Cereal crops account for 88.52% of grain production in Ethiopia and 87.6% in the Guji Zone. Despite its size, its contribution to household welfare has yet not been studied. Besides, there are limited studies with rigorous methodological approaches regarding the effects of commercializing cereal production on household welfare. This paper is set out to measure the commercialization of cereal crops and examines its welfare effects measured as food and nonfood consumption expenditure. The study was based on cross-sectional data collected in 2019 from 288 sample farm households selected through a multistage sampling technique. A Kruskal-Wallis test and post hoc Dunn's test were employed to examine the welfare effects of commercialization. The study shows that about 48.33% of cereal production was sold to the market, suggesting a moderate level of commercialization. Moreover, the finding indicates that the welfare effects differed across various levels of commercialization at p < 0.01, p < 0.05, and p < 0.1 significance levels. This implies that at least one of the commercialization categories had a different mean. The effects of cereal crop commercialization were statistically significant in terms of monetary expenditure on coffee and sugar, edible oil, clothes and shoes, education, medications, farm implements, durable goods, and aggregate expenditure. The study showed the positive welfare effects of cereal crop commercialization between comparisons considered (moderate vs. low, high vs. moderate, and high vs. low commercialization categories). It also pinpointed the possibility of further improving their consumption expenditure by enhancing their intensity of commercialization if appropriate strategies are designed and implemented. Thus, stakeholders involved in cereal subsector development should work collaboratively to enhance the farm-level intensity of commercialization by improving public service delivery in rural areas. Besides, farm households should work on value addition and market linkage to achieve a better commercial status, thus, improve their welfare.

1. Introduction

There is a consensus among policymakers that agricultural commercialization is an important means of achieving food security and moving out of poverty (Von Braun, 1995). For instance, the finding by Tafesse (2013), Geoffrey (2015), and Zegeye et al. (2021) suggests that smallholder commercialization can lead to a better food security status and reduced poverty level through its effect on production, income, nutrition, and other socio-economic dimensions of smallholder farmers. A study by Jaleeta et al. (2009) explains the effects of commercialization as first (income and employment), second (health and nutrition), and third-order (macro-economic and environmental). They conclude that households who followed a commercial scheme earned significantly higher annual net income. Besides its positive socio-economic effects on farming households, smallholder’s commercialization also has a direct and positive impact on value chain actors.

Furthermore, empirical evidence across the globe also indicates multi-dimensional benefits of agricultural commercialization on agricultural productivity, food security, nutrition, income, and poverty reduction. For instance, crop commercialization increased income and diversity scores of farmers in Central Africa (Ochieng et al., 2016), households with high degree of commercialization enjoyed better consumption of food, goods, and services in Bangladesh (Osmani et al., 2015), agricultural commercialization improved food security and diversity quality in terms of calorie, zinc, and iron consumption in Kenya (Ogutu et al., 2019), market participation and stepping up to intensive and profit-oriented farming has contributed to income, provided benefits to rural livelihood, and improved welfare of the farmers in Indonesia (Mariyono, 2019a,b), shifting from subsistence farming towards market orientation significantly increased the income and welfare of smallholder farmers and contributed to economic growth and poverty alleviation in Southern Africa (Zhou et al., 2013), and agricultural commercialization had positive effect on the food variety score and household welfare in Vietnam (Cazzulfi et al., 2018; Janssen, 2018).

This entails that the ultimate goal of agricultural commercialization is to bring an improvement in the welfare of farmers and market chain...
actors and enable them to sustainably progress out of the multifaceted poverty (Tesso, 2017). Conversely, the empirical evidence by Pingali (1997), Strasberg et al., (1999), and Tesso (2017) suggests that agricultural commercialization would rather contribute to poverty, food insecurity, and negatively affect household welfare. They argued that commercialization leads to loss of productivity and the capacity to produce food due to overuse of fertilizers, pesticides, and land degradation following increased production intensification thereby affecting the environment negatively.

To assess the interaction between smallholder commercialization and household welfare, different methodological approaches have been employed by different authors. For instance, Diyana (2014), Osmani et al. (2015), and Abera (2009) analyzed the welfare outcomes of commercialization using a one-way analysis of variance (ANOVA). The logit estimation was employed by Mohammed et al. (2017) to study the impact of commercialization on food security. On the other hand, Tafesse (2013) analyzed the interaction of agricultural commercialization with productivity and food security using the descriptive method (figures). Using one-way ANOVA requires the satisfaction of model assumptions, such as normality, homoscedasticity of population variance, and independent samples. Under non-satisfaction of these assumptions, estimation using one-way ANOVA leads to wrong conclusions unless remedial measures are being taken (Delacre et al., 2019). The aforementioned studies, which analyzed the level of commercialization and welfare interaction using one-way ANOVA, ignored justifying how this model was appropriate, especially with the assumptions. They overlooked post hoc analysis, which is the most important part of one-way ANOVA to perform pairwise comparisons among categories. Besides, in their way of welfare measurement using the expenditure approach, they excluded aggregate consumption expenditure, from which the household maximizes utility (Hentschel and Lanjouw, nd). The estimation using the logit model (food security as a dependent variable) also fails to account for the various effects of commercialization (e.g., consumption of nonfood items). The descriptive analysis also does not show whether the effects are statistically significant.

In the Guji Zone, irrespective of the focus on productivity-enhancing mechanisms such as site-specific crop adaptability tests (Kebede and Korji, 2017), and production determinants for different crops (Kebede et al., 2017), previous studies placed a little emphasis on measuring the marketability index of those products and associating them with welfare indicators to test a hypothesis about whether a better commercial position contributes to an improvement in household welfare, especially of cereal crops, which account for 88.52% of grain production in the country and 87.6% in the Zone (CSA, 2020). Despite their large share in terms of production, there is a dearth of information about their contribution to household income and welfare. Moreover, from the reviewed literature, it is possible to conclude that there are controversies about the effects of commercialization on household welfare. Given the knowledge and methodological gaps, and theoretical arguments, hence, this study was set out to measure the current status of cereal crop commercialization and examine its effect on household welfare in the Guji Zone. The findings of this study will be useful for stakeholders involved in the development of the cereal subsector, particularly agricultural offices, to recognize the effects of cereal crop commercialization and, design and implement measures that enhance cereal crop production and commercialization by smallholder farmers to improve their income and welfare status.

