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Is Potato Market Efficient in Ethiopia? Evidence from Farta District of Amhara Region

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Abstract
The study aimed to explore the structure and conduct of the potato market in the Farta District of Amhara Region in Ethiopia. Data was collected from 123 potato producers, 30 traders and 13 consumers selected through a two-step random sampling procedure. Four major value chain actors that held about 49.2 percent of the total quantity of potato purchased were identified. It was found that the Farta potato market was weakly oligopolistic. The study showed that competition, commercial licenses and limited capital are the main obstacles to enter the potato market. About 47.11 percent of the overall gross margin of marketing was added to potato prices in the value chain. Approximately 19.5% of total gross margins were absorbed by collectors, while retailers and wholesalers accounted for 15.6% and 11.9%, respectively. The actors in the value chain of potatoes generated positive profits, but the barriers to entry, the structure of oligopoly markets and the inability to determine price sets the potato market inefficient.

Keywords
Concentration ratio; Farta district; Potato; SCP model; Oligopoly; Value

Introduction

Ethiopia is considered to be one of Africa's most important regions with the greatest potential for potato production that plays an important role in improving food security, increased agricultural revenues and poverty reduction (EARO, 2000; Tesfaye, 2016). Currently, potatoes can be consumed not merely as a native food item, but also as processed foods. The consumption of potato chips appears to be growing in Ethiopia at the household level, in the hotels, restaurants, and supermarkets. Many of the retailers process French fries for selling in their establishment (AgroBIG, 2016). Ethiopia's potato production zone is relatively young and is confronted with low output, insufficient supply of agricultural inputs, limited provision of extension services, weak association with the actors in the value chain, damage to production, poor class of the product fluctuation of prices, low prices received by farmers, and relatively deprived infrastructure accessibility. There are inadequate opportunities for marketing and value adding as a result of poor marketing and processing services (Bymolt, 2014; Kemaw *et al*., 2017).

The South Gondar Zone in Ethiopia is considered one of the Amhara's primary potato production zones (Deressa *et al*., 2017). In the southern Gondar Zone, the total area under potato is 6,125.49 hectares engaging 96,262 small farmers with production of 935,059.17 quintals (Qt), and the mean productivity is 152.65 quintal per hectare (Qt/ha) (CSA, 2016).

The Farta District is a highly favorable area in the south Gondar Zone in which smallholder farmers produce high-quality potato to earn cash income and ensure food security (Wubet *et al*., 2022). However, there is limited scientific evidence regarding potato marketing behaviour (structure conduct and performance analysis) and its profitability (benefit cost-analysis) (Wegi *et al*., 2017; Geremewe, 2018; Aliyi *et al*., 2021; Oyka, 2020; Dessie *et al*., 2019; Mirie *et al*., 2018; Hailegiorgis and Hagos, 2016).

As explained before, potato is highly produced in the Farta district both in rain-fed and irrigation seasons. Potato has many economic benefits used as food and cash crop in the Farta district. Even though the Farta district has enormous potential for potato production, the kinds of storage, condition for market information, product quality, market linkage, the status of potato production, marketing, market performance, and expected profit from potato products have not been studied yet and documented. The previous studies (Chanie *et al*., 2017; Geremewe, 2018; Milkias and Keba, 2021) were focused on the types of potato seed, characterization, productivity and amount of production, and potato marketing constraints, respectively, but no studies were conducted on the marketing and profit aspects in Farta district.

Therefore, this study was initiated to address the above-mentioned gaps and produce documents for further study with the objective of analyzing the structure, conduct, and performance of the potato market in the study area. In this effect, this paper is oriented to assess the structure, conduct and efficiency of potato market through quantifying the costs, profit margins and describing the challenges and prospects as well.

Research Methods

Area, Types, Sources and Collection Methods of Data

This study was conducted in the Farta district of southern Gondar in the Amhara region of Ethiopia (Figure 1).

