
# Agricultural Commercialization in Ethiopia: Results from the Analysis of Panel Household Data

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# Abstract

Agricultural transformation refers to a series of changes in agriculture that both reflect and drive rising income and economic development more broadly. While the macroeconomic patterns of agricultural transformation are relatively well documented, less is known about how it manifests at the household level. Ethiopia makes an excellent case study as it has had one of the fastest growing economies in the world. This paper focuses on one aspect of this process: agricultural commercialization, that is, the share of agricultural output that is sold on the market rather than being consumed at home. The analysis uses three nationally representative rural household surveys carried out in 2012, 2016, and 2019, including a panel of 1,900 households. The results show that the share of marketed agricultural output has increased significantly over the seven-year period. The bivariate comparisons and panel-data analysis suggest an uneven increase, with variation by region, sex of head of household, distance to markets, wealth, and other characteristics. The data show that the rate of commercialization has increased for most crops, but we do not find any shift in crop mix toward more commercial crops. Finally, the results suggest that there are no clear lines between "subsistence" and "commercial" farms. A large majority of farms have some crop sales, while virtually none of them sell all their output. Similarly, the contrast between subsistence crops and cash crops can be misleading. For example, the sales of staple cereals is almost three times greater than the sale of coffee, the main cash crop.



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## 1. Introduction

Agricultural transformation describes a set of changes that occur in the agricultural sector as the economy expands and income rises. These changes include greater use of purchased agricultural inputs such as purchased seed and fertilizer, rising agricultural productivity, a decline in subsistence food production as farmers shift to growing for the market, and the expanding importance of non-farm activities and income. This is part of broader changes in the economy known as structural transformation, in which the agricultural sector grows more slowly than the rest of the economy so that its share in national output declines, along with a shift in labor from rural to urban areas and from agricultural to non-agricultural activities. At some point, the process of urbanization often results in a absolute decline in the rural population, leading to rising rural wages and growing average farm size, both of which contribute to improved standards of living in rural areas.

Agricultural commercialization refers to the gradual increase in the share of agricultural output that is sold, as opposed to being consumed directly by the farm household. This is a key component of the process of agricultural transformation. The immediate causes include rising agricultural productivity, generating a surplus which can be sold, and improvements in infrastructure which facilitate the sale of agricultural output. It is widely assumed that shifting from low-value staple food crops to higher-value commercial crops raises farm household income, although demonstrating causality is not easy.

The patterns of agricultural transformation have been extensively researched at the national level, using cross-country analysis of the composition of gross domestic product (GDP), demographic data on urbanization, and employment data by sector. However, less research has been carried out on how these national trends are manifested at the household level. For example, does agricultural commercialization involve all rural households selling more, or is commercialization limited to households with more land or regions with higher agro-ecological potential?

The household-level patterns in agricultural commercialization are important for policymakers and development organizations. Many programs assume that helping farmers shift into commercial agriculture will increase their income, but is this true? If true, what are the main constraints on commercial production and how can policies and programs address these constraints? Should programs to promote commercial production be aimed at all farmers or is commercialization only feasible for selected farmers?

This paper examines the trends and patterns in agricultural commercialization in Ethiopia over the period 2012 to 2019. Ethiopia makes a good case study for several reasons. First, it has experienced some of the highest rates of growth in per capita income of any country in the world. This makes it more likely that

we can observe changes in agricultural transformation over a relatively short period of seven years. Second, the Ethiopian government has pursued a strategy of agricultural-led economic growth, making significant investments in rural infrastructure, creating an enabling environment for agricultural growth, and devoting resources to identifying and relieving obstacles to agricultural growth. Third, the study is facilitated by the availability of three highly-comparable household surveys with relatively large samples (3,000 to 5,000 households) and a subsample of almost 1,900 households that form a panel.

The paper is organized as follows. Section 2 describes previous theoretical and empirical research on agricultural commercialization with an emphasis on sub-Saharan Africa and Ethiopia. Section 3 provides an outline of the data and methods used in this study. Section 4 describes the results of the analysis of the three ACC Surveys. And Section 5 summarizes the main finding in the context of previous research.

## 2. Previous research on agricultural commercialization

One of the most salient characteristics of agriculture in low-income countries is the importance of subsistence food production. Most farmers grow crops and raise livestock on a relatively small scale, with farms of less than 2 hectares. A large share of their crop production consists of staple food crops, including cereals, starchy root crops, and other inexpensive sources of calories. While few farmers are completely disconnected from the market, a large majority sell less than half of their crop production. In order to understand the agricultural commercialization, it is useful to begin with an examination of subsistence food production.

### 2.1. Economic rationale for subsistence food production

In an idealized world with perfect information, competitive markets, and no transaction costs, each farmer would produce the crop that maximizes profit, sell all of the crop, and use the revenue to purchase a utility-maximizing basket of consumer goods. Production decisions would be "separable" from consumption decisions in that the latter would have no effect on the former (Singh, Squire, and Strauss, 1984). Thus, an economic explanation for subsistence production must be linked to a violation of one or more of these assumptions.

For example, markets in the real world are characterized by transaction costs, that is, the cost of getting to the market, finding a buyer, negotiating a price, and selling the product. Transaction costs are particularly important for small-scale farmers living in rural areas. de Janvry et al. (1991) show that transaction costs (including the cost of transportation) between the farm and market creates a gap between the (higher) farm-gate purchase price and the (lower) farm-gate selling price of a staple food crop. The gap between the purchase price and the selling price will be large for farmers living in remote areas with poor infrastructure and relatively large for low-value staple crops. When transaction costs are significant, the

shadow price of the crop at the farm level may well be too low to justify buying the commodity but too high to justify selling it. This creates a situation in which the rational farmer produces enough of a food crop for the consumption of the household, neither selling any of the production nor buying from the market. In other words, a farmer is "forced" to supply almost all his food requirements because of the high cost of selling crops or buying food. This breaks "separability" since now production decisions are influenced by consumption preferences. It also makes the farm-level supply inelastic to price changes over a range of prices and makes aggregate supply less responsive to prices. High transaction costs can also explain low use of purchased inputs like seed and fertilizer, which reduces productivity and income.

A second explanation is risk. Even without transaction costs, risk may be an obstacle to accessing agricultural markets. Most households avoid risk, but small farmers and others living at the margin of survival are particularly risk averse in their livelihood decisions because a negative shock to income could threaten their health and survival. Producing a food crop for own consumption certainly involves some risk: if the weather is bad, the harvest may be too small to feed the family. However, producing crops for the market involves multiple risks, including the risk of poor weather, the risk of a drop in the price of the cash crop, and the risk of an increase in the price of the food they need to buy. High-value crops such as vegetables introduce greater production risk (particularly if they are perishable) and high price risks because their prices tend to be more volatile. Thus, commercial crop production is likely to be riskier, which discourage farmers, particularly those that are more risk averse.

Third, producing some commercial crops may involve initial investments that are out of the reach of subsistence farmers. For example, switching from maize to vegetables is likely to involve higher costs for seed, fertilizer, and labor. And switching from a food crop (almost all of which are annual) to coffee, cocoa, or another tree-crop requires a 3- to 5-year wait for the first harvest. In economic terms, even if the investment is profitable, the farmer does not have the savings or access to credit that would be needed to cover the upfront costs. The lack of access to credit is linked to market failures such as lack of information on the part of lenders about credit-worthiness of the farmer and the high costs of enforcing repayment.

In summary, subsistence agricultural production can be explained by transaction costs, risk, and investment costs associated with commercial production. Relaxing these three constraints would allow farmers to produce for the market, thereby raising their income and improving food security.

### 2.2. Level of commercialization

A simple measure of commercialization is the proportion of farmers that participate in commercialization, meaning that they have some crop sales. Earlier research in Ethiopia estimated that about 57% of

Ethiopian farmers were involved in selling crops (Pender and Alemu, 2007). In contrast, a recent study found that the share of farmers participating in the market was 90% in Malawi, 80% in Uganda, and 68% in Tanzania.

A better measure of commercialization is the marketed share of crop production, which takes into account the degree of commercialization among those selling crops. Table 1 summarizes a number of studies on household crop commercialization by country and by crop types. In Ethiopia, Pender and Alemu (2007) and Gebremedhin and Jaleta (2010) estimated marketed shares of cereal grains to be about 24-25%. Among the major staple food corps, teff was the most commercialized (24%) cereal crop, followed by wheat (17%). Several studies of wheat in Ethiopia estimated the marketed share of production to be between 18% and 27% (Minot et al., 2015; Mamo et al., 2017; and FAO, 2019) .