**Figure 1.** Cereal commercialization and household welfare. Source: Author construct based on Kilimani et al. (2020).
2. Materials and methods

2.1. Conceptual framework

The conceptual framework forming the basis for the empirical analysis is summarized in Figure 1. Smallholder farmers are supposed to produce crops for two main purposes which are consumption and marketing purposes. They could entirely consume their output, entirely market, consume a part of it and market the remaining depending on the commodity. If the farmers entirely consume their products, it means that they are not market-oriented and they can be said to be autarchic. It implies that they produce just to meet what they need throughout the production season and do not need to depend on the market (Benjamin, 2013). If they sell a fraction of the production, the extent of commercialization will be observed and thus, farmers earn income from market participation.

According toUNCTAD (2015), the level of smallholders' participation in output markets determines their earnings. Better linkages with markets can induce rural populations to consider farming as a profitable, and therefore a viable livelihood choice. It increases farmers' capacity to produce a marketable surplus, which, if sold in competitive output markets, can enable them to obtain higher prices and consequently increase their incomes (Tafesse, 2013). The resulting income is then used to buy consumer items that households need but cannot produce. Theoretically, commercialization is expected to yield welfare increases at both the household and aggregate levels (Eshetu, 2018; Ochieng et al., 2019; Ogutu et al., 2019). These gains stem from static welfare effects of trade based on comparative advantage, which translate into income and employment effects that are directly reflected in household welfare, as well as improvements in health and nutrition that are dependent on income levels (Cazzuffi et al., 2018). Access to markets and a shift away from subsistence farming can lead to changes in economic growth and, eventually, higher living standards. The findings of Zhou et al. (2013), Kem (2017), and Ngwako (2021) indicate that a transition from subsistence-oriented farming towards commercialized farming increases a household's income, welfare, economic growth, and a reduction in rural poverty directly through income effects. Moreover, a study byKirimi et al., (2013), Mmbando (2014), and Geoffrey (2015) clearly outlined the contribution of commercialization to dietary diversity and per capita consumption expenditure, and a reduced risk of being chronically food poor, and transition households out of food poverty. Compared to subsistence farming, commercialization increases rural households' income and employment due to the expansion in the use of hired labor. Furthermore, increasing income and employment due to commercialization would result in a wide range of development across the entire rural sector. Having the consumption and marketing goals, farmers' production decisions are influenced by the choices they make about the production technologies (land, labor, fertilizer, improved seeds, etc.).

2.2. Research design and data collection

The study covered three districts in Guji Zone, namely, Adola Rede, Odo Shakiso, and Ana Sora districts (Figure 2). Adola Rede is located about 475 kilometers from Addis Ababa. It shares a boundary with Girja in the north-east, Anna Sorra in the north-west, Odo Shakiso in the southern, and Wadara in the south-east direction (ARBoFED, 2017). Astronomically, it is found between 5°44'10"N-6°12'38"N and 38°45'10"E-39°12'37"E. It has a total area of 1401 km². Based on the projections made to the 2007 Population and Housing Census Results, the total population of the district is estimated at 141,502, of which 50.84% and 49.16% respectively, were male and female in 2020. The district is classified into three agro-climatic zones (lowland (60%),

Figure 2. Location of study site. Source: Developed based on Ethio-GIS (2015).
midland (29%), and highland (11%)) and it comprises 28 rural kebeles and 3 rural towns (ARANRO, 2020). Moreover, the majority of farm households continue to engage in traditional agriculture. However, some of its occupants also engaged in semi-nomadic economic activity as a means of subsistence. The district’s typical annual temperature is 28°C, and its mean annual rainfall is approximately 1000 mm. In the district, crop production occurs in bimodal seasons. Farmers are engaged in the production of fruits and vegetables as well as cereals including teff, wheat, barley, and maize, and pulses such as haricot beans. Besides, they also engaged in the production of commercial crops like coffee and khat. Additionally, the district is endowed with a livestock population like cattle, goats, sheep, horses, mules, donkeys, and poultry (ARBoFED, 2017). Of the total area of the district, about 60,195 ha is suitable for crop production. However, only 27,843 ha were covered by different crops during the main cropping season of 2020 (ARANRO, 2020).

Astronomically, Odo Shakiso is located between 5°2’29”–5°58’24” northings and 38°35’0”–39°13’38” easting longitudes at a distance of 490km southeast from Addis Ababa, the capital city of Ethiopia and the Regional State of Oromia, and 139 km away from the zonal capital city Negelle town. It is bordered by Saba Bori in the south, Aga Wayu in the southwest, Birbisa Kojawa in the west, Adola Rede in the east, and Uraga district in the north. The total area of the district is 15,740.02 km². It is classified into 20 rural kebeles and 2 rural towns (OSBoFED, 2020). The main economic activities of the district are farming, mining, construction, etc. The district is characterized by three agro-climatic zones, namely highland (33%), which starts in early November and extends up to December, midland (47%), which starts in late June and extends up to November, and lowland (20%), which starts in March and extends up to May. Approximately, the mean annual rainfall and the mean annual temperature of the district are respectively 900 mm and 25°C. Of the total land area of the district, about 23.14% is cultivated land. The district produces a variety of crops, including teff, wheat, barley, maize, haricot beans, rapeseed, fruits, and vegetables. Furthermore, the district is well-known for its livestock production, which includes cattle, sheep, goats, horses, donkeys, mules, camels, and poultry. All farming practices are carried out on smallholding farms. In the district, traditional agricultural methods (hand-dug and oxen-driven) are predominantly practiced, with very little use of modern agricultural inputs (OSBoFED, 2020).

Ana Sora district is located 414 km from Addis Ababa and 180 km from Nagelle, the zonal town. It has a total area of 798.74 km². The district is located between 620°30’ to 557°30’N latitudes and 338°5’–39°13’38” easting longitudes at a distance of 490km southeast from Addis Ababa, the capital city of Ethiopia and the Regional State of Oromia, and 139 km away from the zonal capital city Negelle town. It is bordered by Saba Bori in the south, Aga Wayu in the southwest, Birbisa Kojawa in the west, Adola Rede in the east, and Uraga district in the north. The total area of the district is 15,740.02 km². It is classified into 20 rural kebeles and 2 rural towns (OSBoFED, 2020). The main economic activities of the district are farming, mining, construction, etc. The district is characterized by three agro-climatic zones, namely highland (33%), which starts in early November and extends up to December, midland (47%), which starts in late June and extends up to November, and lowland (20%), which starts in March and extends up to May. Approximately, the mean annual rainfall and the mean annual temperature of the district are respectively 900 mm and 25°C. Of the total land area of the district, about 23.14% is cultivated land. The district produces a variety of crops, including teff, wheat, barley, maize, haricot beans, rapeseed, fruits, and vegetables. Furthermore, the district is well-known for its livestock production, which includes cattle, sheep, goats, horses, donkeys, mules, camels, and poultry. All farming practices are carried out on smallholding farms. In the district, traditional agricultural methods (hand-dug and oxen-driven) are predominantly practiced, with very little use of modern agricultural inputs (OSBoFED, 2020).