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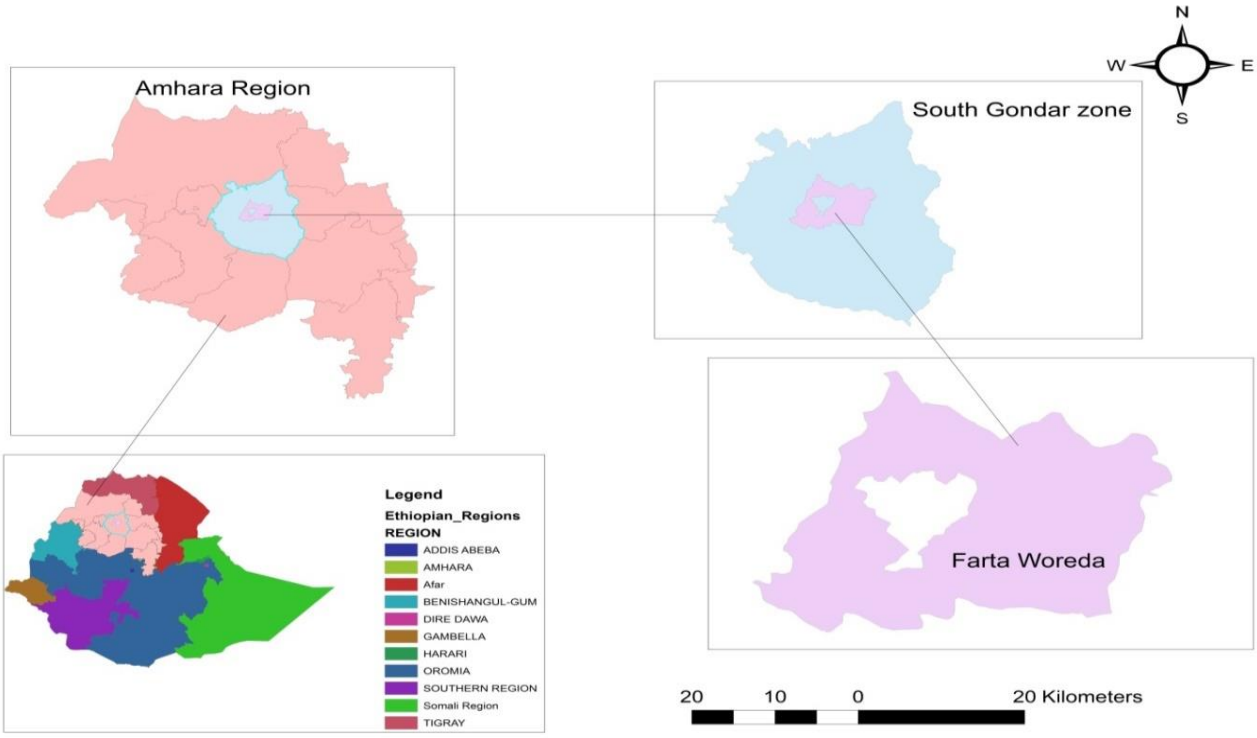

Figure 1: Study area

This study used primary and secondary data. The primary data were collected from sampled households and dealers at different levels, from agricultural agents and regional wholesalers. Structured questionnaires were used, and it was pre-tested and modified. Secondary data was collected from the Farta District Agriculture Office, Amhara Region Agriculture Bureau, and some peer-reviewed journals.

Sampling Technique and Methods of Sample Size Determination

In order to select potato producers, a two-step random sampling technique was used. First, out of 37 *kebeles* (the lowest government administration level in Ethiopia) in the district, approximately 4 *kebeles* were selected using simple random sampling technique. Then, using the list of producer farmers of sample kebeles, potato farmers were randomly selected on the basis of probabilities proportional to the population size of the selected kebeles.

