service related to coffee marketing, while 111 growers (29.6%) do not receive any extension service.

4.2.2. Descriptive Analysis of Continuous Variables

The descriptive analysis of continuous variables used in this study was given as the following table. The mean, the standard deviation, the minimum and maximum values, and the total number of observations were all included in this study.

From this table of analysis, the minimum quantity of coffee produced by the participants is seven quintals per year; while on maximum forty four quintals can be produced. The average coffee produced in Sayo district by depending on the sample information is concluded to be 25.15 quintals annually.

The farm size that farmers used to grow coffee which is measured in hectare, as they respond us it at least 1.25 hectare and at most 6.05 hectare which have average area of 3.71 farming size.

The number of active family that participate of the coffee farm is also taken as an independent variable. Accordingly, the descriptive analysis of this variable shows that the greatest number of family members actively involved in coffee production is eight, and on average, each household in Sayo district has three family members to assist them in their coffee growing.

When we consider the age of coffee they are using for production, on average its age is 17.13 years, while the oldest coffee plant is 37 years old.

Table 2: The descriptive analysis of continuous variables

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Quantity_prod	375	7.00	44.00	25.15	5.86
Land_size	375	1.25	6.05	3.71	0.8112
Active_family	375	1	8	2.28	1.454
Age_coffee	375	5	37	17.13	12.03
Number of coffee per hectare	375	164	6556	3458.64	2374.74
Coffee production experience of farmers	375	14.2	20.0	17.18	1.53
age of HH	375	18	79	47.65	18.282
Transport_Cost	375	15900	135000	34733.8	17139.4
Distance from DD	375	1.00	72.00	37.44	22.84
Valid N (listwise)	375				