The con

Table 1. Sampling distribution by districts and kebeles

| Sample Districts | Sample Kebeles | Number of HHs (no.) | Proportion of Sampled HHs (%) | Number of Sample HHs |
|------------------|----------------|---------------------|-----------------------------|---------------------|
| Ana Sora         | i. Sahe Chichu | 4,006               | 23.79                       | 45                  |
|                  | ii. Gidicho Ghati | 2,574               | 15.29                       | 29                  |
|                  | iii. Ababa Kohu | 5,020               | 29.81                       | 56                  |
|                  | iv. Raya Boda | 5,238               | 31.11                       | 59                  |
|                  | **Sub-total** | **16,838**          | **100**                     | **189**             |
| Odo Shakiso      | i. Korba Chicho | 716                 | 12.84                       | 8                   |
|                  | ii. Wolabo    | 2,234               | 40.06                       | 25                  |
|                  | iii. Reji     | 1,118               | 20.05                       | 12                  |
|                  | iv. Taro Badya| 1,508               | 27.05                       | 17                  |
| **Sub-total**    | **5576**      | **100**             | **62**                      |                     |
| Adola Rede       | i. Maleka     | 673                 | 20.25                       | 7                   |
|                  | ii. Dararut  | 957                 | 28.79                       | 11                  |
|                  | iii. Michicha | 906                 | 27.25                       | 10                  |
|                  | iv. Bachara   | 788                 | 23.71                       | 9                   |
| **Sub-total**    | **3324**      | **100**             | **37**                      |                     |
| **Total**        | **25,738**    |                     |                             | **288**             |

Source: Own computation based on data from each districts’ ANRO.

The smallest administrative unit in Ethiopia.

preliminary evaluation of sample kebeles in the districts was conducted, and enumerators were recruited and trained on interview techniques. Then, in line with study objectives, a semi-structured questionnaire with open and closed-ended questions was designed, examined, and interviews were held with sample respondents. A multistage sampling technique was employed in this study. In the first stage, three districts were selected using a simple random sampling technique from eight cereal crop producer districts by excluding six pastoral and three town districts in the zone where cereal production is infrequently cultivated. At this stage, the simple random sampling technique was chosen over the other sampling techniques because, as all districts in the sampling frame are producers of cereal crops, it ensures that all districts have an equal chance of being included in the sampling frame (Singh and Masuku, 2014). Secondly, a stratified random sampling technique was used to select four kebeles1 from each sample district. The agro-climatic zones (lowland, midland, and highland) were used to form the strata. The reason for using a stratified random sampling technique at this stage is to draw representative samples by accounting for the size distribution of each stratum and the heterogeneity within the strata. Lastly, sample households were selected using a simple random sampling technique by considering the size distribution of households in the sample kebeles. The sample size was calculated using a formula given by Cochran (1977) mentioned in Eq. (1).

\[ n = \frac{Z^2 \cdot \alpha \cdot (1 - \alpha)}{d^2} \]  

(1)

where \( n \) denotes the sample size; \( Z \) is the statistic derived from the standard normal distribution table at a given level of significance (\( \alpha \)). The confidence level is found by deducting the significance level from 1, i.e. 1 – \( \alpha \). Accordingly, at a 5% of significance level, a 95% confidence level is used to estimate the value of \( Z \). Therefore, \( Z = 1.96 \); \( p \) designates the fraction of prevalence, and \( q = 1 - p \). The data were collected from a total sample size of 288 (Table 1). The sample size in each district was determined proportionally to the size of households in each district. For
instance, to determine the sample size for the Ana Sora district, the number of households in Ana Sora district is divided by the total number of households in the three districts multiplied by the total sample size \((16,838/25,738) \times 288 = 189\). The same procedure was followed to determine the sample size of the remaining districts. To determine the number of samples for each kebele, the number of households in the kebele is divided by the number of households in the district and multiplied by the number of samples in the district.

### 2.3. Methods of data analysis

The study objectives were achieved using different analytical methods and statistical tools. A Kruskal-Wallis test was employed to determine the welfare effects of cereal crop commercialization. For this purpose, farmers were categorized into three commercial statuses as low (Household Commercialization Index (HCI) \(\leq 35\%\)), moderate (35\% < HCI < 65\%), and high (>65\%) based on the level of commercialization in cereal production which were determined using the household commercialization index (HCI) in Eq. (2). Then, the Kruskal-Wallis test was performed to detect the welfare effects of cereal crop commercialization among smallholder farmers at different levels of commercialization. The study used the consumption expenditure welfare measurement approach. The welfare was measured using the household's total expenditure on different food and nonfood items as they represent the money metric utility for a utility-maximizing household and a proxy for the real consumption of goods and services from which assumed to be people derive welfare (Hentschel and Lanjouw, nd). Therefore, monetary spending by smallholder farmers on non-grain consumables, kerosene, cloth and shoes, schooling, health care, housing, durable goods (TV, phones, radio, and furniture), and farm tools were taken as a proxy measure of welfare.

\[
\text{HCl}_i = \frac{\sum_{j=1}^{c} P_j S_{ji}}{\sum_{j} P_j Q_{ji}} \times 100
\]

(2)

where HCl\(_i\) is the household commercialization index; \(S_{ji}\) is the amount of crop \(j\) sold by household \(i\); \(Q_{ji}\) is the total amount of crop \(j\) produced by household \(i\); \(P\) is the community level average price, and \(C\) is the number of cereal crops grown by the household.