The sample size was determined by using Yamane's (1967) sampling formula by considering 95% confidence, and 5% precision levels as follows:

$$n = \frac{N}{1+N(e)^2} \quad , n = \frac{46{,}812}{1+46{,}812(0.09)^2} \sim 123 \qquad Eq(1)$$

where, n is the sampled potato producers, N is the total number of potato farmers in sampled *kebeles* existing in the selected district, and e is the correction factor used.

Based on the flow of potato products, three markets such as Debre Tabor, Gassay and Kimirdinigay were purposively selected as they are the major potato marketing centers in the district. All lists of traders in the towns were obtained from the District Trade and Transport Office. From 58 collectors, 9 collectors were selected randomly; from 62 wholesalers, 10 wholesalers were randomly selected; from 35 retailers, 8 retailers were selected, in addition to 3 processors sampled in Debre Tabor town. Thus, total 30 traders from

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three towns were selected. Finally, data from 13 consumers were also randomly selected from the respective towns.

Table 1: The distribution of sample potatoes producers in designated Kebeles

Name of identified kebeles	*Total no. of potato farmers*	*No. of sampled potato farmers*
Mokish	1462	30
Minet	1806	38
Kanat	1569	33
Limado	1040	22
Total	5877	123

Table 2: The distribution of sampled traders and consumers of potatoes

Traders	*Debre Tabor*	*Gassay*	*Kimirdingay*	*Total*
Local collectors	3	2	4	9
Wholesalers	3	4	3	10
Retailers	4	2	2	8
Processors	3	0	0	3
Consumers	7	2	4	13
Total	20	10	13	43

Methods of Data Analysis

Descriptive statistics like frequency, percentages, mean, standard deviation, etc. were used to classify the data and the significance was tested through t-test and χ^2 test. The relationship between market structure, conduct and performance was studied and with the assessment of market efficiency. In addition, concentration ratios and analysis of marketing margins were used to describe potato market structure and to assess market performance (Kohls, 1955).

Market Structure

Market structures are defined as the characteristics of market organizations that strategically affect competition and pricing in the market (Pender, 2005). The characteristics most often employed are the number and size of firms distribution, the size of market, the barriers for free entry and exit to the market, and the nature of product diversity, as stated by Kohls and Uhl (1985). Market concentration and entry barriers were used to estimate the structure of the Farta district's potato market. The most common methods to measure the market concentration and structure are three, such as concentration ratio (CR), Herfindahl Hirschman Index (HHI), and Gini coefficient (Orwin and Boyle, 1927). From the types of approaches of market concentration, since its most understandable measure, a pervasive measure of market power and market concentration, its popularity stems from its simplicity, in terms of calculation as well as in terms of user friendliness. The concentration ratio (CR) was used for this study.
The market concentration is measured by following formula:

$$MS_i = \frac{Q_i}{\sum Q_i} \qquad Eq(2)$$

Where MSi is the market share of firm i; Qi is quantity of potatoes held by firm i; and ΣQi is total sum of quantities of potatoes held.

$$C = \sum_{i=1}^{r} S_i \quad i = 1, \ldots \ldots n \qquad Eq(3)$$

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Where, C = concentration ratio handle
Si = percentage share of i^{th} firm
r = number of the first largest firms for which the ratio is considered.

Market Conduct

Market conduct refers to the behaviour that a company adopts to adapt or regulate its market for purchases and sales. In this study, market behavior indicators such as price setting and purchasing and selling strategies were taken into account (Kotler and Armstrong, 2012). It refers to the patterns of behavior that firms follow in adapting or adjusting to the markets in which they sell or buy. Such a definition implies the analysis of human behavior patterns that are not readily identifiable, obtainable, or quantifiable. Thus, in the absence of a theoretical framework for market analysis, there is a tendency to treat conduct variables in a descriptive manner, or as a spill-over in the assessment of market performance. The conduct of a market can be characterized by the following practices: Pricing strategy predatory, exclusionary, collusive, product strategy, responsiveness to change. The following indicators had been considered for this study: traders' price setting, purchasing and selling strategies.