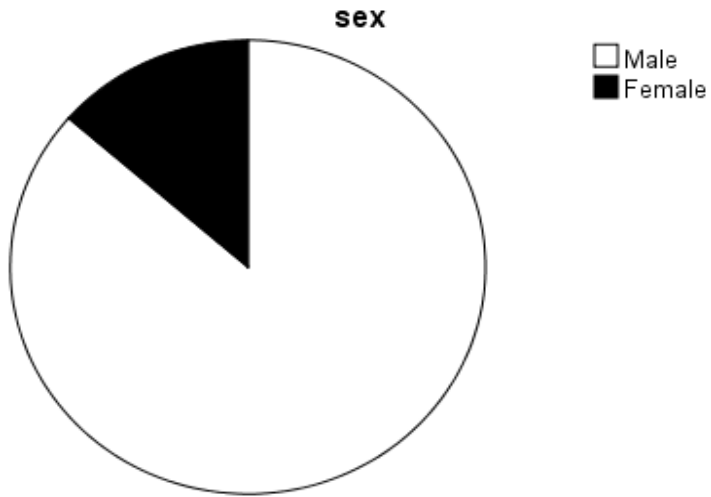


Figure 3: The pie chart of gender of respondents

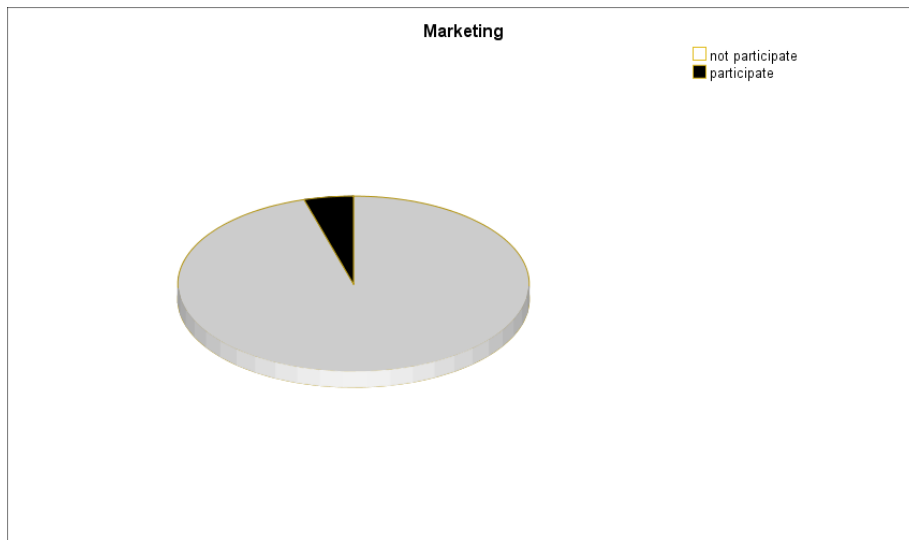


Figure 4: The pie chart of market participation of farmers

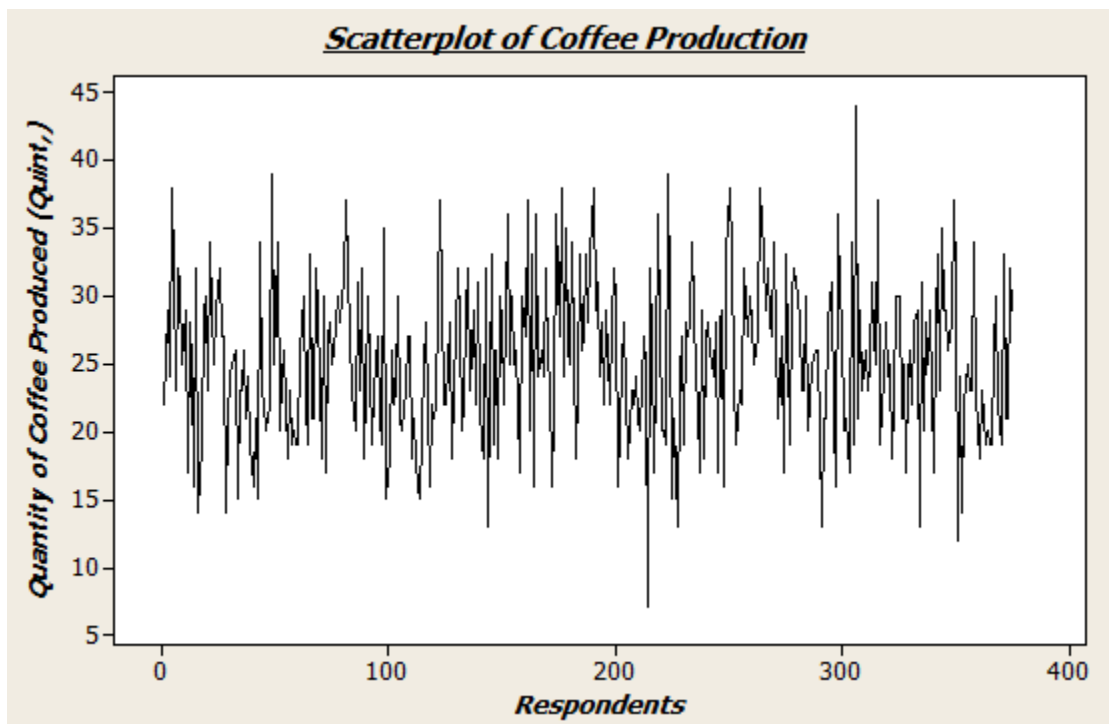


Figure 5: The scatterplot of coffee production

4.3. Econometric Analysis of Coffee Production and Marketing

4.3.1. Cobb-Douglas Analysis of Coffee Production

To explain the relationship of coffee production and factor inputs and its major determinants and marketing in the study area; we used Cobb-Douglas production

function for coffee production and *logit* model for coffee marketing.

The econometric analysis for the Cobb-Douglas production function was performed using STATA version 13 and the significance of variables were determined at 5% level of significance. Data were collected on 375 observations from Sayo district. The maximum likelihood estimate of CD production function relates the production of coffee and explanatory variables given in the following table.

The model fits the data well at the 5% level of significance, according to the model estimates derived from this table. This demonstrates that the independent variables have a role in explaining the coffee producers' output. Seven of the eight explanatory variables that were part of the Cobb-Douglas production were determined to be the determinants of coffee production; three of them were dummies and five of them were continuous.

Variables found to be significant included: cultivated land size, active family labor, coffee pruning, age of coffee plant, coffee shading, access of DA service, production experience were among the significant determinants of coffee production.