Prior to the rejection of the parametric one-way ANOVA, the data were checked for normality and homoscedasticity assumptions. Shapiro-Wilk test of normality by Shapiro and Wilk (1965) is not met for the data at hand, suggesting a violation of the normality assumption. The skewness (as different from zero) and kurtosis (as different from three) statistics also showed a violation of the normality assumption for all variables included in the model (Appendix A). The histogram of the variables considered in this study was left or right-skewed for different groups. In this context, a nonparametric test (Kruskal-Wallis test) should be considered. The homoscedasticity assumption was checked using Levene's test. The test statistic was strongly significant for all variables included in the model, suggesting the rejection of the homoscedasticity assumption (Appendix B). For this reason, the data were analyzed using the Kruskal-Wallis test (Kruskal and Wallis, 1952). It is specified as follows in eqs. (3) and (4).

\[
H = \frac{12}{n_{T}(n_{T} + 1)} \sum_{i=1}^{k} \frac{R_{iT}^2}{n_{T}} - 3(n_{T} + 1)
\]

(3)

\[
n_{T} = \sum_{i=1}^{k} n_{Ti}
\]

(4)

where \(k\) is the number of populations, \(n_{Ti}\) is the number of observations in sample \(i\), \(n_{T}\) is the total number of observations in all samples, and \(R_{iT}\) is the sum of the ranks for sample \(i\).

The data were also checked for ties. For all variables considered, the unique values present in the data did not include the entire sample of 288, suggesting the presence of ties in the data (Appendix C). The post hoc analysis was performed using Dunn's test of pairwise multiple comparisons based on rank sums (Dunn, 1964). A distribution-free Dunn's Z test that approximates the rank-sum test using the mean rankings of the outcome in each group from the preceding Kruskal-Wallis test for comparison of one group with another group where the inference is based on the differences in mean ranks in each group with ties is specified in Eq. (5).

\[
Z_i = \frac{y_i}{\sigma_i}
\]

(5)

where \(i\) is 1 to \(m\) multiple comparisons, \(y_i\) is the difference in mean rank in each group, and \(\sigma_i\) is the standard deviation of \(y_i\), which is given by Eq. (6).

\[
\sigma_i = \sqrt{\frac{N(N + 1)}{12} - \sum_{s=1}^{T} \frac{T_s^2 - T_s}{12(N - 1)}} \left(\frac{1}{n_{T_i}} - \frac{1}{n_{T_i}}\right)
\]

(6)

where \(N\) is the total number of observations across all groups, \(r\) is the number of tied ranks, and \(T\) is the number of observations tied at the sth specific tied value. The mean ranks in each group are given by Eq. (7).

\[
W_i = \frac{W_i}{n_i}
\]

(7)

where \(W\) is the mean rankings of the outcome in each group, \(W_i\) is the sum of ranks, and \(n_i\) is the sample size for the ith group.

### 3. Results and discussion

#### 3.1. Demographic characteristics of sample households

In this subsection, descriptive results on the demographic and socioeconomic characteristics of sample respondents are presented and discussed. The study revealed that out of the 288 sample respondents, households with low commercialization category (HCI \(\leq 35\%\)) accounted for about 17.01\%, whereas the remaining 67.36\%, and 16.63\%, respectively, were accounted by households with moderate (35\% < HCI < 65\%), and high commercial status (HCI >65\%) (Table 2). It implies that most of the sample households were semi-commercially oriented with a moderate level of participation in the cereal crops output market. About 89.6\% of households were headed by a male, while the remaining 10.4\% were headed by a female. This implies that male-headed households more participated in the production and marketing of cereals than their female-headed counterparts. The mean family size measured in adult equivalent units was 5.50. This estimate of family size was

| Variables | Commercial Status |
|-----------|-------------------|
|           | Low \((\leq 35\%\)) | Moderate \((35-65\%\)) | High \((>65\%\)) | Total |
| Number of samples | 49 | 194 | 45 | 288 |
| Sex of household heads | 0.775 | 0.902 | 1.00 | 0.896 |
| Family size (Adult equivalent) | 5.15 | 5.57 | 5.56 | 5.50 |
| Education level (Years) | 5.71 | 6.20 | 6.04 | 6.09 |
| Farm experiences (Years) | 15.24 | 14.02 | 15.53 | 14.47 |
| Cultivated land size (ha) | 2.97 | 3.38 | 3.41 | 3.32 |
| Livestock ownership (TLU) | 5.60 | 5.57 | 5.45 | 5.56 |

Source: Computed from survey data (2019).
relatively higher than the national average family size (4.8 persons per household) reported by the Central Statistical Agency (CSA, 2012).

The implication is that households with a high family size retain a significant fraction of their production for home consumption and become less dependent on the market which could reduce their capability to access basic goods and services other than those produced by farm households. This will in turn reduce farmers’ welfare gains following poor market integration. The mean level of formal education in terms of years of schooling attained by sample respondents in the study site was 6.09 years. This estimate is by far higher than the national average of 2.9 years of schooling implying better education status among farming households in the study area (UNDP, 2020). The sample respondents had 14.47 years of farm experience on average terms. This indicates that farm households had the sufficient experience necessary to manage and operate their farm in accordance with market behavior. Farmland has been an important production asset for farming households in the Guji Zone. The survey result indicated that the mean cultivated land size by sample household heads was 3.52 ha. Compared to the average national holdings (0.9 ha), the cultivated land size was higher, and it implies the possibility of boosting commercialization in small farms (FAO, 2015). Besides providing food and animal protein for households, livestock is another important socio-economic indicator and production asset in the Guji Zone. The result revealed that the mean livestock holding in the study area was 5.56 TLU. It indicates that the area is well endowed with livestock resources.

3.2. Land allocation, values of cereals produced, utilization, and income levels

The statistical summary of the area of land allocated, the value of crops production, the value of crops sold, the value of crops consumed, non-farm income, livestock income, and total income are presented in Table 3. The finding shows the area of land allocated for tef, maize, wheat, and barley during the study period, respectively, was 0.60 ha, 1.26 ha, 0.43 ha, and 0.33 ha. This indicates that more areas of land were allocated for maize production. The total area of land covered under these crops was 2.62 ha. The mean value of land allocated by households in the high commercialization category was higher than those households in the low and moderate commercialization categories.

The mean value of cereals produced was 46,597.09 ETB (Ethiopian Birr). The statistical summary result by the type of crops produced shows the mean value of tef, maize, wheat, and barley produced, respectively, was ETB 17,677.95, ETB 15,469.82, ETB 7,276.68, and ETB 6,172.62. The mean value of cereals sold amounted to ETB 23,138.88. The mean values of tef, maize, wheat, and barley sold were ETB 10,552.45, ETB 7,698.22, ETB 3,889.60, and ETB 2,976.80. Compared to households in the low and moderate commercialization category, households in the high commercialization category had high crop sale value on average terms, suggesting a positive income effect of attaining high commercialization state. The findings of Kilimani et al. (2020) and Manda et al. (2021) also suggest that commercialization improved the income, food expenditure, and dietary diversity of farm households.