Market Performance

Estimating marketing margins and costs is the best tool for analyzing market efficiency. Marketing margin is computed by compiling the difference among producer farmers and final retail prices (Baker, 1991).
The total marketing margin was calculated using the following formulae:

$$TGMM = \frac{End\ buyer\ price - Farmgate\ price}{End\ buyer\ price} * 100 \qquad \text{Eq(4)}$$

The producer's margin or share in the consumer price GMM_P is calculated as:

$$GMM_p = \frac{Price\ paid\ by\ End\ buyers - Gross\ Marketing\ Margin}{Price\ paid\ by\ End\ buyers} * 100 \qquad Eq(5)$$

The producer's share is the proportion of the farm gate price to the end-user's price. It is stated as:

$$PS = \frac{P_p}{P_c} = 1 - \frac{MM}{P_c} \qquad Eq(6)$$

Where, PS = the producer's share
P_p = Producer price
Pc = Consumer price
MM = Marketing margin

The price share of potato market intermediaries is calculated as:

$$GMM = \frac{SP - BP}{EBP} * 100 \qquad \text{Eq(7)}$$

Where:
GMM = Gross Marketing Margin (%)
SP = Selling price at each level
BP = Buying price
EBP = End buyer price

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Results and Discussion

Sample Characteristics

Among the samples, about 76.7 percent were male, while 23.3 percent were female indicating that women were less involved in the potato trade. The mean age of traders was 32.5 years indicating a young and energetic age group, and the standard deviation was 9.7. About 86.7 percent of the traders were married and the remaining 13.3 percent were single. The results for the educational level of traders showed that about 86.67% of the traders attended formal education while the mean educational level in terms of year of schooling was 6.3 years at a deviation of 3.4. Furthermore, the mean potato trading experience of the sampled traders was 6.5 years. The mean initial capital of the traders to start and expand potato trading was 24,152.67 Birr while the current average capital of the sampled traders was 34,796.67 Birr.

Table 3. Demographic Characteristics of Sampled Traders

Variable	*Mean*	*Standard Deviation*	*Minimum*	*Maximum*
Age	32.5	9.7	21	54
Family size	3.5	1.7	1	8
Education level	6.3	3.4	0	12
Trading experience	6.5	5.08	1	19
Initial capital	24,152.67	33,074.21	100	11,0980
Current capital	34,796.67	45,100.51	1200	145,000
Sex	*Frequency*	*Percent*		
Male	23	76.7		
Female	7	23.3		
Total	30	100		
Marital status	*Frequency*	*Percent*		
Single	4	13.3		
Married	26	86.7		
Total	30	100		

Scenario of Potato Trade

The transaction processes of potato marketing from producers to final consumers are illustrated through diverse marketing networks. It includes direct sell of the product to final consumers and the involvement of various intermediaries between producers and consumers. Accordingly, in the research area, eight alternative channels are identified as below:

1. Producers → Consumer
2. Producers → Retailers → Consumer
3. Producers → Collectors → Consumers
4. Producers → Wholesalers → Consumers
5. Producers → Processor → Consumer
6. Producers → Collectors → Retailers → Consumers
7. Producers → Wholesaler → Retailers → Consumer
8. Producers → Collectors → Wholesaler → Retailers → Consumer

