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Agricultural Policy Research in Africa

Patterns and Drivers of Agricultural Commercialisation: Evidence from Ghana, Nigeria and Malawi

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Acronyms

ADMARC	Agricultural Development and Marketing Corporation (Malawi)
EA	enumeration area
FAO	Food and Agriculture Organization of the United Nations
FCS	Food Consumption Score
FE	fixed effect
FISP	Farm Input Subsidy Programme (Malawi)
GHS	General Household Survey (Nigeria)
GLSS	Ghana Living Standards Survey
GSS	Ghana Statistical Service
HCI	household commercialisation index
IHPS	Integrated Household Panel Survey (Malawi)
LSMS	Living Standards Measurement Surveys
MPI	multidimensional poverty index
PCA	principal component analysis
SAP	Structural Adjustment Policy
SSA	sub-Saharan Africa

Executive summary

Farm households differ in terms of their access to land, capital, labour, skills, as well as access to external services – hence, it is no surprise that the processes of agricultural commercialisation are experienced unevenly across different groups and geographies.

This report examines patterns and drivers of agricultural commercialisation in three African contexts: Ghana, Nigeria, and Malawi; using household level data drawn from three sources: (i) *Ghana's Living Standards Surveys* in 2012/2013 and 2016/2017 (GLSS6 and GLSS7); (ii). *Nigeria's General Household Surveys* (GHS-Panel) in 2010/2011 and 2015/2016 drawn from the Living Standards Measurement Surveys (LSMS) database; and (iii). *Malawi's Integrated Household Panel Surveys* (IHPS) which are part of the LSMS database collected by the National Statistical Office with technical support from the World Bank.

We focus on four questions: First, what have been the broad patterns of agricultural commercialisation across different regions/zones and crops? Second, what have been the observable differences across groups of households – namely by gender and farm type? Third, how has the incidence of poverty changed across the years? Finally, and importantly, what are the drivers of agricultural commercialisation? With this focus, this report presents consolidated evidence across three African contexts, drawing attention to key trends and findings as a basis for further research.

Overall, we find that labour, poverty status and asset ownership have been key characteristics that explain differences in commercialisation across farm households. However, when we account for differences across regions or zones, we find that these factors are not always significant drivers of commercialisation outcomes – suggesting the importance of other external supply-side factors such as access to markets in driving commercialisation.

Interestingly, when we control for differences across the ecological zones, such as in the case of Ghana, the above-mentioned results for asset ownership as a significant factor driving commercialisation persists, which is evidence of the rising opportunity costs of family labour vis-à-vis off-farm employment. In contrast, asset ownership was not a significant factor in Malawi.

In Nigeria, our results suggest the importance of differences in supply-side factors across zones, such as access to markets, driving differences in commercialisation. Further, we find that hired labour costs, poverty status of a household, and households' asset ownership are key drivers of household agricultural commercialisation. Other significant determinants of household commercialisation in the study include household size, own output processing, land holding, and land productivity.

In Malawi, our results highlight that though poverty is a constraint to engagement with markets, only income poverty was a significant driver of commercialisation; this was however not the case for other multidimensional and subjective measures. Female-headed households are further less likely to participate in markets in Malawi, raising concerns about inclusiveness of the commercialisation process. Nonetheless, receipt of market-oriented extension is a key positive driver of commercialisation.

We draw attention to the importance of different factors in driving the degree of commercialisation – these can be specific to households, farm types, or geographies. The importance of access to labour and assets are critical to the processes of agricultural commercialisation. These results on

heterogeneities in patterns and drivers of commercialisation signifies that to ensure the promotion of inclusive agricultural commercialisation, policies must adopt a comprehensive approach that aims to tackle bottlenecks at different levels. The design of interventions should be better targeted to capacity building measures that address these differences and protect against any risks from commercialisation.

1. Introduction

Agricultural commercialisation is defined as the process of farmers becoming more integrated with markets, including the integration of agricultural households into agricultural input or output markets (von Braun and Kennedy, 1994; Jaleta, Gebremedhin and Hoekstra, 2009). For smallholder farmers, agricultural commercialisation entails transforming agriculture, whereby individual farms shift from a highly subsistence-oriented production towards more specialised production (Pingali, Khwaja and Meijer, 2005) – targeting markets for input procurement as well as output sales.

Substantial benefits from agricultural commercialisation are alluded to in the literature. According to von Braun (1995), commercialisation directly affects households' disposable income through sales and employment opportunities that commercialisation creates within a value chain. These benefits may translate to poverty alleviation, food and nutrition security, and overall health and living standards (Leavy and Poulton 2007; Ogutu and Qaim, 2019). The effects of commercialisation may also spill over to the wider rural economy and contribute to the revitalisation of the entire economy (von Braun, 1995).

Agricultural commercialisation can be key for development in countries that rely on agriculture as the major source of livelihood – this has been driven by two primary areas of thought (Poole, Chitundu and Msoni, 2013). The first recommends agricultural commercialisation policy as the ideal or rational intervention in addressing welfare problems such as poverty or food insecurity, implying a broad application of commercialisation policies and strategies as a one-size-fits-all intervention. The second stipulates that a farmer can be reluctant to engage in market activities for fear of adverse outcomes and the risk of bankruptcy or starvation (Timmer, 1997).