Table 3: The CD production function estimates

Variables		Coefficient	SE	t-value	Sig.
Cultivated land		0.755	.074	10.473	.0000***
Active family labor		0.768	.016	4.80	.0007**
Pruning	Un pruned (Ref.)				
	Pruned	1.616	.804	2.01	.0396*
Age_coffee		-1.12	.029	-38.62	.0000***
Shading	No shade (Ref.)				
	Shade	.278	.057	4.88	.0006**
DA	No access (Ref.)				
	Access	2.35	.747	3.15	.0068**
Coffee per_Hect		.520	.320	.794	.2251
Prod_experience		.199	.084	2.37	.0226*
Constant		20.6	3.845	5.346	.0003***
Observations		375			
R-square		0.79			
Adjusted R-square		0.62			

Root MSE	0.4396
Ref.=Reference category; * = 5%; **= 1% level of significance	

The Cobb-Douglas production function's input variable coefficients are the mean output's elasticity with regard to the various inputs employed.

As a result, the amount of land allotted to coffee cultivation, expressed in hectares, was a continuous variable that was found to have a positive impact on household coffee production (the CD estimated coefficient for this variable is 0.755). By controlling for all other explanatory variables, coffee growers who are able to increase the acreage of their coffee farms in hectares should see an increase in coffee production of 0.775 times. The production elasticity for farm size exhibits the anticipated patterns and is significant at the 5% level of significance. This outcome supports the research by Poulton *et al.*, (2001), which shows that land has a significant role in influencing farmers' decisions to grow any kind of cash crop.

Regarding coffee production, there is a positive and substantial link (significant at the 5% significance level) between the number of active family laborers engaged in agricultural farms and coffee production. It was calculated that the elasticity of coffee production with respect to the number of active family laborers was 0.768. The positive association suggests that, while holding all other variables fixed at their mean value, farmers' coffee production will increase by 0.768 times when we add one person to the active family labor force. This might be the result of an active family that offers labor for agronomic operations including planting, weeding, harvesting, and other tasks. According to the model's output, the outcome agrees with both the earlier prediction and the research of (Lelissa, 1998; Techane, 2002).

Another element influencing the coffee productivity of farmers in Sayo district is coffee pruning. Growers who prune their coffee produce 1.616 times more coffee than growers who do not prune as the coffee ages, as long as the effects of independent factors are held constant.

The age of the coffee plant is another important factor in determining its yield. It has a detrimental impact on household coffee output levels. The calculated coefficient value

for this variable was determined to be -1.12, meaning that under its production of coffee, the elasticity of frontier production drops by 1.12 times with respect to the age of the coffee plant.

This variable has a substantial impact on how much coffee is generated by research participants by taking into account the recommendations of the development agency officers. Due to the constant values of all independent variables, the amount of coffee collected by these farmers is 2.35 times higher than that of those who do not receive the advice access.

There is no discernible variation in the quantity of coffee planted per hectare on the property. The data collected from the Sayo farmers did not yield sufficient information to determine the production quantity of coffee, even though coffee plant density is scientifically proven to lower coffee production.

The amount of coffee that growers harvest also depends on the farmers' level of experience in producing coffee. Consequently, the elasticity of frontier production with regard to experience in coffee production increases by 0.199 times as the experience of the farmers grows by one year after correcting for the values of other variables.

The model's computed R-square is 0.79, meaning that the explanatory variables identified can account for 79% of the variation in the farmers' coffee production. The remaining 21% of the variability in the response variable are due to variables that are not taken into consideration in this study.

4.3.1.1. Multicollinearity Assumption of CD Production Function

The assumption of the CD model is that none of the independent factors in the model have a precise linear connection with one another. The existence of perfect collinearity or perfectly collinear independent variables is indicated by the existence of such a linear relationship. In actuality, the issue with a high degree of multicollinearity is more challenging. The most crucial tests for identifying multicollinearity are the variance inflation factors (VIF) (Pindyck and Rubinfeld, 1991). The variance inflation factor was utilized in the study to look for independent variables that were multicollinear. The test

results are displayed in the table that follows.

The test result indicated that multicollinearity among the variables was not a significant issue. Given that each independent variable's tolerance value is at least 0.10 in the table below, it was determined that there were no issues with multicollinearity or connection between the set of independent variables. As a result, the multicollinearity assumption is upheld.

Table 4: Multicollinearity Test Values

Variables	Collinearity Statistics	
	Tolerance	VIF
Land_size	.842	1.188
Active_family_labor	.933	1.071
Pruning	.862	1.160
Age_coffee	.811	1.233
Shade	.974	1.027
Coffee plant per hectare	.883	1.132
DA advise	.988	1.012
Product_experience	.993	1.007

The VIF value, which is much below the cut-off 10 as indicated in the coefficient table, supports this as well.