**Table 1. Estimates of the level of commercialization**

| Study | Year and survey | Country | Crop(s) | Marketed share of output (%) |
|---|---|---|---|---|
| Pender and Alemu (2007) | 2005, IFPRI/CSA | Ethiopia | Teff | 24 |
| Pender and Alemu (2007) | 2005, IFPRI/CSA | Ethiopia | Wheat | 17 |
| Gebremedhin & Jaleta (2010) | 2007/08, ILRI | Ethiopia | All crops | 25 |
| Minot et al. (2015) | 2013/14, AgSS | Ethiopia | Wheat | 18 |
| Mamo et al. (2016) | 2013/14 | Ethiopia | Wheat | 27 |
| FAO (2019) | | Ethiopia | Wheat | 19 |
| Muricho et al. (2017) | | Kenya | All crops | 37 |
| Friesen and Palmer (2004) | | Kenya | Maize | 40 |
| Carletto et al. (2017) | 2010/11, LSMS-ISA | Malawi | All crops | 17.6 |
| Carletto et al. (2017) | 2010/11, LSMS-ISA | Tanzania | All crops | 27.5 |
| Carletto et al. (2017) | 2010/11, LSMS-ISA | Uganda | All crops | 26.3 |
| Agwu et al. (2013) | | Nigeria | Cassava | 29.6 |
| Agwu et al. (2013) | | Nigeria | Maize | 24.0 |
| Martey et al., (2012) | | Ghana | Maize | 53 |
| Martey et al., (2012) | | Ghana | Cassava | 72 |
| Martey et al., (2012) | | Ghana | All crops | 66 |

Note: It is not clear whether these figures represent the average marketed share or the total value of sales as a percentage of the total value of production. This distinction is discussed more in Section 3.2.

One study estimated the rates of commercialization in Malawi, Uganda and Tanzania, finding that between 18% and 28% of crop production was sold (Carletto et al. 2017). In Kenya, the estimated level of crop commercialization was higher at 37% for all crops (Muricho et al., 2017) and 40% in the case of maize (Friesen and Palmer, 2004). In Nigeria and Ghana, it has been estimated that the marketed share for maize was 24% and 53%, respectively (Agwu et al., 2013, Martey et al., 2012). In Ghana, a large share of cassava is marketed (72%), while the share is much more modest in Nigeria (24%). In general, the literature suggests that a large share of farmers sell at least some crops, but for many crops the average marketed share of staple food crops is less than 30%.

### 2.3. Determinants of commercialization

Given the variation in the commercialization, the next question is: what household and community-level factors influence, or at least are correlated with, agricultural commercialization? At the household level, most discussion of commercialization starts from the premise that farmers have to produce beyond their perceived consumption needs in order to participate in the market (Barrett, 2008), which implies that higher productivity leads to higher degree of commercialization (von Braun and Kennedy, 1994). Studies in many African countries have reported a positive correlation between levels of production and commercialization (e.g., Carletto et al. 2017, Pender & Alemu 2007, Gebremedhin and Jaleta 2010, Aman et al 2014, Mamo et al. 2017). Thus, it is not surprising that many studies find that the degree of commercialization increases with farm size (Carletto et al., 2017). Research also found consistently strong positive associations, across multiple countries, crops and years, between crop sales, livestock ownership, credit access or other measures of wealth. Conversely, lower levels of output production are mainly associated with lack of assets and low adoption of production technologies.

Given the small farm size of many farms in sub-Saharan Africa and the difficulty of generating income above the minimum needed for subsistence, it is not surprising that studies generally find that farmers are risk averse (Guttormsen and Roll, 2014; Gebremedhin and Jaleta, 2010; Barrett, 2008; Aimin, 2010; Jayne et al., 2011; Pandey, 2006). Risk aversion inhibits the adoption of new technology, such as fertilizer and improved seed because purchased inputs involve certain costs and uncertain returns. For example, African average use of fertilizer is 11 kg of nutrients per hectare of arable land compared with the world average of 62 kg/ha (Obayelu et al., 2021). In this way, risk aversion reduces productivity and indirectly makes it more difficult to achieve marketable surpluses. There is evidence of this in research which shows a significant impact of the agricultural services on the intensity of input use, agricultural productivity and market participation of Ethiopian smallholders (Gebremedhin et al., 2009). Risk aversion can also directly inhibit production for the market because it exposes farmers to price risks and (for perishable crops) greater production risk.

Another set of factors influencing agricultural commercialization are related to access to infrastructure such as markets and roads. For example, distance to the market, which is certainly high most of Sub-Saharan Africa (World Bank, 2007), leads to high costs of transportation to reach to the market, limiting both household-level market participation and sales volume (Foster and Briceno 2010; Barrett, 2008). A study by Alene et al. (2008) in Kenya showed that transactions costs had a significant negative effect on the market participation of farmers in Kenya. Weak infrastructure and limited access to markets has also been identified as an obstacle to commercialization in developing Asian countries (Wiggins, 2018). Several studies find that poor access to roads is an important factor in reducing the level of

commercialization (Key et al., 2000; Barret, 2007; Pender and Alemu, 2007; Alene et al., 2008; Yamauchi et al., 2009; Gebremedhin and Jaleta, 2010; Agwu et al., 2013).

### 2.4. Agricultural policy in Ethiopia

After the collapse of its Soviet-inspired centralized planned economy in 1991, Ethiopia embarked on a more market-oriented strategy with greater support for the agricultural sector. Beginning in 1993, the government launched the Agricultural Development Led Industrialization (ADLI) strategy, with an emphasis on increasing agricultural productivity. According to a government strategy statement, "the objective is to bring about a structural transformation in the productivity of peasant agriculture and the replacement of the command economy by an economic system driven by market forces" (MOFED, 1993).

Other development strategies followed including the Plan for Accelerated and Sustained Development to End Poverty (PASDEP) and two successive five-year Growth and Transformation Plans (GTPI and GTPII). Over the course of these strategies, the emphasis shifted from the productivity of smallholder agriculture toward increased agricultural commercialization as a key to further economic development. The second Growth and Transformation Plan stated that:

> A shift in the attitudes and production processes of farmers and pastoralists from subsistence to more market driven production has started to occur. … Farmers and pastoralists will be helped to shift gradually from the production of low to the production of high value products and to ensure that their incomes increase as a result (MoFED, 2010).

The latest major development strategy is the Ten Year Development Plan, which will run from 2021 to 2030. As stated in the description of the Plan:

> The main objectives of the agricultural development plan are to raise the incomes and livelihoods of farmers and pastoralists and end poverty by making agriculture more productive and competitive; to play a major role in the structural transformation of the economy, especially to satisfy the food and nutritional needs of the nation by modernizing agriculture; to supply raw material inputs for the industrial sector; to provide adequate quantities of exportable agricultural products that have added value… (FDRE, 2021).

Coupled with policy directives, there have been several major interventions that have sought to accelerate agricultural production and productivity as well as provide a safety net for more vulnerable farmers.

Beyond major policy documents, the Ethiopian Government has sought to better facilitate their stated agricultural goals with at least three major interventions. The Agricultural Growth Programs (AGP1 and AGP2) seek to increase production and commercialization in targeted, high potential woredas. As part of the AGP, the Agricultural Commercialization Cluster (ACC) initiative created geographic clusters of primary agricultural commodities that are designed to support increasing production and productivity while better integrating commercialization activities of the locally targeted crops. While both AGP and

ACC seek to enhance production in relatively high potential areas, the Productive and Safety Net Program (PSNP) is designed to improve food security and resilience for more marginalized rural households by providing direct support to households vulnerable to food insecurity and hunger.

In the last 30 years, Ethiopian agricultural policy and interventions have transitioned from emphasis on increased productivity for poverty reduction to a more market-oriented approach that seeks to facilitate agricultural commercialization and diversification into high value crops as a way to raise income and improve the welfare of rural households.

## 3. Data and methods

### 3.1. Data

This analysis makes use of three rounds of the Ethiopia Agricultural Commercialization Cluster (ACC) Survey, carried out by the International Food Policy Research Institute for the Ethiopia Agricultural Transformation Agency (ATA).

#### *Sample*

Each of the three ACC Surveys used a three-stage random sampling method for selecting households. They are designed to be representative of the rural areas of the four main regions of Ethiopia: Tigray, Amhara, Oromia, and the Southern Nations, Nationalities, and Peoples (SNNP). These four regions account for 86% of the population and more than 95% of the agricultural production in the country. The country was stratified by region and by ATA Agricultural Commercialization Clusters (ACC). We selected five woreda in each ACC, two kebele in each selected woreda, and 15 rural households in each selected kebele. At each level, the units were selected using systematic random sampling. This generates a sample of 150 rural households per ACC.

We also selected a sample of households in the four main regions but outside the ACCs by randomly selecting woredas, then two kebele in each selected woreda, and 15 rural households in each selected kebele. The non-ACC sample accounted for about 15-20% of the overall sample. In the 2016 and 2019 surveys, we followed the guidelines listed above but gave priority to woredas, kebeles, and households selected in previous rounds in order to maximize the number of panel households.

Because the number of ACCs increased over the years the survey was implemented, the sample size did as well, particularly between 2012 and 2016. Table 2 gives the main characteristics of the sample in each round of the ACC Survey.

Figure 1 shows the location of the sample clusters on a map of Ethiopia, with light dots indicating the kebele included in the full sample and dark dots indicating those included in all three rounds of the ACC Survey.