Table 3. Summary statistics of production values, utilization, and income level.

| Variables                                | Commercial Status |
|-----------------------------------------|-------------------|
|                                        | Low (<35%)      | Moderate (30-45%) | High (>45%) | Total |
| Area cultivated                         | 1.96            | 2.74             | 2.77        | 2.62  |
| Land allocated for tef (ha)             | 0.30            | 0.61             | 0.85        | 0.60  |
| Land allocated for maize (ha)           | 1.12            | 1.31             | 1.23        | 1.26  |
| Land allocated for wheat (ha)           | 0.30            | 0.47             | 0.35        | 0.43  |
| Land allocated for barley (ha)          | 0.25            | 0.34             | 0.33        | 0.33  |
| Value of cereals produced (ETB)         | 36663.06        | 49003.24         | 47,040.93   | 46597.09 |
| Value of tef produced (ETB)             | 9157.14         | 18825.51         | 22008.93    | 17777.95 |
| Value of maize produced (ETB)           | 15912.65        | 15652.63         | 14199.55    | 15469.82 |
| Value of wheat produced (ETB)           | 6845.41         | 7715.51          | 5854.44     | 7276.68 |
| Value of barley produced (ETB)          | 4747.85         | 6809.58          | 4978        | 6172.62 |
| Value of cereals sold (ETB)             | 10974.89        | 23757.82         | 33715.8     | 23138.88 |
| Value of tef sold (ETB)                 | 2522.45         | 10760.72         | 18398.35    | 10552.45 |
| Value of maize sold (ETB)               | 3856.02         | 5731.97          | 7698.22     | 5720.02 |
| Value of wheat sold (ETB)               | 2950            | 3993.71          | 4463.89     | 3889.60 |
| Value of barley sold (ETB)              | 1646.42         | 3271.41          | 3155.33     | 2976.80 |
| Value of cereals consumed (ETB)         | 9975.71         | 14183.69         | 9272.46     | 12700.37 |
| Value of cereals consumed (ETB)         | 2353.06         | 4950.10          | 3220.57     | 4238.00 |
| Income from livestock and its products (ETB) | 5096.73        | 5611.04          | 4116.44     | 5290.00 |
| Income from livestock and its products (ETB) | 1197.45        | 1726.08          | 940.55      | 1513.40 |
| Income from livestock and its products (ETB) | 1328.47        | 1896.47          | 994.89      | 1658.95 |
| Income from livestock and its products (ETB) | 30             | 47               | 71          | 48.33  |
| Income from livestock and its products (ETB) | 62661.33       | 88647.25         | 103968.43   | 86619.97 |
| Income from livestock and its products (ETB) | 13542.16      | 16659.58         | 22384.93    | 17023.77 |
| Income from livestock and its products (ETB) | 0              | 168.04           | 629.11      | 211.49  |
| Income from livestock and its products (ETB) | 43099.74       | 71073.35         | 98178.65    | 70549.16 |

Note: 1ETB = 0.0344USD in 2019.
Source: Computed from survey data (2019).

3.3. Level of commercialization by crop type, districts, and sex of households

Results indicating the level of commercialization by type of cereal grown are displayed in Figure 3. It shows that farmers in the study area were engaged in the production and marketing of cereal crops such as tef, maize, wheat, and barley. The level of commercialization for tef and maize was higher for households in the high commercialization category compared to the remaining categories, whereas households in the moderate commercial status had a high level of commercialization in barley and wheat production (tef: high (65.8%) > moderate (39.7%) > low (14.1%); maize: high (51.9%) > moderate (37.1%) > low (28%); barley: moderate (39.7%) > high (32.3%) > low (14.1%); wheat: moderate (33.2%) > high (32.8%) > low (28%)). Moreover, the study revealed that the mean level of commercialization for tef, barley, wheat, and maize, respectively, was 40%, 31%, 32%, and 37% suggesting that the level of produced, livestock, and nonfarm source, respectively, was ETB 86,619.97, ETB 17,023.77, and ETB 211.49, while the mean income from all sources was ETB 70,549.16. On average, households in the high commercialization category had higher income from all sources than both low and moderate commercialization categories.
commercialization in the study area is at a moderate level. The percentage values elucidate the fraction of crop sales of the total value of crop production. Besides, among the cereal crops addressed, relatively, tef and maize were the more commercialized crops in the Guji Zone.

Furthermore, a comparison of the commercialization by sample districts shows that Odo Shakiso had the highest mean value of commercialization, followed by Adola Rede and Ana Sora districts (Figure 4). This implies that Odo Shakiso is a relatively more crop commercialized district than Adola Rede and Ana Sora districts. The finding also shows that male-headed households are more commercialized than female-headed households in the cereal crop output market as female-headed households by far deviated from the mean value of commercialization.

Figure 3. Level of commercialization by crop type. Source: Authors’ construct (2019).

Figure 4. Level of commercialization by districts and sex of households. Source: Authors’ construct (2019).
3.4. Welfare effects of cereal crops commercialization

The results of the effects of commercializing cereal crops on households in the Guji Zone are presented in Table 4. The role of agricultural commercialization on household welfare has been a subject of debate among the scientific community. While the first category argued in favor of its positive effects, the other side witnessed its adverse effects on household welfare. Those studies that argued in favor of its positive effects suggest that agricultural commercialization primarily increases farmers’ income and then the enhanced income can further be used to purchase different goods and services. The increase in consumption of the market basket will in turn increase household welfare (Barrett, 2008; Ochieng et al., 2016; Cazzuffi et al., 2018). The base of argument for studies that found a negative association between household welfare and agricultural commercialization is that increase in household income can be taken as a necessary but not sufficient condition for welfare improvement (Randolph, 1992). Moreover, agricultural commercialization has been criticized for failure to significantly impact the livelihoods of the poorest, exacerbating household risk, and failing to guarantee household food security (Pingali et al., 2005; Wiggins et al., 2011).