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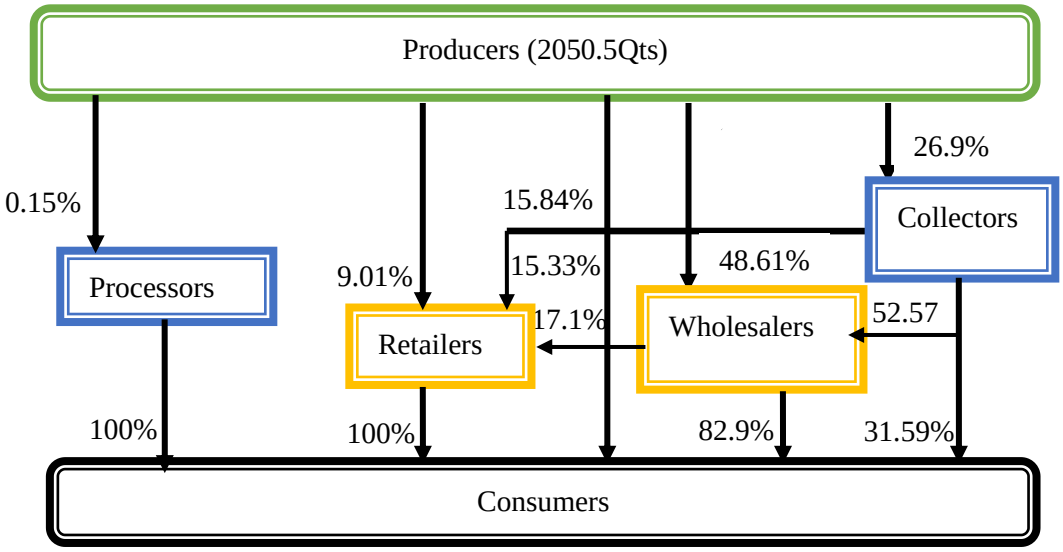

Figure 2: Marketing channels of potato in Farta District

Farmers sold 48.61 percent potatoes to wholesalers, 26.9 percent to collectors, 15.33 percent to consumers, 9.01 percent to retailers and 0.15 percent to processors. Wholesalers capture and dominate the market and play the crucial role in price determination. During the survey, sampled farmers reported that the wholesale market had two types of benefits. Firstly, farmers can sell a large volume of potato, especially in surplus production periods, and, secondly, obtaining a reasonable price than other traders. The outcome displays that farmers have linkages with collectors, consumers, and retailers and they made an assessment about the information on the price and the market before choosing a particular market. Farmers used different market centers to sell their products. The result of this study depicted that 39.02% of producers sold potatoes at Debre Tabor market, 39.84% at Gassay, 17.07% at Debre Tabor and Gassay, and 4.07% farmers sold at Gassay and Kimirdingay markets.

Structure - Conduct - Performance of the Potato Market

Potato Market Structure

The concentration ratio of four-firm (CR4) above 50% is considered a strong oligopoly; CR4 between 33 percent and 50 percent is considered a weak oligopoly, and a CR4 of less than 33% is not a concentrated market. The study showed that the potato market at the research area was a feeble oligopoly market (Table 4).

Although potato trading is a profitable business activity in the study area, most of the big traders play a game of imperfect competition to hinder other small/new traders engaged in potato trading. According to the report obtained from the Trade and Transport Office, 58 percent of potato traders have a trading license based on the amount of trading (the current capital asset) they have. The license acts as the main entry barrier.

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Table 4: Potato Traders' Concentration Ratio in Farta District

Number of traders (A)	*Percent of traders* $C = \frac{A}{30}$	*Quantity purchased in Qt(F)*	*Total quantity purchased in Qt (G)=* (AXF)	*Percent share of purchase* $Si = \frac{G}{126055}$	*Percent of cumulative purchase* $\left(C = \sum_{i=1}^{r} Si\right)$
1	3.33	20000	20000	15.87	15.87
1	3.33	15000	15000	11.90	27.77
1	3.33	14000	14000	11.10	38.87
1	3.33	13000	13000	10.31	49.18
1	3.33	12500	12500	9.92	59.1
1	3.33	10800	10800	8.57	67.67
1	3.33	10000	10000	7.93	75.6
1	3.33	9000	9000	7.14	82.74
1	3.33	8000	8000	6.35	89.09
1	3.33	8000	8000	6.35	95.44
1	3.33	900	900	0.71	96.15
2	6.67	800	1600	1.3	97.45
1	3.33	750	750	0.6	98.05
1	3.33	600	600	0.48	98.53
1	3.33	500	500	0.4	98.93
1	3.33	400	400	0.32	99.25
2	6.67	120	240	0.2	99.45
1	3.33	110	110	0.09	99.54
1	3.33	100	100	0.08	99.62
1	3.33	80	80	0.06	99.68
1	3.33	75	75	0.06	99.74
1	3.33	65	65	0.05	99.79
3	10	60	180	0.14	99.93
1	3.33	55	55	0.04	99.97
2	6.67	50	100	0.08	100
30	100		126055	100	