**Table 2. Characteristics of the sample of each round of the ACC Surveys**

| | 2012 ACC Survey | 2016 ACC Survey | 2019 ACC Survey |
|---|---|---|---|
| Sample size (households) | 3,000 | 4,991 | 5,311 |
| Number of woreda | 99 | 153 | 154 |
| Number of kebele | 200 | 334 | 355 |
| Number of panel households | 1,899 | 1,899 | 1,899 |

In each round of the ACC Survey, sampling weights were calculated based on three terms, one for each stage of the sample selection process. At each stage, the sampling weight is the inverse of the probability of selection. The sampling weights are used in the calculation of all statistical measures that involve calculation across households. Sampling weights are not used in the regression analysis.

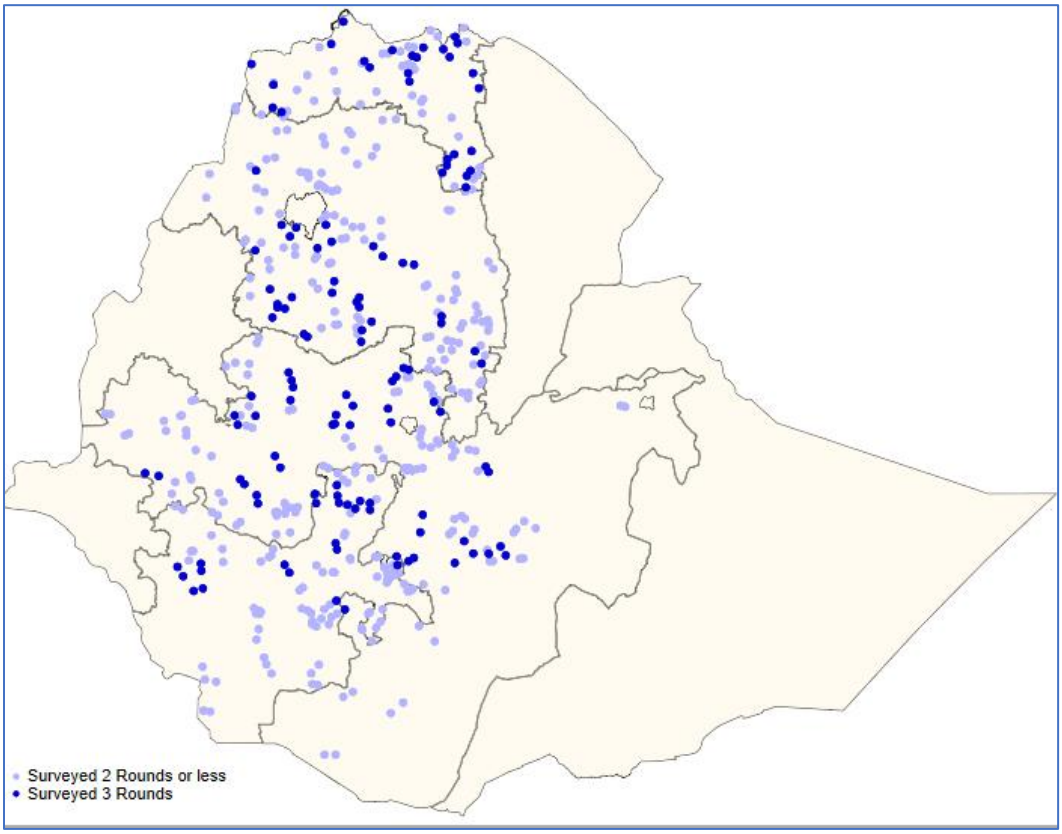


**Figure 1. Map of the kebele in the full sample and those in the panel data sample**

### *Questionnaire*

The household questionnaire was quite similar across the three rounds of the ACC Survey, but there were some modifications, as shown in the table below. In the 2016 and 2019 rounds, the crop production module was expanded to include questions on production methods for selected crops targeted by the ATA. In 2019, the livestock module was streamlined, dropping questions about costs of production, purchase and sale of animals, home consumption, and use and sale of by-products, but retaining questions

on the number of each type of animal owned by the household. A food security model with questions on periods of food insecurity and level of diet diversity was added to the 2016 and 2019 questionnaire. And finally, the individual survey, with separate questions for the husband and wife, was added to the 2016 and 2019 versions of the questionnaire.

**Table 3. Characteristics of the household questionnaire in each round of the ACC Surveys**

| | 2012 ACC Survey | 2016 ACC Survey | 2019 ACC Survey |
|---|---|---|---|
| A. Characteristics of members | Yes | Yes | Yes |
| B. Housing and assets | Yes | Yes | Yes |
| C. Land ownership and use | Yes | Yes | Yes |
| D. Crop production | Yes | Yes + methods | Yes + methods |
| E. Crop input and labor use | Yes | Yes | Yes |
| F. Crop utilization & sales | Yes | Yes | Yes |
| G. Crop storage | Yes | Yes | Yes |
| H. Livestock | Yes | Yes | Only herd size |
| I. Non-farm income | Yes | Yes | Yes |
| J. Savings | Yes | Yes | Yes |
| K. Credit | Yes | Yes | Yes |
| L. Food & non-food consumption | Yes | Yes+food security | Yes+food security |
| M. Perceptions & opinions | Yes | Yes | Yes |
| O. Individual survey | No | Yes | Yes |

### 3.2. Methods

This section describes the indicators used to measure agricultural commercialization, the research questions to be addressed, and the methods used to address those questions.

#### *Indicators*

The main indicator of agricultural commercialization is the share of agricultural output that is sold. In this study, we focus on the commercialization of crop production, which represents the bulk of agricultural production in Ethiopia[1]. This indicator can be calculated at the crop level, the household level, or at the aggregate level. At the crop level, it is a simple ratio of quantities:

$$M_i = \frac{P_i X_i}{P_i Q_i} = \frac{X_i}{Q_i}$$

where $M_i$ is the marketed share of crop i, $P_i$ is the price of crop i, $X_i$ is the quantity of sales of crop i, and $Q_i$ is the quantity produced of crop i. At the household level, it is calculated in value terms:

[1] Although it is possible to calculate the rate of commercialization for livestock production, the 2019 ATA survey did not include a module which would allow these calculations. .

$$M_h = \frac{\sum_i P_i X_i}{\sum_i P_i Q_i}$$

This has been called the crop commercialization index (Strasberg et al., 1998).

The marketed share can be also calculated at the aggregate level, such as for the full sample or for all households of a certain type, such as female-headed farmers. Although previous research has not highlighted this point, there are two ways to calculate the aggregate market share. The first is the average marketed share across households:

$$M_1 = \overline{M_h} = \frac{\sum_h M_h}{N}$$

where N is the number of households. The second way to calculate aggregate market share is the ratio of the value of total sales to the value of total production:

$$M_2 = \frac{\sum_h \sum_i P_{hi} X_{hi}}{\sum_h \sum_i P_{hi} Q_{hi}}$$

The difference between the two is that $M_1$ gives equal weight to each household (ignoring sampling weights for the moment), while $M_2$ gives greater weight to households with larger value of production. To distinguish the two, $M_1$ is called the average marketed share, while $M_2$ is called the ratio of sales to production. As shown in the box, the difference between M1 and M2 can be substantial because of the correlation between the value of production and the marketed share of the farm.

To calculate the value of production, it is necessary to use average or median prices for the same commodity in the kebele, district, region, or nation. To reduce the influence of outliers, we use the median rather than the mean. For the same reason, we typically use the lowest level price for which there are at least 5 or 10 observations. The median price is used to calculate the value of both production and sales.

***Research questions***

Agricultural transformation and commercialization are closely associated with economic growth. Given the high rate of economic growth in Ethiopia in recent years, a key question is:

- Has the marketed share of crop production (measured by $M_1$ or $M_2$) increased over the seven-year period from 2012 to 2019? Given the rapid economic growth in Ethiopia, we expect crop commercialization to have increased as part of the broader process of agricultural transformation.

- If so, how does the increase in commercialization vary across different types of households? Is the increase limited to higher-income, larger farmers in favorable locations or does it extend to include poorer households with small farms in remote areas?
- What are the household-level determinants of crop commercialization, such as farm size, region, remoteness, sex of head of household, age of head of household, and income?

### *Methods*

The analysis of the three rounds of household survey data is carried out with descriptive statistics and econometric analysis. The descriptive statistics are useful for assessing the trends in commercialization over time and patterns in commercialization across different types of households. The advantage is that the results are easily interpreted, but the disadvantage is that we can only examine two or three variables at a time. They allow us to look at patterns, but cannot be used to infer causality between variables. When examining descriptive statistics, it is generally preferable to use the full sample of households in each round, taking advantage of the larger sample size and greater precision in measuring means and percentages.

For questions related to causation, however, there is an advantage to econometric analysis of the balanced panel of households, that is, those that were interviewed in all three rounds of the survey. This is because econometric analysis with panel data allows us to control both observed and unobserved heterogeneity across households. There are three main approaches to econometric analysis of panel data.