4.3.2. Logit Analysis of Coffee Marketing

The logit analysis of coffee marketing of the farmers is used to identify whether the participation of the selected farmer is determined by the independent variables or not. Due to the fact that this response variable has a dichotomous category where each outcome is randomly determined, the binary logit model is preferred to other models.

The table below displays the parameters' maximum likelihood estimation results. To make sure the model fits the data well, a variety of goodness of fit metrics were used. The chi-square goodness-of-fit test figures show that the model fits the data significantly at a significance level below 5%. This demonstrates the significance of the independent variables in determining the farmers' involvement in coffee marketing.

The output for the logit model reveals that four variables—two continuous and two dummy—of the total seven explanatory variables were found to be strongly correlated with coffee marketing. At the 5% level of significance, the variables that were determined to be significant were literacy status, the distance of the rural road, the accessibility of market information, and the transportation of coffee from the main road.

The household heads' age, sex, and access to extension services did not exhibit statistical significance at the established significance levels, suggesting that their influence on the involvement in coffee marketing was not as great.

These significant variables are interpreted using the odds-ratio which is similar to the sign of the coefficient of the significant variables.

Table 5: Logit estimates of market participation

Variables		Coefficient	SE	Wald	Sig.	OR	95% CI (OR)	
							Lower	Upper
Literacy status	Illiterate (Ref.)							
	Literate	.512	.255	4.031	.0447*	1.669	1.01	2.75
Age of HH		.009	.007	1.482	.223	1.009	.995	1.024
Sex of HH	Female (Ref.)							
	Male	-.311	.320	.940	.332	.733	.391	1.373
Transport cost		-.048	.021	5.22	.022*	.953	.915	.993
Access Market info	No (Ref.)							
	Yes	.685	.297	5.32	.021*	1.984	1.11	3.55
Access extension	No (Ref.)							
	Yes	-.244	.253	.933	.334	.783	.477	1.286
Distance road		-.030	.006	25.00	.000** *	.970	.959	.982

Constant			-0.480	.588	.668	.414	.619		
Observations	375								
LR χ^2 (8)	14.1								
Sig.	0.000								

The primary factor influencing farmers' engagement in local marketing is their level of literacy. Changes in people's capacities, or their human capital, which is mostly influenced by literacy, are what propel economic progress. Higher educated individuals were better able to both use and contribute to the development of new technology. Additionally, they effectively manage their fields, which have the effect of pushing the land's productivity and production upward. According to the study's findings, one of the major factors influencing coffee marketing in the research region is the head of the household's level of literacy. Regarding participation in coffee marketing, the household head's education level shows a positive and significant relationship at the 5% significance level. With other parameters held constant, the odds-ratio for educated farmers—represented by the HH odds-ratio of 1.669—imply that their chances of engaging in local coffee selling are 1.669 times greater than those of illiterate farmers. This suggests that the farmers' marketing experiences will have a higher literacy level. This might be because farmers who are more literate have easier access to information and are more aware of new technologies, which helps them grow high-value products like coffee. This is because household heads who receive an education are better able to acquire and adjust to new information, which in turn makes them aware of chances for gainful employment and helps them make reasonable decisions. The leader of the household's education could raise awareness of the potential benefits. The head of the household who has completed their education may become aware of the potential benefits of using technology to modernize agriculture, be able to read fertilizer pack instructions, and be able to diversify their sources of income, all of which would improve their ability to feed their families. This outcome agrees with findings from Tesfaye and Alemu (2001), Bekele (2008), and Asfaw et al. (1997).

At the 5% level, there is a statistically significant negative correlation between the

chance of participating in coffee marketing events and the expense of transportation. Assuming all other conditions stay the same, the likelihood of selling coffee production in the local market increases by 0.953 times when the transit cost decreases by one ETB. This is indicated by the odds-ratio of 0.953 for transport cost. This indicates that the likelihood of taking part in the local market increases by 0.995 times when the transport cost decreases by 10%. The negative correlation suggests that there will be a decrease in the likelihood of farmers participating in coffee marketing events for every unitary increase in distance between their farm and the closest market centers. Farms located far from the market will have higher transaction costs associated with purchasing input and selling finished goods, which will lessen the overall benefit of taking part in coffee marketing initiatives. Marketing the farmers' produce may be more expensive if their farm is far from the closest local market. The revenue from the selling of agricultural produce decreases with distance from the market center. Kidane (2001) and Haji (2003) reported similar outcomes. This suggests that the proximity to the closest market in various locations has a comparable impact on the decision to participate or accept new technologies.