In favor of the former argument, the results of the Kruskal-Wallis test in Table 4 indicates that the welfare effects differed across various levels of commercialization at p < 0.01, p < 0.05, and p < 0.1 significance level. This implies that at least one of the commercialization categories had a different mean. Specifically, the amount spent on coffee and sugar, the value of cereal production consumed, the amount of expenditure on edible oil, clothes and shoes, education, medications, farm implements, and durables were statistically significant. A statistically significant mean difference indicates that holding other factors constant at a time, the observed difference in values of expenditure on salt, edible oil, clothes and shoes, education, medication, and housing respectively was associated with the variation in the level of cereal crop commercialization. Besides, the amount of money expenditure on those goods and services was higher for the households in the high commercialization category compared to those households in the low and moderate commercialization category on average terms (Appendix D). It implies that improving farmers’ commercialization status in cereal production increases the level of spending on goods and services. This is due to the fact that commercialization can increase farmers’ integration into the market, make them more market-oriented, and reap the gains associated with farm profitability.

The result complements the findings of Abera (2009) that demonstrated that the consumption of basic non-grain consumables, kerosene consumption, and annual expenditure on shoes and clothes, education, and housing has a consistent increasing pattern along with the commercialization index, low to high. On contrary, the mean expenditures on grain, coffee and sugar, and durable goods were not significantly different across different levels of commercialization. It was also consistent with the findings of Osmani et al. (2015), and Diyana (2014) which found a statistically significant welfare difference among different commercialization categories. This result also supports the findings of Ahmed (2017) who stated that agricultural commercialization significantly influenced household welfare.

The result of the Kruskal-Wallis test shows only whether the groups (i.e. levels of commercialization) have the same distribution on the response variable (welfare indicators). The Kruskal-Wallis test does not provide pairwise differences between commercialization categories. To determine differences between a set of commercialization categories, Dunn’s test was run after the Kruskal-Wallis test. The Dunn’s test results (Table 5) showed a significant difference in welfare effects between low and moderate or high, and moderate and high commercialization categories. The value of cereals consumed, expenditure on clothes and shoes, education, and durables were significantly different between low and moderate commercialization categories. In addition, households in the low and high commercialization categories significantly differed in the amount of expenditure on coffee and sugar, salt, edible oil, clothes and shoes, education, medication, housing, farm implements, and durable goods. Besides the aforementioned welfare indicators, except for the level of monetary expenditure on salt, a statistically significant difference was observed between the households in the moderate and high commercialization categories in terms of the value of cereals consumed.

Overall, the statistical figures in Table 5 indicate that households in the high commercialization category were better-off in terms of consumption expenditure than the households in the moderate and low commercialization categories. The important implication is that intensifying smallholder cereal production from subsistence-oriented to commercially-oriented production systems assists farmers to generate more income from their farms and improve their living standards. Previous studies also assert positive effects of agricultural commercialization on per capita income (Qaim and Ogotu, 2018; Ochieng et al., 2019), food security (Janssen, 2018), household assets and consumption expenditure (Kem, 2017), poverty reduction (Muricho et al., 2017), and household welfare (Mariyono, 2019b).

Moreover, the study results concur with the findings of Cazzuffi et al. (2018) that found households who commercialize rice production were better-off in terms of asset accumulation and income in their study on the impact of commercialization of rice on household welfare in rural Viet Nam. They also found that increasing agricultural commercialization is negatively associated with per capita food consumption. This emanates from the fact that changes in the amount of budget allocated for food consumption.

### Table 4. Results of Kruskal-Wallis test

| Welfare indicators | H-statistics | P-value | Significance |
|--------------------|--------------|---------|--------------|
| Purchased grains   | 2.345        | 0.3995  | ns           |
| Coffee and sugar   | 14.785       | 0.0006  | ***          |
| Cereals consumed   | 9.498        | 0.0087  | ***          |
| Salt               | 3.003        | 0.2228  | ns           |
| Kerosene           | 0.100        | 0.9514  | ns           |
| Edible oil         | 21.671       | 0.0001  | ***          |
| Clothes and shoes  | 26.395       | 0.0001  | ***          |
| Education          | 9.038        | 0.0190  | **           |
| Medication cost    | 14.941       | 0.0006  | ***          |
| Housing            | 3.233        | 0.1986  | ns           |
| Farm implements    | 5.224        | 0.0734  | *            |
| Durables           | 15.812       | 0.0004  | ***          |
| Aggregate expenditure | 12.659    | 0.0018  | ***          |

Note: *, **, and *** indicate statistical significance at p < 0.1, p < 0.05, and p < 0.01, respectively. ns—nonsignificance, 1ETB = 0.0344 USD in 2019. Source: Computed from survey data (2019).

### Table 5. Results of Dunn's multiple comparison tests

| Welfare indicators | Mean comparison |
|--------------------|-----------------|
|                    | Low Vs. Moderate| Low Vs. High | Moderate Vs. High |
| Purchased grains   | 0.55**          | 1.46*         | 1.29*             |
| Coffee and sugar   | 0.93**          | –2.35***      | –3.84***          |
| Cereals consumed   | –2.39***        | 0.04**        | 2.36***           |
| Salt               | –0.94**         | –1.72**       | –1.24**           |
| Kerosene           | –0.27**         | –0.05**       | 0.20**            |
| Edible oil         | –1.02**         | –4.20***      | –4.25***          |
| Clothes and shoes  | –2.38***        | –5.05***      | –3.99***          |
| Education          | –1.52           | –2.98***      | –2.24**           |
| Medication cost    | –0.77**         | –3.45***      | –3.56***          |
| Housing            | –0.39**         | –1.62*        | –1.64*            |
| Farm implements    | –0.75**         | –2.16**       | –1.97**           |
| Durables           | –2.09**         | –3.95***      | –2.91***          |
| Aggregate expenditure | –1.49*       | –3.46**       | –2.87**           |

Note: *, **, and *** indicate statistical significance at p < 0.1, p < 0.05, and p < 0.01, respectively. ns—nonsignificance, figures in table indicates Dunn’s Z statistic. 1ETB = 0.0344 USD in 2019. Source: Computed from survey data (2019).
consumption is inversely related to the level of per capita income. It is hypothesized that agricultural commercialization influences farmers’ income, then income increase raises farmers’ spending capacity on goods and services. The inverse relationship between the change in the amount of budget allocated for food consumption and the level of per capita income is not merely associated with diminishing food consumption in terms of quantity and quality rather it is associated with the effect of rising income level on food consumption expenditure budget (Tafoese, 2013). Furthermore, the finding by Tesso (2017) suggests market participation as an insignificant determinant of poverty and households participating in the market were poor compared to non-participants. He argued that increased participation in the market decreases productivity and ability to produce food as farmers decrease the production of crops that are consumed at home in favor of highly marketable crops that in turn expose them to market price fluctuation and risks of climate variability. The reason the study result is contradicting the finding by Tesso (2017) is because of the nature of the crops considered. In the study site, farmers grow cereal crops for both consumption and market purposes as opposed to cash crops where a significant proportion of the output is produced with marketing objectives. In this context, the farmers consume a part of the outputs produced and sell the remaining output to the market.