- The random-effects model takes advantage of relationships between the dependent variable (y) and the independent variables (x) over time and across households. It generates coefficients for each independent variable that are a weighted average of the time-series and cross-sectional relationships, where the weights are the inverse of the variance of the respective coefficients. In other words, the stronger the relationships over time or across households, the more weight is given that relationship.
- The fixed-effect model relies entirely on the over-time relationship between the dependent variable and the independent variables. The estimated coefficients are equivalent to those that would result from including dummy variables for each household in the sample. These dummy variables effectively control for all household characteristics, observed or unobserved. Thus, the fixed-effect model eliminates bias in the coefficients caused by time-invariant unobserved variables. The disadvantage, however, is that we cannot include any time-invariant characteristics (such as region) as explanatory variables.

- The correlated random effect model includes time-invariant variables, time-varying variables, and the household-means of the time variant variables. This yields fixed-effect coefficients for the time varying variables and coefficients for time-invariant variables based on the cross-sectional patterns.

However, the fixed-effect model and correlated random effect models do not address two other sources of bias. One is simultaneity bias, where the dependent variable has an effect on one of the explanatory variables. The simplest way to avoid these biases is by selecting the explanatory variables that are not likely to be affected by the dependent variable. In our case, we need to avoid explanatory variables that are, for example, the result of farmer decisions, such as cooperative membership.

Another source of bias is confounding factors, meaning an unobserved variable that is correlated with both the dependent variable and one or more explanatory variables. For example, living near a town may increase off-farm income by offering employment opportunities and increase marketed share by reducing marketing costs. This could over-estimate the effect of non-farm income on marketed share. We can minimize this risk by thinking carefully about alternative paths of causal effects and avoiding explanatory variables that may have confounding factors.

## 4. Patterns and trends in commercialization

In this section, we examine the patterns of crop commercialization across households and the trends in commercialization over the three rounds of the ACC Survey.

### 4.1. Trends in commercialization over time

Table 3 shows the overall trends in crop commercialization over the three rounds of the ACC Survey, using the two indicators of commercialization, M1 and M2, and the two samples, the full sample and the panel households. It includes all farmers with crop production, whether they sold or not, but excludes households without crop production. Three findings can be drawn from this table.

First, the level of commercialization increased substantially between 2012 and 2019 according to all four measures. The final column indicates that commercialization increased by between 6 and 11 percentage points over this period. The average marketed share of crop production (M1) in the full sample rises between 2012 and 2016 but then falls slightly in 2019, while the other three indicators rise steadily across all three rounds of the survey.

Second, the average marketed share (M1) is much smaller than total sales as a share of total production (M2). The average marketed share is about 32-33%, in 2019 meaning that the average household sells roughly one-third of its crop production. However, M2 is about 49% in 2019, meaning that about half of all crop production was sold on the market. This relatively high figure suggests that the rural economy of

Ethiopia is more commercialized than previously thought. As discussed in Section 3.2, M1 gives equal weight to each household so it more accurately reflects the typical rural household, while M2 gives greater weight to households with larger crop production, so it reflects the share of total production that is sold.

Finally, the table shows only modest differences in crop commercialization between the full sample (3,000-5,000 households per round) and the panel sample (1,899 households per round). For M1, the differences are 2-3 percentage points, while for M2 the differences are less than 1.4 percentage points.

**Table 4. Crop commercialization over time (%)**

| | | Round | | | Change over |
|---|---|---|---|---|---|
| Indicator | Sample | 2012 | 2016 | 2019 | 2012-19 |
| M1: Average market share (%) | Full sample | 26.9 | 33.1 | 32.7 | +5.8 *** |
| | Panel households | 24.3 | 30.3 | 33.4 | +10.1 *** |
| M2: Total sales as share of total production (%) | Full sample | 38.6 | 46.0 | 48.5 | +9.9 *** |
| | Panel households | 38.4 | 44.7 | 49.1 | +10.7 *** |

Source: Analysis of ACC Surveys 2012, 2016, and 2019.

Note: *** change over 2012-19 is statistically significant at the 1% level. ** at the 5% level.

The table only gives us the average values, but it is also useful to examine the distribution of households according by the marketed share of crop production. Figure 2 give this distribution for 2012, including all households with crop production. The graph shows that 20% of crop producers had no sales in 2012. Among those selling crops, the most common categories are those with marketed shares of 20-29% (17% of households) and those with marketed shares of 10-19% (15% of households). The last two columns show that few growers in Ethiopia (3%) sell 80% or more of their crop production.

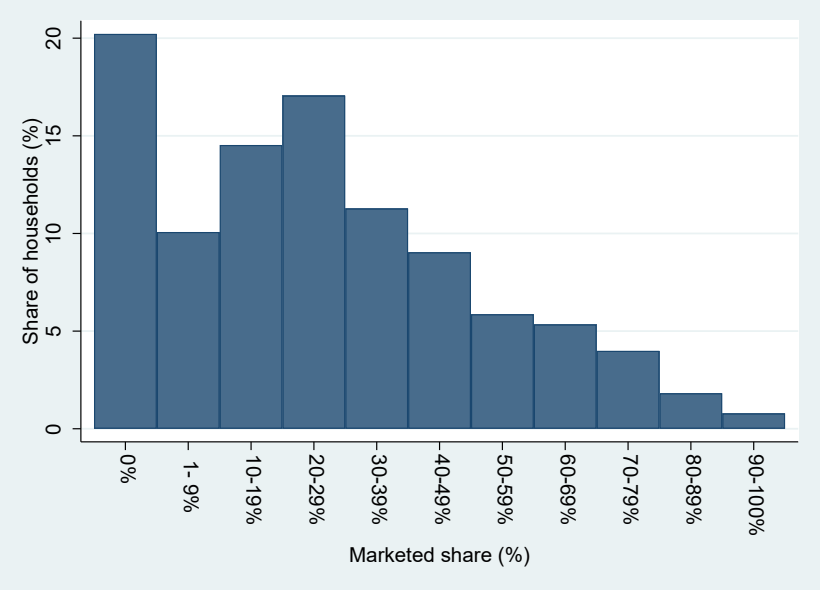


**Figure 2. Distribution of households by marketed share in 2012**

Figure 3 shows the distribution of crop-growing households by marketed share in 2016. As in 2012, about one-fifth of crop producers have no crop sales, though it is important to recognize that these are not necessarily the same households that had no sales in the 2012 survey. The middle bars have shifted somewhat so that fewer households sell 1-29% of output and more are selling 40-69% of output. The proportion of farmers selling 80% or more of their output has increased to 6%, though it remains small.

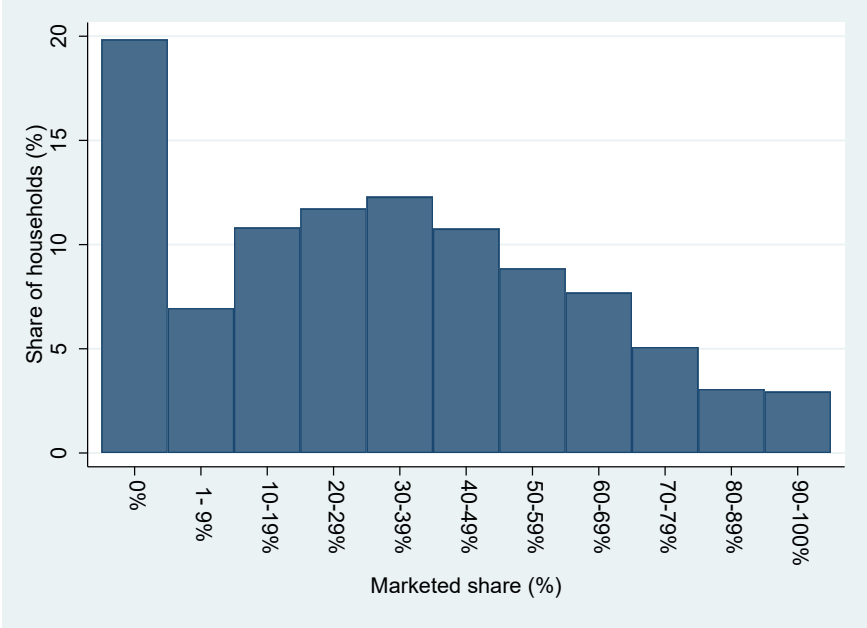


**Figure 3. Distribution of households by marketed share in 2016**

Figure 4 shows the same graph for the data collected in 2019. The share of producers that have no sales remains roughly the same, 21%. The proportion of farm households selling 1-10% of output has further declined to 5%, while the share selling 20-29% has increased slightly, with little change in the other categories.

In interpreting these three graphs, it is important to keep in mind that households can and do move between categories from one round to the next. For example, although roughly 20% of farm households had no crop sales in each round of the survey, they do not necessarily represent the same households. Looking at the panel data, for example, we find that only 5% of all farm households had no crop sales in all three years. Put another way, of the 20% of households with no crop sales in a given round, about three-quarters of them had crop sales in one or two of the other rounds of the survey.