Another important factor that influences farmers' market participation is their knowledge of the local or national market. Ownership of a TV, radio, or cell phone by a household had a favorable impact at the 5% significance level. The odds ratio of 1.984 indicates that there is a 1.984-fold increase in the likelihood of participating in the local market while the values of the independent variables stay fixed. This finding implies that farmers with information access benefit more from their experiences participating in the market, as radio or cell phones provide instantaneous methods of communication for receiving up-to-date market information from many sources.

Market intelligence is a key component in coffee marketing strategies. It has been discovered that involvement in coffee marketing experiences is strongly and favorably impacted by access to market information. Knowledge regarding coffee prices and distribution methods is a crucial component in helping rural farm people improve their standard of living. Furthermore, market data is essential for manufacturers to understand how much a product costs in relation to its quality and how much demand

there is for it (number of customers), as this enables them to modify their manufacturing methods. Farmers are encouraged to produce more in terms of both quantity and quality of the product as having access to market information positively affects household income in the study area. Additionally, using market knowledge, households may sell perishable farm goods at the right moment without compromising quality. Accurate information on the supply and demand of agricultural inputs and products can be obtained through market research, which is another important factor. This outcome is consistent with Goyal's (2010) outcome. This suggests that having knowledge of the market leads to excellent production and marketing returns.

The distance between the coffee estate and the local market location (which is limited to Dambi Dollo town) is another factor that determines whether or not to engage in marketing. As a result, the OR of the local market's distance is 0.970, indicating that the likelihood of a farmer selling coffee in this market is decreased by 0.970 due to the farmer's coffee farm's distance from the market. This difference is significant at the 5% level of significance. The logit model's outcome indicates that fewer farmers participate in the local market the farther they are from the center. This result contradicts with the study of Gebre (2020) which found that the transport distance has a positive effect on market supply of the farmers.

4.3.2.1. Logit Model Adequacy Checking

The adequacy of the logit model used to analysis the dichotomous response variable of marketing participation of farmers is checked by the binomial model goodness checking criteria like Omnibus test and Cox and Snell statistic methods.

Table 6: Omnibus test of model adequacy

Omnibus Tests of Model Coefficients				
		Chi-square	Df	Sig.
Step 1	Step	23.003	7	.0017
	Block	23.003	7	.0017
	Model	23.003	7	.0017

As a consequence, the findings of the residuals analysis indicate that the model with explanatory variables is statistically significant at the 5% level of significance and performs better at predicting the response variable. Adding explanatory variables to the model has greatly improved our capacity to forecast our subjects' actions, according to the Omnibus test statistic, which has a Chi-square of 23 with seven degrees of freedom significance. We may thus draw the conclusion that more explanatory factors will improve our capacity to forecast farmers' involvement in local marketplaces.

Table 7: Nagelkerke test model adequacy

Model Summary			
Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	45.64	.531	.790

Nagelkerke R Square 0.790 gives a rough estimate of the variance that can be predicted from the combination of the independent variables. From this analysis, 79% of the variations in the market participations is predicted by the used independent variables and is good enough as it exceeds 50%.

This shows how better the model predicts the response variable and the logit model is good to fit the predictors of participation of farmers in local market.

As given in Appendix B, the distribution of market participation is normal and residuals were distributed normally.

4.3.3. Analysis of the Interrelationship of Production and Marketing of Coffee

The binary logistic regression is a favored model to examine the interdependency of these factors by utilizing the amount of coffee produced as a covariate that influences farmers' decisions to participate in local marketplaces. Below is the binomial regression model's maximum likelihood estimation.

Table 8: MLE estimates of interdependence of variables

Variable	Coefficient	SE	Wald	df	Sig.	OR	95% CI (OR)	
							Lower	Upper

Quantity_pro d	.075	.042	3.18	1	.075	1.078	.993	1.171
Constant	-5.031	1.189	17.91	1	.000	.007		

From this analysis output, we can conclude that the quantity of coffee produced by farmers have no significant effect on the choices made whether to participate or not in marketing. Therefore, we conclude that production of coffee has no effect on participation of farmers in local markets. The reason of this is that may be access of information about price of coffee and the interests that may obtained after a while from that markets, and transportation cost wise.