Note: C=concentration ratio; S_i= share of the four largest firms

Conduct of Potato Market

The result of the study showed that 26% of sampled respondents stated that the market price was set with negotiation to traders; 32% responded price was set by the market; and the remaining 42 percent replied price was set by traders. Most farmers agree that prices are the factor in deciding who will sell their products and where. Due to the absence of a stable price-setting strategy and the perishable nature of the product, the potato market price leads to seasonal price fluctuation and resulted in producers' dissatisfaction. The result was in line with the findings of Negussie et al. (2022) on Teff.

Traders attract sellers by providing reasonable prices with negotiation between the two sides. The marketing approach of traders is carried out systematically by investigating the market where the demand of the product increase and price also rises, and they communicate with buyers about the quality and amount of product with mobile and other information media before supplying the product to the respective market outlet.

Performance of the Potato Market

Table 5 shows average production cost and profitability analysis of potato in both Birr per quintal and Birr per hectare. The survey results indicated that farmers incurred an average production cost of 140.65 Birr per quintal and 15,963.83 Birr per hectare.

Table 5: Profitability Analysis and Average Production Cost of Potato

Production activities	*Cost Birr/quintal*	*Cost Birr per hectare*	*Share %*
Inputs buying cost			
Seed, fertilizer, and equipment	27.62	3134.87	19.64
Land cost (rental value)	24.53	2784.2	17.44
Labor cost (hired value)			
Land preparation cost	16.05	1821.43	11.41
Planting/sowing cost	13.74	1559.22	9.77
Digging/wedding cost	16.83	1909.93	11.97
Harvesting/collecting cost	13.42	1522.92	9.54
Packaging material cost	12.35	1401.7	8.78
Transportation cost			
Transportation to their home cost	6.42	728.67	4.56
Transportation to market cost	8.81	999.9	6.3
Taxes payment cost	0.89	101	0.63
Average total cost Birr/qt		140.65	
Average total cost Birr/ha		15,963. 83	
Average selling price Birr/qt		238.00	
Average selling price Birr/ha		27,013	
Average gross profit in Birr/qt		97.35	
Average gross profit in Birr/ha		11,049.17	

Note: Converting Birr/qt into Birr/ha using average productivity of sample potato farm households'=113.5 quintal per hectare.

The land cost is a prospect cost of land which is the rental value of land farmers can have. More than 75% of farmers produced potato using family labour. The input cost represented 19.64 percent of the overall cost. The average gross profit was 97.35 Birr per quintal and Birr 11,049.17 per hectare.

Analysis of Marketing Costs and Margin

The marketing cost of potatoes mainly involves the cost of post-harvest activities incurred before reaching the consumer. Generally, these components constitute a large share in the total margin between the final retailer price and the cost of production. Marketing margin can be used to measure the share from the final selling price captured by a particular actor in the value chain. To calculate the marketing margin of an actor, the average price of potato for that particular actor was taken. For example, the buying price of consumers was obtained by taking the average purchasing price of consumers.