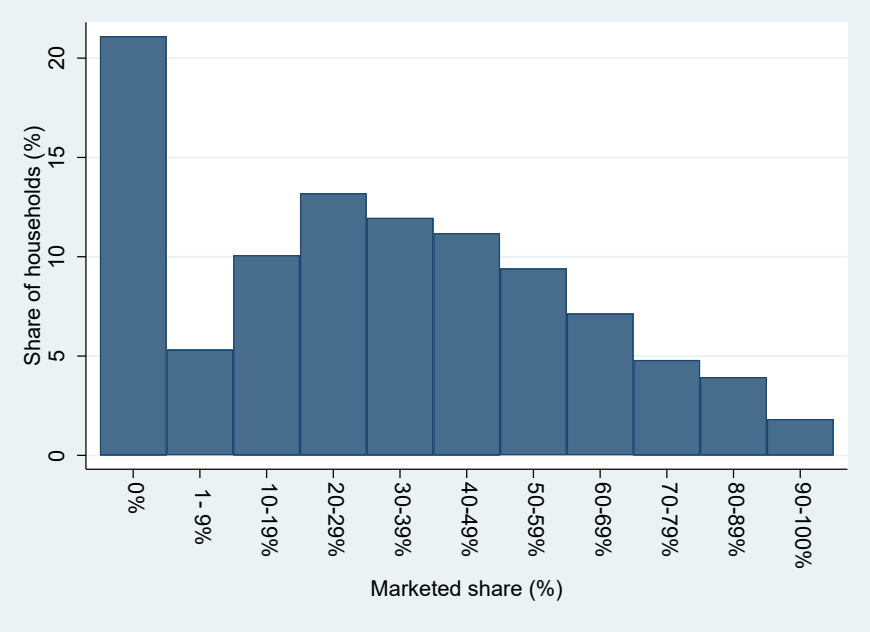


**Figure 4. Distribution of households by marketed share in 2019**

Figure 5 shows the cumulative distribution of households by the share of crop production that is marketed for each round of the ACC Survey. Each point on the curved lines represents the percentage of crop-producing households (on the horizontal axis) that sell a given share of their output or less (on the vertical axis). The three curved lines represent the three rounds of the survey. Thus, the vertical red segment on the left side indicates the households with no crop sales account for 23% of all crop-growing households. The three vertical lines represent the mean values of the marketed share (M1) in each round of the survey. The fact that the cumulative distribution lines and the vertical mean lines shift to the right over time indicates that the marketed share has increased over time. Furthermore, this graph shows that the shift is not limited to the highly commercial households. For the period between 2012 and 2016, there is a rightward shift across the full range of marketed surplus, from those selling very little to those selling almost all. For the period 2016-19, the shift seems to be limited to those selling between 5% and 60% of their crop output, suggesting that the gains occurred among household with low to middle levels of commercialization, excluding highly commercialized households.

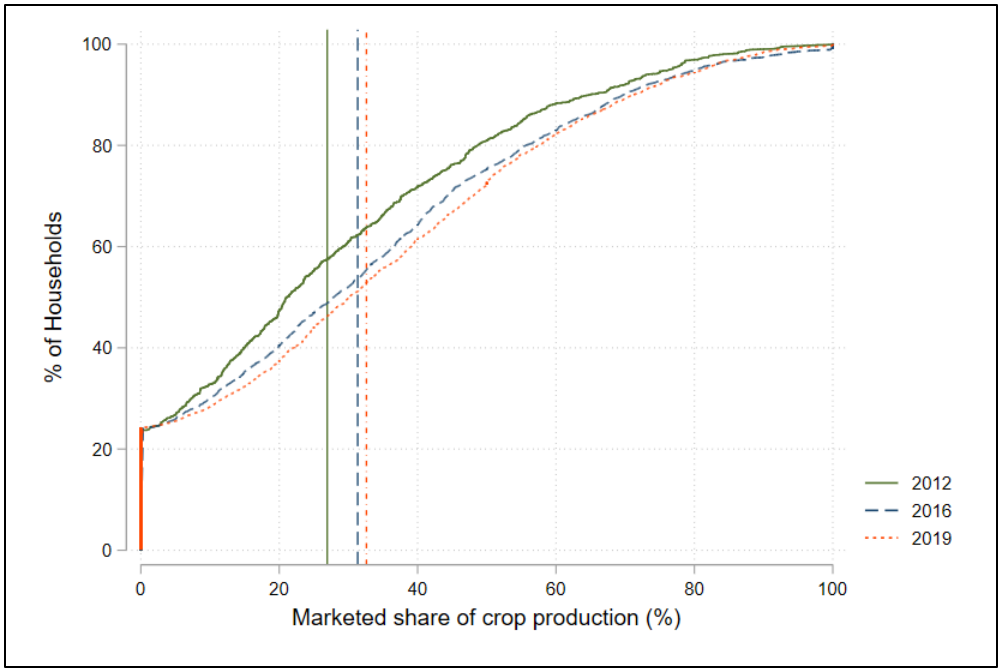


**Figure 5. Cumulative distribution of marketed share by year**

### 4.2. Patterns in commercialization across households

In this section, we examine how the marketed share of crop output varies across different types of households. Table 5 shows the average marketed share of crop production (M1) by round and by various household characteristics. The first panel shows regional patterns. Farm households in Tigray are generally less commercialized than those in the other three main regions of Ethiopia. In 2012, the SNNP region was the most commercialized, probably because of the importance of coffee production. However, by 2019 Amhara and Oromia had caught up to the rate of the SNNP region. The last column shows that the increases in commercialization in Tigray and the SNNP region are statistically insignificant. On the other hand, farmers in Oromia and Amhara have experienced large and statistically significant increases in crop commercialization over this time.

The second panel of Table 5 shows the patterns of crop commercialization for male- and female-headed households. The average marketed share of crop production is higher among male-headed households is 7-11 percentage points higher than among female-headed households. This is not surprising because female-headed households tend to be older, own smaller farms, and have lower per capita income, all of which are associated with being less commercialized. In the regression analysis presented later, we show that the independent effect of the sex of head of household on commercialization disappears when these (and other) factors are taking into account.

**Table 5. Patterns in market share of crops**

| | Round | | | Change |
|---|---|---|---|---|
| Region | 2012 | 2016 | 2019 | 2012-19 |
| Tigray | 18.4 | 15.4 | 18.7 | +0.3 |
| Amhara | 21.2 | 32.6 | 33.8 | +12.6 *** |
| Oromia | 29.3 | 30.3 | 33.5 | +4.2 ** |
| SNNP | 35.9 | 34.6 | 34.5 | -1.4 |
| Total | 26.8 | 31.0 | 32.4 | +5.6 *** |
| Sex of head | | | | |
| Male | 27.8 | 32.2 | 33.7 | +5.9 *** |
| Female | 20.7 | 21.6 | 22.6 | +1.9 |
| Total | 26.8 | 31.0 | 32.4 | +5.6 *** |
| Age of head (yrs) | | | | |
| 20-29 | 27.8 | 33.7 | 34.6 | +6.8 ** |
| 30-39 | 28.1 | 32.7 | 34.9 | +6.8 *** |
| 40-49 | 26.1 | 32.0 | 32.9 | +6.8 *** |
| 50-59 | 26.4 | 31.9 | 33.4 | +7.0 *** |
| 60-69 | 26.7 | 28.9 | 31.4 | +4.7 ** |
| 70-79 | 27.2 | 21.1 | 25.0 | -2.2 |
| 80 and above | 19.3 | 16.5 | 18.1 | -1.2 |
| Total | 26.8 | 31.0 | 32.4 | +5.6 |
| Farm size (ha) | | | | |
| Less than 0.5 | 24.7 | 24.6 | 24.7 | 0.0 |
| 0.5 - 1.0 | 23.8 | 27.4 | 29.0 | +5.2 *** |
| 1.0 - 2.0 | 24.8 | 31.7 | 31.6 | +6.8 *** |
| 2.0 - 5.0 | 31.8 | 35.2 | 37.7 | +5.9 *** |
| 5.0 or more | 47.8 | 46.8 | 48.1 | +0.3 |
| Total | 26.8 | 31.0 | 32.4 | +5.6 *** |
| Distance to road (km) | | | | |
| Less than 1k | 34.2 | 36.2 | 36.1 | +1.9 |
| 1K to 4k | 29.2 | 34.2 | 31.6 | +2.4 ** |
| Greater than 4k | 18.8 | 28.8 | 31.3 | +12.5 *** |
| Total | 27.1 | 30.9 | 32.4 | +5.3 *** |
| Quintile of income p.c. | | | | |
| Poorest | 16.7 | 20.3 | 16.7 | 0.0 |
| 2nd | 20.8 | 23.4 | 25.0 | +4.2 * |
| 3rd | 23.8 | 27.2 | 31.0 | +7.2 *** |
| 4th | 30.9 | 36.1 | 35.4 | +4.5 *** |
| Richest | 41.7 | 47.1 | 51.4 | +9.7 *** |
| Total | 26.8 | 31.0 | 32.4 | +5.6 *** |

Source: Analysis of ACC Surveys 2012, 2016, and 2019.

Note: *** change over 2012-19 is statistically significant at the 1% level. ** at the 5% level.