And, to check if the choices made by farmers affect the quantity produced, the one way ANOVA model is preferred method of identification.

Table 9: ANOVA test of interdependence of variables

Sources of Variation	Sum of Squares	DF	Mean Square	F	Sig.
Market_parti.	110.619	1	110.619	3.245	.072
Error	12716.410	373	34.092		
Total	12827.029	374			

Since the p-value is 0.072, which is more than 0.05, we can once more infer from this ANOVA table that the variance in the quantity of coffee produced by Sayo farmers is not influenced by the markets they choose to sell their goods at the 5% level of significance. This result supports the finding of binomial analysis output. Therefore, we can conclude that there is no interdependence between the amount of coffee produced and where they sale their production according to the information obtained from the Sayo farmers.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1. Summary of Major Findings

Coffee is a cash crop that is highly sought after worldwide and is often farmed by smallholder farmers. Because of this, bulk coffee manufacturing in particular requires maintaining coffee's quality in order to stay competitive in the global, national, and local markets. One of the main income crops for Sayo district's smallholder farmers is coffee. Additionally, the district has potential arable land for additional output. In the production year 2014–15, the research area's average yield, or productivity, was low. Conventional methods continued to dominate the production technique. Insufficient soil fertility, insufficient supply of inputs, and insufficient knowledge and ability to use fertilizer for coffee production are the other main variables contributing to low crop output in the research region. In order to accomplish the study's goals, two distinct response variables as well as fifteen explanatory variables—eight of which were continuous and seven of which were dummy variables—are generally used.

5.2. Conclusion

Examining the variables affecting small-scale coffee production and sales in Sayo district, Kellem Wollega zone, Oromia Regional State, was the aim of this paper. The information gathered from a household survey carried out in May 2024 served as the basis for our choice of analytic parameters.

375 household heads who were actively involved in coffee cultivation were chosen for this study using a basic random selection technique in the Sayo district. A questionnaire was utilized to collect primary data for the study, which also included secondary data.

Data of this study was analysed by using both descriptive analysis and econometric and inferential models and tests.

According to the study's descriptive analysis, the lowest amount of coffee produced in the Sayo area during this fiscal year was seven quintals, while the highest amount

produced was forty-four quintals. 25.15 quintals of coffee were produced on average, according to the survey data, with a 5.86 estimated standard deviation.

Based on an investigation of these farmers' market participation, 358 (95.5%) of the study participants do not sell their coffee in local markets, whereas just 4.5% do.

In order to determine the important factors of production amount and market choice, the analysis used the Cobb-Douglas production function, logit model, and ANOVA model. As a result, factors influencing coffee productivity and production in the research area included the coffee tree's cultivation area, the availability of skilled labor, the coffee tree's productive age, coffee pruning techniques, coffee shade, and production expertise, all of which raised the chance that farmers would grow coffee. Similar factors affected the marketing of coffee: the farmers' level of literacy, the cost of transportation, the availability of information, and how distant the market center is from the farm.

And, the quantity of production does not affect the market choices made by farmers and vice versa. This shows that the production and choice of market are independent from each other.

5.2. Recommendations

Ethiopia presently exports coffee as a major agricultural product. However, due to a lack of agro-ecological zones for its production and productivity, its production is restricted to a few locations of the nation and is heavily controlled by smallholder farmers. Therefore, several adjustments are needed to support and motivate smallholder farmers in coffee production and selling. The following policy recommendations might be made for more thought and enhancement of coffee production and marketing in the research region based on the study's findings. The size of the land the coffee farm is cultivated on is the important one. Henceforth, as much as possible farmers are recommended to expand their coffee farm.

- One more important component to increase coffee yield is the amount of active family members that participate on the coffee farm. Therefore, in order to improve their yields, farmers need increase the number of active individuals on

their coffee farm.