Table 6: Cost of Potatoes marketing for variety of actors (Birr/Qt)

Cost of marketing in Birr	*Actors*		
	Local collectors	*Wholesalers*	*Retailer*
Purchase Price	244.4	259.4	271.0
Labor cost packaging	5.78	4.7	5.25
Loading/Unloading	5.3	4.5	6.63
Transportation fee	7	8.2	11.88
Sorting cost	3.56	3.8	4.5
Storage cost	4.78	4.1	6.25
Loss in transport and storage	11.11	9.1	11.63
Processing cost	3.2	5.4	5.5
Telephone	11.22	10.3	9
License and tax cost	0	18.3	12.86
Total cost	296.39	327.5	344.5
Selling price	326.22	380	450

Table 7: Analysis of Potato Marketing Margin for its Value Chain Actors

Actors	*Selling price Birr/qt*	*Production/marketing cost*	*% GMM*	*Gross profit (Birr/qt)*	*% Profit share*
Producers	238	140.65	52.89	97.35	34.14
Collectors	326.22	296.39	19.5	29.83	10.46
Wholesalers	380	327.5	11.9	52.5	18.41
Retailers	450	344.5	15.6	105.5	36.99
Total			100	285.18	100

As indicated in Table 7, the total gross marketing margin added to the price when it passes through the value chain was 47.11%. From the total gross marketing margin obtained, 19.5 percent had gone to collectors, 11.9 percent for wholesalers, and 15.6 percent for retailers. Compared to farmers, retailers received a large part of the profit margin. Because retailers had not incurred extra operating costs as other actors did. Even though there was positive profit for all potato value chain actors, farmers are not as such benefited as retailers and also the structure and conduct of potato market indicated oligopoly market structure and misconduct in pricing strategy and also there are barriers to entry to potato market. Therefore, all these are indicators of the deviation of the potato market from the standards of the competitive market structure.

Conclusions and Recommendations

The main objective of the study was to analyze the structure, conduct, performance, and efficiency of the potato market in the Farta District, Ethiopia. The structure of the potato market was analyzed by taking the share of the four largest firms from the total volume of potatoes purchased by sample traders. The four-firm concentration ratio (CR_4) indicated that the four largest traders handled 49.18 percent of the total volume of purchase. Therefore, the structure of the potato market in the study area is a weak oligopoly market, which means the potato market is dominated by limited traders. It revealed that there was an imperfect market competition between traders in the market. In the process of the potato market, every actor incurs costs for production and marketing activities. Marketing costs constitute a large share in the total margin between the final retailer price and the cost of production. The total gross marketing margin added to potato price when it passes through the value chain was 47.11 percent. Compared to farmers, retailers received a large proportion of profit since retailers had not incurred much cost as other market actors. Most big traders play a game of imperfect competition to hinder other small/new traders engaged in potato trading. The license issuance acts as the main entry barrier for small sized traders. Due to the absence of a stable price-setting

strategy and the perishable nature of the product, the potato market price leads to seasonal price fluctuation and resulted in producers' dissatisfaction. Even though all actors received positive profit in the potato market since the market is oligopolies and also there are barriers to entry, the potato market in the study area deviated from competitive market standards. Government and concerned institutions should strengthen effective market information system; creating a competitive market structure; and assuring stable prices to improve producers' return. It is also essential that support producers intensify their bargaining power and set rules to other value chain actors for governing their informal marketing practice for improving market competitiveness and efficiency by reducing the level of an oligopolistic market.

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Authors' Declarations and Essential Ethical Compliances

Authors' Contributions (in accordance with ICMJE criteria for authorship)

Contribution	Author 1	Author 2	Author 3
Conceived and designed the research or analysis	Yes	Yes	Yes
Collected the data	Yes	Yes	Yes
Contributed to data analysis & interpretation	Yes	Yes	Yes
Wrote the article/paper	Yes	Yes	Yes
Critical revision of the article/paper	Yes	Yes	Yes
Editing of the article/paper	Yes	Yes	Yes
Supervision	Yes	No	Yes
Project Administration	Yes	No	No
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Research involving human bodies (Helsinki Declaration)
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During the research, the authors followed the principles of the Convention on Biological Diversity and the Convention on the Trade in Endangered Species of Wild Fauna and Flora. Yes

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