Though a majority of reviewed literature agrees on the positive impacts of agricultural commercialization on household welfare, Jaleta et al. (2009) set out conditions to be met for agricultural commercialization to produce the desired outcome. According to their argument, under an imperfect market structure, a shift from subsistence to commercial agriculture may negatively impact household welfare as a result of farmers’ exposure to volatile prices and food insecurity. Moreover, farmers with better resources (productive assets and human capital) are more likely to benefit from commercialization opportunities as opposed to the case of smallholder farmers who are endowed with few resources. Commercialization might also affect household welfare directly particularly if the gains from commercialization generate new employment opportunities in other sectors, through local backward and forward linkages (Cazzuffi et al., 2018). Usman and Concha (2021) also emphasize the essential role of market infrastructure in influencing household consumption expenditure and dietary diversity of farming households in addition to the income effect of agricultural commercialization.

Besides improving the welfare of the households in the farming sector, agricultural commercialization can also enhance the welfare of the actors involved in the market chain (input suppliers, transporters, processors, and financiers) by creating jobs and improving income. One of the apparent reasons is due to economies of scale generated from increased demand and supply that decrease the average cost per unit of operation. Moreover, as farmers become more commercially oriented, they highly rely on purchased inputs for production; hence it creates a strong linkage between input and output market. According to Jaleta et al. (2009), with a fully commercialized agricultural system, inputs are accessed from the markets rather than household generated inputs and profit maximization becomes the farmer’s driving objective.

As it can be concluded from previous studies, many researchers have investigated the heterogenous effects of commercialization. Though there are similar works with the subject under consideration, in the present work, detailed information on the status and effects of cereal crops commercialization on household welfare is generated through comprehensive scientific details besides what has been covered by the literature described in the introduction section (i.e., Abera, 2009; Diyana, 2014; Mohammed et al., 2017). Besides, while previous studies examined the effects of commercialization on household income (Opondo and Owuor, 2018) and cereal productivity-enhancing methods (Kebede and Korji, 2017) with a little emphasis on its impact on the welfare of farming households, the current study examined its welfare implications in addition to discussing its income effects. Moreover, the study emphasizes cereal crops (a priority crop in Ethiopia’s policy initiative), which Mohammed et al. (2016), Mariyono (2017), Ochieng & Heipelwa (2018), and Endalew et al. (2020) considered as subsistence-oriented crops generating low income and welfare while they account for 35% of the value of crop sales, which is more than the amount accounted by vegetables (15%) and coffee (12%), products that are generally labeled as cash crops in Ethiopia according to Nicholas et al. (2021). Unlike Amsalu (2014) and Tesso (2017) who suggested alternative means of welfare improvement instead of commercialization, the paper suggests the need to target commercialization as a pathway to improve household welfare and rural economic growth.

Thus, in order to contribute to household welfare, the intensity of commercialization by farming households should progressively increase. This requires concerted efforts of local government, NGOs, research institutions, universities, extension workers, and market development specialists to affect the level of commercialization. They assist the farmers in accessing improved technologies, new production methods, and financial resources and find a better market to boost their production and generate a more marketable surplus. Currently, cereals have become a market-oriented crop with increasing prices and high demand in Ethiopia. Given the availability of land and labor, farmers can harness these opportunities by increasing the level of production and market supply. Nonetheless, farmers’ production and commercialization capacity may be challenged due to rain-fed farming practices, traditional technologies, and increasing prices of agricultural inputs (fertilizer, improved seeds, pesticides, etc.) in the country.

4. Conclusion

This paper is set out to measure cereal crop commercialization and examine the welfare effects of commercializing cereal crop production in the Guji Zone. The study shows that farmers in the Guji Zone were oriented towards a semi-commercial farming system in the cereal crops output market, pinpointing an opportunity still exists to improve farm households’ scale of commercialization. Moreover, like many literatures that found a positive association between commercialization and household welfare, the study result also suggests positive effects of commercialization on household consumption expenditure between comparisons considered (moderate vs. low, high vs. moderate, and high vs. low commercialization categories).

Hence, the study concludes that any policies and strategies targeted at improving the commercial status of smallholder farmers can contribute to an improvement in their welfare status. Therefore, the study calls for the promotion of commercialization in the cereal-dominated farming systems in Guji Zone specifically and Ethiopia, in general. This can help the farmers increase their income, and spending capacity (both on consumer goods/services and other assets), and enjoy a better life. Moreover, in a commercial farming system, as farmers rely more on purchased inputs, agricultural commercialization has a spillover effect on the input market, thus, creating more capital and employment in other sectors and stimulating economic growth in rural areas. In the Guji Zone, commercialization can be enhanced by improving public service delivery for the rural community, investing in modern agriculture, establishing a well-functioning market system, and employing market-oriented production strategies.

Given its dominance in terms of production in the study site, cereal crops were considered to provide evidence about the interaction between household welfare and commercialization based on the fact that farmers produce crops with consumption and marketing objectives. Depending upon the market value of the crops grown, farmers may retain those crops with low market value for home consumption and sell those with high market values to the market. As production goals mainly affect the extent of commercialization, future studies should consider crops with a high marketability index to provide a clear picture of the interaction between household welfare and commercialization. Besides, as this study provides information on cereal crop commercialization and household welfare only for the survey year, future studies should also consider the time dimension in their analysis to capture the dynamics of commercialization and household welfare over time.

5. Ethical approval and informed consent

As this study employed a survey approach, ethical approval and informed consent were not required for this study. It is because ethical
approval and informed consent are most often reported by experimental research involving human and animal subjects in Ethiopia. In this study, participants were included based on their willingness to participate after the details of the purpose of the study were briefed before the interview, including a promise to keep the confidentiality of information provided by them. Moreover, codes were assigned to the samples during the survey with a little emphasis on the participant’s names. Materials from other sources other than the findings of the study have been duly acknowledged through citation.