In addition to the differences in the level of commercialization by sex of head of household, it is worth noting that the increase in commercialization over 2012-2019 is large and statistically significant for male-headed households (+5.9 percentage points) but small and statistically insignificant for female-

headed households. These results suggest that female-headed households are being left behind in the trend toward greater crop commercialization.

The third panel shows that the level of crop commercialization seems to vary with the age of the head of household. More specifically, it is lower among households whose head is 60 years or older. In addition, the change in commercialization over the period 2016-19 is large (almost +7 percentage points) and statistically significant for households with heads up to 69 years old, but statistically insignificant for those with older heads. Farm size and education are correlated with age, so this pattern may be related to these variables. The regression analysis (presented later) allows us to test for the independent effect of each age and other variables.

The relationship between the average marketed share of crop production and farm size is shown in the fourth panel of Table 5. Across the farm-size categories, the average marketed share rises from about one-quarter in the smallest farms to close to one-half in farms with 5.0 hectares or more. This is not surprising because more land allows more crop production, making it easier to produce a surplus for sale. It is somewhat surprising that even farms with less than 0.5 hectares are able to sell (on average) about 25% of their crop output.

The last column shows the change in marketed share for each farm-size category. Households with at least 0.5 hectares and up to 5.0 hectares saw a statistically significant increase in commercialization over the period 2012-19. However, for very small farms (less than 0.5 ha) and large farms (over 5 ha), there is no statistically significant change in commercialization over this period. It is easy to understand that very small farms may not be able to (or wish to) commercialize given their limited production potential, but it is more difficult to understand why larger farms did not increase their level of commercialization over this period.

As mentioned earlier, one factor that makes commercial crop production less profitable is the cost of getting crops to market and the cost of getting food from the market. The sixth panel of Table 5 shows the averaged marketed share for households at different distances to a road, where distance is measured as a straight line to the nearest primary, secondary, or tertiary road. It is not surprising that the marketed share of crop production declines as distance to the nearest road increases. In 2012, the marketed share was 34% among those within 1.0 kilometer of a road, but less than 19% among those more than 4.0 kilometers from a road. Between 2012 and 2019, farmers in all three categories became more commercialized, but the change was statistically significant only for farmers more than 1 kilometer from a road. Furthermore, the largest increase in commercialization was among farms living more than 4 kilometers from a road. As a result, the differences in commercialization between those living near a road and those farther away

have decreased dramatically over the period under study. This could reflect improved infrastructure, better taxi service, and/or wider ownership of motorbikes and mobile phones, which make distance less of an obstacle.

The last panel of Table 5 shows the relationship between the marketed share of crop production and the quintile of per capita income. The quintile is defined separately for each round, so that 20% of the households fall in each category each year. The table indicates a strong correlation between per capita income and the marketed share of crop production. For example, in 2019, the poorest 20% of households sold an average of less than 17% of their crop output, while the richest 20% sold more than half of their crop output. On the one hand, richer households are better able to tolerate the risk associated with commercial crop production and better able to afford the additional input costs. On the other hand, more commercial crops generate more returns per hectare than staple food crops (as shown later), so commercialization also contributes to higher per capita income.

The last column of the table indicates that the third, fourth, and fifth income quintiles experienced large and statistically significant increases in the marketed share of crop production, ranging from 4.5 to almost 10 percentage point increases over 2012-19. However, the poorest 20% of rural households did not show any increase in commercialization over this period, and the second quintile experienced only weakly significant increases. In interpreting these results, it is important to recall that the table compares the poorest households in 2012 with the poorest in 2019, but they are not necessarily the same households. For example, a household in the third quintile in 2012 may experience a weather related crop failure and fall to the poorest quintile in 2019.

The tables above show the marketed share of crop production for different types of household, examining one household characteristics at a time. However, the difference in commercialization across one characteristic, such as age of head of household, may be caused by a correlation between age and farm size, so it is possible that farm size is the real "cause" of variations in commercialization by age. Regression analysis allows us to estimate the independent effect of each characteristic on the marketed share of crop production while controlling for other characteristics.

Ideally, all the household characteristics should be exogenous; otherwise, the coefficients could be affected by endogeneity bias. From Table 5, we know that there is a strong positive relationship between per capita income and marketed share. However, it is risky to include income as an explanatory variable because income is probably influenced by the dependent variable, marketed share. In Table 6, we use an asset index instead of income per capita, reflecting the fact that tolerance of the risks associated with commercialization is probably related to the wealth of the household. The asset index is generated using

principal components analysis and data on ownership of a series of consumer assets including radio, television, bicycle, motorbike, electric fan, and various furniture. Even if the level of commercialization influences income, the effect on wealth would be indirect and lagged since higher income is not always or immediately converted into ownership of consumer assets.

Table 6 gives the results of three regression analyses to "predict" the marketed share of crop production as a function of various household characteristics. The first column gives the results of the fixed-effect model, which only uses over-time within-household relationships to estimate the coefficients. As discussed earlier, it has the advantage of controlling for all household characteristics, observed and unobserved, but it is limited to characteristics that vary across rounds. The second column shows the output from the random effects model. This model incorporates both within-household and across-household relationships, but may be biased by unobserved heterogeneity across households. The third columns gives the results of the correlated random-effects model, which gives fixed effect coefficients for variables that vary over time but also provides estimates of time-invariant variables such as region.

In the fixed-effect model, crop commercialization has positive and statistically significant coefficients for household wealth (as measured by the asset index), farm size, and the dummy variables for 2016 and 2019. In other words, holding constant other variables, wealthier households sell a larger share of their crop production, as do households with larger farms. Furthermore, the marketed share of production was higher in 2016 and 2019 than in 2012, even holding constant farm size and household wealth.

The random effects model shows similar results for household wealth, farm size, and the year dummies. In addition, the age of the head of household and distance to the nearest road have negative effects on marketed share. Finally, farmers in Amhara and the SNNP region sell a higher share of crop production than farmers in Tigray (the reference region), holding other variables constant.

The correlated-random-effects (CRE) model is a hybrid between the fixed-effects model and the random-effects model. For variables that are fixed over time, such as region, the coefficient is based on the between-household relationship. For variables that vary over time, such as income, the model includes both the original variable and the household-level mean of the variable. Because of the presence of the household-level mean, the coefficient on the original variable is equivalent to the fixed-effect coefficient. The household-mean variables indicate the difference between the within-household estimates and the between-household estimates.

**Table 6. Panel data regression analysis of determinants of marketed share**

| Variables | Fixed effect model | Random effects model | CRE model |
|---|---|---|---|
| Female-headed household | 2.107 | 0.098 | 1.779 |
| | (1.07) | (0.08) | (0.93) |
| Age of head (years) | -0.098 | -0.266 | -0.087 |
| | (1.95)* | (9.04)** | (1.78) |
| Education of head (yrs) | 0.127 | 0.082 | 0.089 |
| | (1.04) | (0.84) | (0.92) |
| Education of spouse (yrs) | 0.155 | 0.155 | 0.142 |
| | (0.84) | (1.05) | (0.97) |
| Asset index | 1.375 | 1.058 | 1.165 |
| | (4.25)*** | (4.30)** | (3.71)** |
| Farm land owned (ha) | 1.315 | 3.449 | 1.319 |
| | (4.60)*** | (15.76)** | (4.65)** |
| Year 2016 | 2.825 | 3.191 | 2.738 |
| | (4.05)*** | (4.66)** | (3.97)** |
| Year 2019 | 4.002 | 4.696 | 3.853 |
| | (5.50)*** | (6.74)** | (5.37)** |
| Amhara | | 12.551 | 12.278 |
| | | (9.30)** | (9.23)** |
| Oromia | | 2.018 | -0.368 |
| | | (1.61) | (0.29) |
| SNNP | | 8.264 | 7.746 |
| | | (5.70)** | (5.30)** |
| Distance to road (km) | | -0.626 | -0.739 |
| | | (6.17)** | (7.35)** |
| Mean of female head | | | -1.752 |
| | | | (0.73) |
| Mean of age of head | | | -0.298 |
| | | | (4.99)** |
| Mean of farm size | | | 5.069 |
| | | | (11.63)** |
| Mean of asset index | | | -0.693 |
| | | | (1.48) |
| Constant | 29.576 | 30.840 | 33.507 |
| | (12.03)*** | (16.38)** | (15.41)** |
| $R^2$ | 0.02 | | |
| *N* | 5,250 | 5,250 | 5,250 |

* $p<0.1$; ** $p<0.05$; *** $p<0.01$

Source: Analysis of panel data in ACC Surveys of 2012, 2016, and 2019

As with the other two models, the CRE model indicates that crop commercialization is positively associated with household wealth and farm size. The coefficient implies that each additional hectare is associated with a 1.3 percentage point increase in the marketed share of crop production. The marketed share was 2.7 percentage points higher in 2016 than in 2012 and another 1.1 percentage point higher in 2019, after controlling for wealth, farm size, and other factors. Commercialization rates are higher among households in Amhara and the SNNP region than in Tigray. And distance to road is negatively related to

crop commercialization, which each additional kilometer reducing the marketed share by 0.7 percentage points.