- ▶ Employ pruning techniques to thin out older coffee plants and replace them with young seedlings. It is also advisable to focus more on timely pesticide supply and training for farmers on when to apply pesticides on coffee farms.
- ▶ Officers from developmental agencies ought to focus more on coffee production, educating farmers and motivating them to cover their coffee farms with as much shade as possible.
- ▶ Experience matters when it comes to producing coffee, thus younger growers should seek out more opportunities to gain it.
- ▶ It is important to provide illiterate farmers with further guidance on market participation options.
- ▶ In order to obtain up-to-date market information for their produce, farmers should be encouraged to own and use mobile phones, radios, or televisions. It is also advisable to focus more on the development of transportation systems by securing universal rural road access program household heads participating in their production to nearby markets.
- ▶ The relationship between coffee output and commercialization was determined to be insignificant for smallholder producers. Therefore, growing coffee without knowing the specifics of the industry will not benefit growers. Consequently, it is advised to use contract farming and value chain development to establish connections between producers and market participants.

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APPENDICES

Appendix A: Questionnaire

Dambi Dollo University
College of Business and Economics
Department of Economics

Questionnaire

Dear our esteemed respondents! Greetings! This is the questionnaire we prepare for the collection of data to assess the factors associated with the production and marketing of coffee in Sayo district, Ethiopia, that is conducted for the partial fulfillment of masters of science degree in developmental economics from Dambi Dollo University. Hence, we select you as a sample that involved in our study. Thanking you to give us your precious time to give us the important data, we kindly request you to fill this questionnaire and answer all of the questions with your honest thoughts. Please, be assured that this data is used for educational purpose only, and it is kept confidentially. Thank you very much in advance.

Please, put '✓' in your choice box for alternative questions.

1. How many quintals of coffee production did you get in this fiscal year?

2. On how much land (hectare) do you invest coffee? _____

3. How many of your family members are actively participate on your coffee farm?

4. Do you use pesticides on your coffee farm? Yes No

5. If your answer on number 4 is 'yes', what type of pesticides do you use?

6. Do you use natural fertilizer composts? Yes No

7. If you use natural fertilizer composts, for how many years you are using it?

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8. Do you experience pruning the older coffee plant? Yes No

9. How old (years) is your widely cultivated coffee? _____

10. Do you grow coffee shadow plants in your coffee farm? Yes No

11. If you grow coffee shadows, how much do you think it covers your coffee farm (percentage)? _____

12. How many seedlings of coffee did you plant per acre? _____

13. Do your coffee seedlings are improved? Yes No

14. What other factors associated with your coffee production? How it affects your production process? Please, specify if any. _____

15. Have you a participate in the coffee marketing this year? Yes No

16. What is your literacy level? Read and write Cannot read and write

17. If you can read and write, do you comprehend the coffee marketing technologies?

Yes No

18. If your answer on no.16 is 'yes', how often do you do? _____

19. At what age did you engage the coffee marketing? _____

20. What is your gender? Male Female

21. For how many years do you involved in the coffee production? _____

22. How much it costs you to transport your coffee production to market place?

23. Do you have electronic devices (Radio or cell phone)? Yes No

24. If you have, do you used it to access information about market? Yes
No

25. If your answer on no.23 is 'No', how do you access information about coffee market? _____

26. Are you given the coffee market trainings? Yes No

27. If 'Yes', how it helps you to expertise coffee market? _____

28. How your coffee farm is far (in KM) from the country road? _____

29. What do you think other factors that have significant effects on the coffee marketing, based on your experience? And, please specify how it affects your marketing process? _____