**Declarations**

**Author contribution statement**

Tariku Ayele, MSc: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

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**Appendices**

**Appendix A. Results of normality test**

| Welfare indicators          | Skewness | Kurtosis | W   | V   | Z   | P-value | Significance |
|-----------------------------|----------|----------|-----|-----|-----|---------|-------------|
| Purchased grains            | 2.89     | 14.01    | 0.702 | 61.09 | 9.634 | 0.000 *** |
| Coffee and sugar            | 2.61     | 10.43    | 0.664 | 69.03 | 9.920 | 0.000 *** |
| Salt                        | 5.63     | 41.75    | 0.469 | 109.07 | 10.992 | 0.000 *** |
| Kerosene                    | 10.12    | 125.46   | 0.241 | 155.85 | 11.828 | 0.000 *** |
| Edible oil                  | 4.71     | 29.52    | 0.496 | 103.45 | 10.868 | 0.000 *** |
| Clothes and shoes           | 9.08     | 99.72    | 0.318 | 140.02 | 11.577 | 0.000 *** |
| Education                   | 4.41     | 29.39    | 0.590 | 84.21  | 10.386 | 0.000 *** |
| Medication cost             | 6.57     | 56.77    | 0.392 | 124.93 | 11.310 | 0.000 *** |
| Housing                     | 6.93     | 60.17    | 0.394 | 124.54 | 11.303 | 0.000 *** |
| Farm implements             | 8.96     | 108.85   | 0.334 | 136.81 | 11.523 | 0.000 *** |
| Durables                    | 9.02     | 91.76    | 0.241 | 155.80 | 11.828 | 0.000 *** |
| Aggregate expenditure       | 5.65     | 41.91    | 0.425 | 118.04 | 11.177 | 0.000 *** |

Note: *** indicate statistical significance at p < 0.01. W, V, and Z denote Shapiro Wilk W-statistic, V-statistic, and Z-statistic respectively. Source: Computed from survey data (2019).

**Appendix B. Results of Levene’s test for homoscedasticity of variance**

| Welfare indicators          | Levene statistic | Degree of freedom | P-value   | Significance |
|-----------------------------|------------------|-------------------|-----------|--------------|
| Purchased grains            | 1.35             | (2, 285)          | 0.2616    | Ns           |
| Coffee and sugar            | 0.03             | (2, 285)          | 0.9695    | Ns           |
| Salt                        | 4.53             | (2, 285)          | 0.0115    | **           |
| Kerosene                    | 5.55             | (2, 285)          | 0.0043    | ***          |
| Edible oil                  | 5.95             | (2, 285)          | 0.0029    | ***          |
| Clothes and shoes           | 1.95             | (2, 285)          | 0.1439    | Ns           |
| Education                   | 15.77            | (2, 285)          | 0.0000    | ***          |
| Medication cost             | 3.49             | (2, 285)          | 0.0318    | **           |
| Housing                     | 8.20             | (2, 285)          | 0.0003    | ***          |
| Farm implements             | 1.74             | (2, 285)          | 0.1766    | Ns           |
| Durables                    | 2.19             | (2, 285)          | 0.1128    | Ns           |
| Aggregate expenditure       | 6.97             | (2, 285)          | 0.0011    | ***          |

Note: **, *** , and ns indicate statistical significance at p < 0.05, p < 0.01, and non-significance respectively. Source: Computed from survey data (2019).
Appendix C. Summary statistics for the test of ties

| Welfare indicators | Percentiles | Unique values |
|--------------------|-------------|---------------|
|                    | 10%         | 25%           | 50%         | 75%         | 90%         |
| Purchased grains   | 0           | 0             | 750         | 2100        | 5600        | 69          |
| Coffee and sugar   | 300         | 450           | 875.5       | 1850        | 4500        | 95          |
| Salt               | 100         | 225           | 405         | 800         | 1200        | 79          |
| Kerosene           | 0           | 0             | 212.5       | 500         | 1000        | 72          |
| Edible oil         | 150         | 305           | 800         | 1625        | 3000        | 89          |
| Clothes and shoes  | 400         | 1297.5        | 2590        | 5425        | 11000       | 117         |
| Education          | 0           | 850           | 2500        | 5000        | 10000       | 100         |
| Medication cost    | 0           | 250           | 1500        | 5000        | 27000       | 93          |
| Housing            | 0           | 0             | 0           | 5000        | 27000       | 93          |
| Farm implements    | 0           | 0             | 250         | 675         | 1300        | 67          |
| Durables           | 0           | 0             | 275         | 3000        | 7500        | 87          |
| Aggregate expenditure | 4250       | 8355          | 14638       | 32440       | 75730       | 274         |

Source: Computed from survey data (2019).

Appendix D. Results of one-way ANOVA

| Welfare Indicators (Spending in ETB/Year) | Commercial Status |
|------------------------------------------|-------------------|
|                                           | Low (<35%)        | Moderate (35-65%) | High (>65%) | Total | F-Value |
| Number (%) of samples                    | 49 (17.01%)       | 194 (67.36%)      | 45 (16.63%) | 288   (100%)    |
| Purchased grains                          | 2,257.9           | 1,813.1           | 1,920.7     | 1,905.6 | 0.44    |
| Coffee and sugar                         | 1,618.8           | 1,582.1           | 2,213.7     | 1,687.1 | 1.55    |
| Salt                                     | 507.9             | 640.0             | 979.7       | 670.64  | (2.84)* |
| Kerosene                                 | 336.8             | 710.2             | 1,532.8     | 775.21  | 1.87    |
| Edible oil                               | 921.4             | 1,356.5           | 2,633.1     | 1,481.9 | (6.41)** |
| Clothes and shoes                        | 2,549.2           | 5,518.3           | 7,865.9     | 5,379.9 | (2.32)* |
| Education                                | 2,764.1           | 3,917.5           | 7,840.5     | 4,334.3 | (8.99)** |
| Medication cost                          | 1,601.7           | 2,083.6           | 4,586.3     | 2,392.6 | (2.40)* |
| Housing                                  | 3,800.3           | 8,637.9           | 20,333.6    | 9,642.3 | (3.38)** |
| Farm implements                          | 687.9             | 1,092.2           | 661.8       | 895.5   | 0.42    |
| Durables                                 | 918.7             | 5,205.8           | 7,720.7     | 4,869.4 | 1.22    |
| Aggregate expenditure                    | 17,964.8          | 32,467.3          | 58,288.9    | 34,034.5| 4.64**  |

Note: *, **, and *** indicate statistical significance at p < 0.1, p < 0.05, and p < 0.01, respectively. 1ETB = 0.0344 USD in 2019.
Source: Computed from survey data (2019).

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