### 4.3. Patterns of commercialization by crop

The previous section focused on the factors associated with the household-level marketed share of crop production. In this section, we focus on crop-level patterns of commercialization.

#### *Commercialization by crop*

Table 7 gives the average marketed share of each crop in each round of the ACC Survey, which we have labeled M1. In 2012, the most commercialized crops were chat, "other crops", fruit, and coffee, all of which have marketed shares over 60%. Oilseeds and vegetables have average marketed shares over 40%, but almost all other crops have shares under 30%. The least marketed crops are millet, enset, barley, and sorghum (under 10%), followed by wheat, maize, black teff, white teff, other cereals, and faba beans (10-20%). This pattern is not surprising, given that the cereals tend to be the least expensive sources of calories, so it makes sense that they would be a large part of the diet for rural households.

**Table 7. Average marketed share of production by crop and round (%)**

| | Round number | | | Change |
|---|---|---|---|---|
| Crop | 2012 | 2016 | 2019 | |
| White teff | 19.8 | 28.9 | 29.0 | +9.2 |
| Black teff | 12.3 | 15.2 | 14.7 | +2.4 |
| Barley | 7.5 | 12.8 | 14.1 | +6.6 |
| Wheat | 12.1 | 17.0 | 21.8 | +9.7 |
| Maize | 12.0 | 16.4 | 18.6 | +6.6 |
| Sorghum | 8.0 | 10.8 | 13.5 | +5.5 |
| Millet | 3.3 | 9.4 | 9.6 | +6.3 |
| Other cereals | 16.4 | 23.5 | 30.7 | +14.3 |
| Faba beans | 19.1 | 18.8 | 17.1 | -2.0 |
| Haricot beans | 29.9 | 35.9 | 27.0 | -2.9 |
| Other pulses | 29.1 | 30.6 | 35.5 | +6.4 |
| Oilseeds | 57.0 | 73.5 | 75.4 | +18.4 |
| Vegetables | 44.4 | 50.1 | 64.0 | +19.6 |
| Fruits | 62.5 | 54.9 | 55.3 | -7.2 |
| Potato | 20.8 | 31.1 | 39.6 | +18.8 |
| Other roots | 32.6 | 14.9 | 50.7 | +18.1 |
| Chat | 76.8 | 81.5 | 70.3 | -6.5 |
| Coffee | 61.4 | 55.1 | 52.3 | -9.1 |
| Enset | 3.8 | 7.2 | 7.5 | +3.7 |
| Other crops | 69.2 | 65.2 | 57.5 | -11.7 |
| Total | 27.7 | 32.3 | 33.5 | +5.8 |

Source: Analysis of ACC Surveys 2012, 2016, and 2019.

The percentages are quite similar in 2016 and 2019. In fact, the Pearson correlation coefficient for the percentages in 2012 and 2019 is 0.91, indicating a close correlation between the two sets of percentages.

Millet, enset, barley, and sorghum remain the least commercialized crops in 2019, and chat, coffee, and fruit remain among the most commercial crops.

The last column shows the changes in the average marketed share between 2012 and 2019. Fifteen of the twenty crops show an increase in the commercialization share. The largest increase is for vegetables, which rose from 44% in 2012 to 64% in 2019. Other crops showing large increases in marketed share are potatoes, oilseeds, and "other cereals" (including rice). The crops whose marketed share declined are faba beans, haricot beans, fruit, chat, and coffee.

Table 8 is similar to the previous table except that it shows total sales as a percentage of total production (M2) rather than the average marketed share (M1). The same general patterns are found in this table: the staple food crops (including cereals and enset) are the least commercialized, while coffee, chat, oilseeds, fruits, and vegetables are highly commercialized. The main difference is that the proportion of total production that is sold (M2) is considerably higher than the average marketed share (M1). For example, the average marked share of coffee in 2019 was slightly over half, while the share of total coffee production sold was more than 70%. As discussed earlier, this is because M2 gives greater weight to households with more production, and these households tend to sell as larger share of their production.

**Table 8. Sales as a share of total production by crop**

| | Round number | | | Change |
|---|---|---|---|---|
| Crop | 2012 | 2016 | 2019 | |
| White teff | 24.4 | 33.4 | 37.3 | +12.9 |
| Black teff | 17.3 | 20.5 | 22.5 | +5.2 |
| Barley | 14.6 | 21.3 | 26.1 | +11.5 |
| Wheat | 23.3 | 32.6 | 43.0 | +19.7 |
| Maize | 27.3 | 31.5 | 35.3 | +8.0 |
| Sorghum | 11.2 | 21.0 | 30.2 | +19.0 |
| Millet | 10.1 | 16.2 | 17.7 | +7.6 |
| Other cereals | 28.3 | 40.7 | 48.8 | +20.5 |
| Faba beans | 30.5 | 30.4 | 29.6 | -0.9 |
| Haricot beans | 45.6 | 60.5 | 41.2 | -4.4 |
| Other pulses | 39.3 | 50.8 | 52.3 | +13.0 |
| Oilseeds | 84.3 | 87.4 | 89.8 | +5.5 |
| Vegetables | 74.3 | 81.8 | 85.1 | +10.8 |
| Fruits | 48.8 | 62.8 | 78.0 | +29.2 |
| Potato | 32.2 | 47.7 | 59.8 | +27.6 |
| Other roots | 49.4 | 29.5 | 86.5 | +37.1 |
| Chat | 79.6 | 96.3 | 84.3 | +4.7 |
| Coffee | 76.4 | 79.5 | 71.9 | -4.5 |
| Enset | 9.0 | 12.9 | 12.7 | +3.7 |
| Other crops | 84.0 | 84.2 | 76.1 | -7.9 |
| Total | 38.1 | 45.5 | 48.9 | +10.8 |

Source: Analysis of ACC Surveys 2012, 2016, and 2019.

Looking at the last column, potatoes, fruit, and other roots experienced dramatic increases in commercialization between 2012 and 2019, rising by more than 25 percentage points. Over this period, the increase in commercialization was almost 20 percentage points for wheat and sorghum and more than 10 percentage points for white teff, barley, "other pulses", and vegetables.

Figure 6 shows the same information as the table above but in graphic form. In addition, the crops are sorted by the level of commercialization in 2012 to visually distinguish between the least commercial crops (at the bottom) and the most commercial crops (at the top). For 16 of the 20 crops and crop categories, the marketed share in 2019 (orange squares) is greater than the share in 2012 (green circles). This shift to the right reflects increasing commercialization for most crops and crop categories.

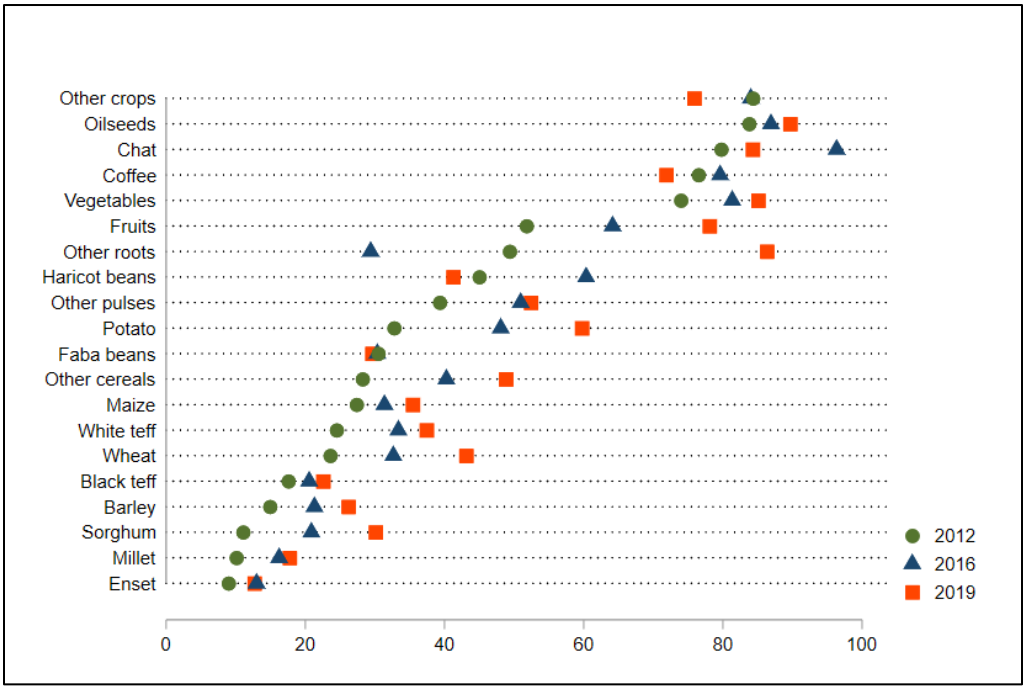


**Figure 6. Total sales as a share of total production by crop (%)**

### *Decomposition of crop commercialization*

As discussed above, the agricultural sector has become noticeably more commercialized even over the relatively short period of 2012-2019. The increase in average commercialization can be caused by two trends. On the one hand, the increase in commercialization can be caused by farmers shifting from subsistence crops to commercial crops. This process is usually given the most attention in the literature and sometimes called diversification toward high-value commercial crops. On the other hand, the increase in commercialization can be the result of an increase in the commercialization of individual crops, even without any change in the crop mix of farmers.