Appendix B: Normality Plots of Market Participation



Figure 6: Normality plots of market 1

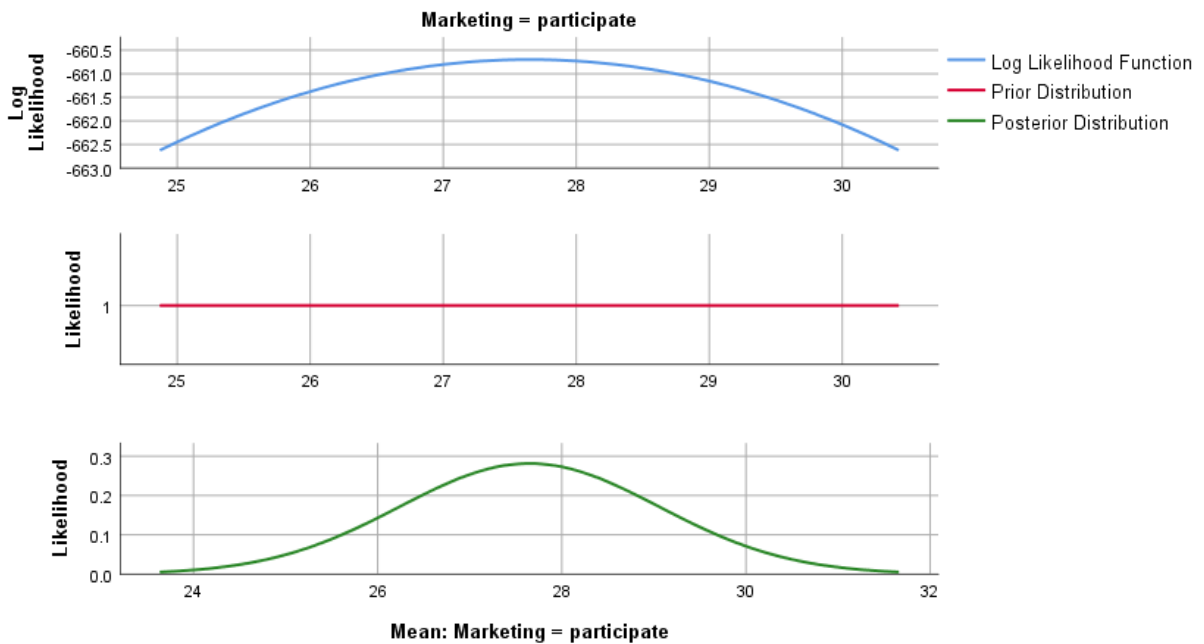


Figure 7: Normality plot of market 2

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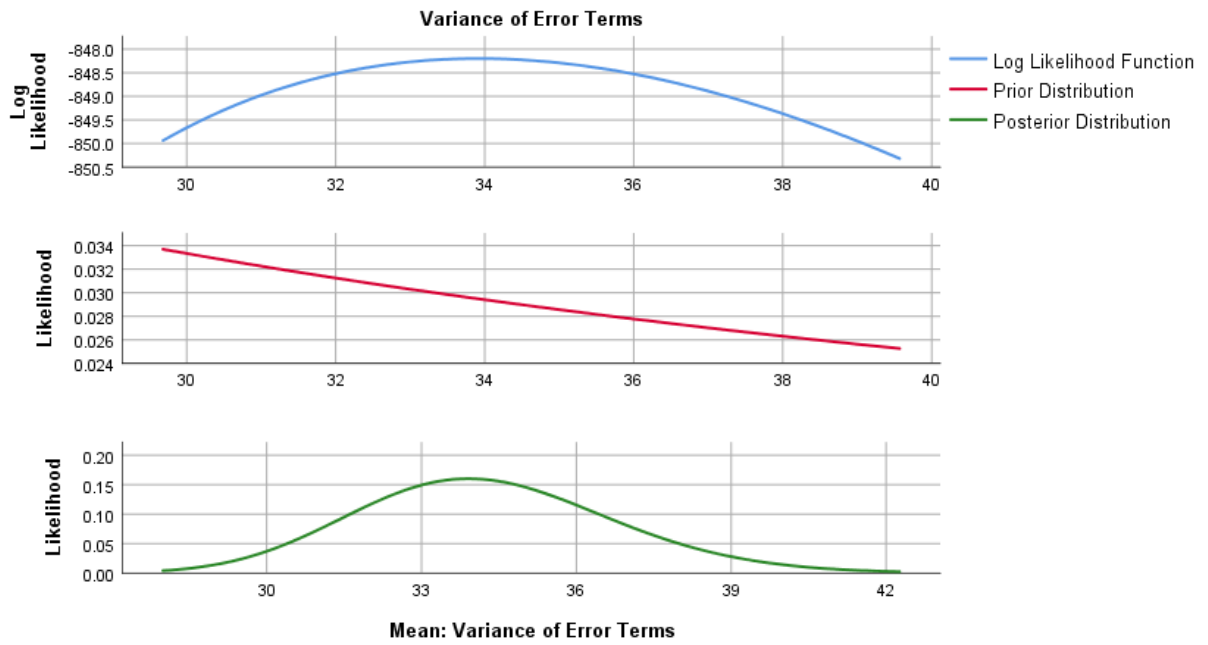


Figure 8: Normality plot of residuals