This section examines the relative importance in Ethiopia of these two trends. In other words, how much of the increase in crop commercialization over 2012-2019 can be attributed to farmers changing their crop mix toward more commercial crops and how much is due to the increase in commercialization of individual crops?

Table 9 shows the 20 crops and crop categories organized by level of commercialization, measured by total sales as a proportion of the value of production (M2) averaged over the three rounds of the ACC Survey. The crops are sorted by level of commercialization and divided into three groups with low, medium, and high commercialization. The first column indicates the value of sales as a percentage of the value of production (the sorting variable). The second and third columns give the proportion of the total value of crop production in 2012 and 2019. The final column gives the change in the percentage between 2012 and 2019. If there is a shift from subsistence crops to more commercial crops, we will see negative changes for subsistence crops and positive changes for commercial crops.

**Table 9. Level of commercialization and change in crop mix over 2012-19**

| Crop | Sales as a share of output | Composition of the value of crop production (%) | | Change in share of crop value |
|---|---|---|---|---|
| | (%) | 2012 | 2019 | |
| Enset | 11.5 | 3.8 | 3.0 | -0.8 |
| Millet | 14.7 | 0.9 | 1.8 | 0.9 |
| Black teff | 20.1 | 4.4 | 4.3 | -0.1 |
| Barley | 20.7 | 5.1 | 6.4 | 1.3 |
| Sorghum | 20.8 | 8.5 | 2.9 | -5.6 |
| Faba beans | 30.2 | 4.0 | 1.7 | -2.3 |
| Maize | 31.4 | 12.3 | 11.9 | -0.4 |
| **Subtotal** | | **39.0** | **32.0** | **-7.0** |
| White teff | 31.7 | 9.0 | 11.3 | 2.3 |
| Wheat | 33.0 | 11.8 | 18.7 | 6.9 |
| Other cereals | 39.3 | 1.4 | 4.0 | 2.6 |
| Potato | 46.6 | 2.5 | 3.9 | 1.4 |
| Other pulses | 47.5 | 5.1 | 4.6 | -0.5 |
| Haricot beans | 49.1 | 0.9 | 0.8 | -0.1 |
| **Subtotal** | | **30.7** | **43.3** | **12.6** |
| Other roots | 55.1 | 1.1 | 1.2 | 0.1 |
| Fruits | 63.2 | 3.3 | 1.3 | -2.0 |
| Coffee | 75.9 | 8.3 | 4.7 | -3.6 |
| Vegetables | 80.4 | 6.9 | 9.7 | 2.8 |
| Other crops | 81.4 | 6.7 | 2.4 | -4.3 |
| Chat | 86.7 | 1.0 | 1.7 | 0.7 |
| Oilseeds | 87.2 | 2.9 | 3.8 | 0.9 |
| **Subtotal** | | **30.2** | **24.8** | **-5.4** |
| **Total** | | **100.0** | **100.0** | **0.0** |

Source: Analysis of ACC Surveys in 2012, 2016, and 2019.

The results show that the crops in the low-commercialization category have in fact declined in their contribution to the value of crop production, falling from 39% to 32% of the total. This is due to

substantial reductions in sorghum and faba beans, as well as smaller declines in most other crops. In contrast, crops in the medium-commercialization category have increased their contribution to the total value of crop production, rising from 31% to 43% of the total. This increase is led by wheat, white teff, and other cereals (including rice). Finally, contrary to expectations, the crops in the high-commercialization category have declined in their contribution, from 30% to 25% of total crop value. Although vegetables and chat have increased in their contribution, this was more than offset by decreases in coffee, fruit, and other crops. In summary, there is evidence of farmers shifting production from staple food crops to somewhat more commercial crops, such as teff, wheat, and potatoes, we do not see a shift to high-commercialization crops like coffee.

This analysis sheds light on the changes in crop mix of Ethiopian farmers, but it does not quantity the contribution of changing crop mix on the overall rate of commercialization. The contribution of the change in crop mix can be estimated by asking: how much would the average commercialization rate increase if the level of commercialization for each crop remained at its 2012 level but the composition of crop production shifted as it did between 2012 and 2019. The result of these calculations is -2.0 percentage points. This means that the change in composition of crop production between 2012 and 2019 had a slightly negative effect on the overall increase in commercialization over that period.

The contribution of the increase in crop-level commercialization can be estimated by asking what would the change in overall commercialization be if the commercialization of each crop changed as it did over 2012 to 2019, but the composition of crop production remained what is was in 2012. This can be calculated as the weighted average change in crop-level commercialization, where the weights are the share of each crop in the total value of crop production in 2012. The result of this calculation (shown in Annex 1) is 10.1 percentage points. Given that the actual change in overall commercialization (M2) was 9.9 percentage points (see Table 4), this factor accounts for all (actually more than 100%) of the observed change in commercialization.

In summary, the results of the three rounds of the ACC Survey indicate that all of the 9.9 percentage point increase in crop commercialization that occurred in Ethiopia over 2012-19 was the result of increases in the commercialization rate of individual crops. The changes in crop mix alone had a slightly negative effect on the overall rate of commercialization.

## 5. Summary

The analysis of the three rounds of the ACC Survey in Ethiopia reveals a number of patterns and trends that we would expect based on previous research. Given the rapid rate of growth in Ethiopia, it is not surprising to see a significant increase in crop commercialization between 2012 and 2017. The increase

was between 6 and 10 percentage points, depending on how commercialization is defined and which sample is used. In addition, several of the cross-sectional patterns are similar to what has been observed elsewhere. As in previous studies, farm size is a strong predictor of the level of commercialization of a household. Farms with less than 0.5 hectares sell, on average, just one quarter of their crop production, while those with more than 5 hectares sell almost half of crop output. This relationship holds up in the regression analysis after controlling for other household characteristics. As expected, households living close to roads face lower transaction costs and thus are more commercialized. Households with higher income or more assets tend to be more commercialized, perhaps because being wealthier makes them less risk averse, able to tolerate the variation in income associated with commercial production. And the regional variation in commercialization is to be expected, with Tigray being less commercialized partly due to the lower rainfall and reduced ability of farmers to generate a surplus.

Other results are somewhat unexpected, demonstrating that the process of commercialization is more complex than is sometimes believed. First, farm households are not easily divided into "subsistence" and "commercial" farmers. In fact, there is a continuous distribution of farmers, from those who do not sell any of their crop production to those that sell all of their production. There are virtually no pure subsistence farmers. About one fifth of those growing crops don't sell any of their harvest in a given year, but they earn income from livestock, enterprises, and wages. Furthermore, virtually all rural households in the sample purchase food to supplement own production.

Second, it is a simplification to think of cereals as "subsistence crops" and coffee and other industrial crops as "cash crops". Cereals account for over half of the value of production, but more surprisingly they represent 35% of the value of crop sales. Vegetables account for 15% of the value of sales, greater than the contribution of coffee (12%). Furthermore, the sale of wheat alone accounts for 11% of the revenue from crop sales, almost as much as coffee.

Third, it is not surprising to find that the marketed share of crop production is higher among male-headed households than female-headed households. However, it is interesting to note that this is largely because female-headed households have smaller farms and lower wealth. The gender gap in commercialization disappears in the regression analysis which controls for these differences.

Fourth, the results show that the increase is commercialization is not uniform across households. Some groups have experienced substantial commercialization, while others appear to have been left behind. For example, the increase in commercialization occurred in households with low and high levels of commercialization, but the share of farmers not selling any crops remained stable at about 20%. The increase in the average marketed share was statistically significant in Amhara and Oromia, but not Tigray

or the SNNP region. Male-headed households recorded a statistically significant increase in marketed share, while the increase for female-headed households was not significant. Households with older heads of households experienced smaller gains in commercialization than younger ones; for heads 70 years and older, the change was statistically insignificant. The increases in commercialization were concentrated among farms with 0.5 to 5.0 hectares, while farms both smaller and larger than this saw no change. With regard to distance, the greatest gains in commercialization were among farms more than 4 km from the nearest road. Finally, the increase in commercialization over 2012-19 was statistically significant for the top three quintiles of per capita income, but not for the poorest two quintiles.

In terms of methods, this paper makes two contributions. First, we highlight the distinction between two measures of commercialization. The average farm household in 2019 sold about one-third of the value of their crop production, but overall crop sales account for almost one-half of the total value of crop production. The reason for this difference is that the average marketed share gives equal weight to each household, while the marketed share of total crop production gives more weight to households with a larger harvest in value terms.

Second, we show a method of disaggregating changes in commercialization into changes in commercialization for each crop and changes in crop mix toward more commercial crops. In the Ethiopia case, we find that all of the increase in commercialization was due to higher shares of each crop being sold, with no contribution from changes in crop mix. In other words, none of the increase in commercialization could be attributed to a shift toward more commercial crops.

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