There are substantial differences across farm households in terms of access to land, capital, labour, skills, and external services, and so it is no surprise that the processes of agricultural commercialisation are experienced unevenly (Wiggins et al., 2011). Responses to factors that stimulate such commercialisation on the demand side and on the supply-side will therefore be quite different, and depend to a great extent on individual circumstances. In fact, Leavy and Poulton (2007) suggest that for smallholder farmers to actualise the benefits of commercialisation, certain critical conditions need to be in place, including market and information infrastructure; and where such conditions are not met, commercialisation might in fact have detrimental effects on smallholder farmers. Additionally, von Braun, Bouis and Kennedy (1994) suggests that it is essential for governments to intervene and cushion smallholder farmers from adverse effects of

commercialisation, allowing for customisation of policies targeted at smallholders (Poole, Chitundu and Msoni, 2013).

This report focuses on agricultural commercialisation in three different contexts in Africa, drawing attention to the heterogeneities in patterns and drivers of commercialisation that should be considered for the promotion of inclusive agricultural commercialisation. Specifically, we focus on four broad questions: First, what are the patterns of agricultural commercialisation across regions and crops? Second, what are the differences by gender of household head and by farm classification? Third, how has the incidence of poverty changed across the two years? Finally, what are the drivers of commercialisation?

The remainder of this report is organised as follows. Chapter 2 discusses the background and key literature. Chapter 3 presents the analysis for Ghana. Chapter 4 discusses agricultural commercialisation in Nigeria. Finally, Chapter 5 presents the case of agricultural commercialisation in Malawi.

2. Background and literature

There are several pathways through which agricultural commercialisation affects welfare outcomes such as income poverty, food consumption or employment. First, through input market integration for production of surplus for the market (von Braun, 1995; Leavy and Poulton, 2007; Jaleta, Gebremedhin and Hoekstra, 2009). Upscaling production requires increasing factors of production such as capital, improved seed, and labour. Smallholder farmers usually grow labour-intensive food crops and outsource labour where family labour is inadequate, hence creating a source of employment and wage income (Ochieng et al., 2016).

A second pathway is through activities of market orientation that were non-existent under subsistence farming – either direct or indirect. Market integration of farmers in output markets provides proceeds from crop sales that may broaden farmers' income streams relative to those practicing subsistence farming (von Braun, 1995; Pingali and Rosegrant, 1995). Such an increase in income may be used for food and non-food purchases. Besides, new market activities arising out of increased commercialisation may also result in increased demand for labour and other extension and agro-dealer services, thereby creating employment opportunities that may in turn have spill over effects across the entire rural economy (Pingali, Khwaja and Meijer, 2005).

Empirically, several studies have examined the nexus between agricultural commercialisation and poverty. Abdullah et al. (2019) demonstrated that integration of rice farmers in markets improved welfare as measured by consumption per capita in Pakistan. Similarly, Ogutu and Qaim (2019) found that agricultural commercialisation significantly reduced income poverty in Kenya, like the sale of horticultural crops in a study by Muriithi and Matz (2015). However, there were caveats – with the later study reporting failures in sufficient investments in assets for capital formulation, and the former reporting increases in income inequality. Thus, commercialisation was linked with inequities and poverty reduction which may be short-lived, with greater gains among richer households compared to the poorest households.

The impacts of smallholder commercialisation on food consumption have been mixed in different contexts. On one hand, commercialisation has a direct positive effect on households' disposable income which, in turn, increases the purchasing power of households, enabling them to participate in food markets (von Braun, Bouis and Kennedy, 1994; Kuijpers, 2018). The advantage of such market participation is that not only are households able to purchase food, but it also allows greater access to a wide range of foods, thereby contributing to dietary diversity and nutrition (Matita et al.,

2021a). On the other hand, agricultural commercialisation might have detrimental effects on food security. Specifically due to the substitution effect, resulting from reallocation of resources from production of staple food crops to cash crops (von Braun, Bouis and Kennedy, 1994; Dillon, 2016). Therefore, commercialisation might also be a risk or a cause of food insecurity and poor nutrition in households. These indirect links show that for agricultural commercialisation being able to translate into welfare improvements is dependent on several factors that interact in complex ways.

An examination of effects of commercialisation on nutrition by Carletto, Corral and Guelfi (2017) shows weak and negative linkages, particular for female-headed households, which the authors argue is due to the change in the roles of female heads from nurturing to productive roles. In some studies, female farmers have been found to participate less in crop marketing, including deciding on how to use realised incomes (Andersson et al., 2018; Djurfeldt, Dzanku and Isinika, 2018) – in which case empowerment and group membership becomes key in mediating the nutrition outcomes of commercialisation (Gupta, Vemireddy and Pingali, 2019). In contrast, Kihiu and Amuakwa-mensah (2020) find greater effects on dietary diversity – actually double for females than males when they participate in organised agricultural markets in Kenya, consistent with studies alluding to higher dietary diversity in market-oriented farming, as opposed to households focused on subsistence farming (Sibhatu and Qaim, 2018). At the same time, studies also show that higher agricultural incomes may not translate into higher food expenditures and better diets (Carletto, Corral and Guelfi, 2017; Radchenko and Corral, 2018).

The factors affecting commercialisation can be classified into a few perspectives. The first is the '*marketable surplus*' perspective that assumes agricultural commercialisation occurs with increased marketable surplus (von Braun, Bouis and Kennedy, 1994). Based on this, the determinants of agricultural commercialisation are those factors that will directly affect agricultural production. Some of these factors include exogenous ones such as population change (demographic change), availability of new technologies, infrastructure and market creation, and macroeconomic and trade policies. These factors shape and frame the nature of agricultural commercialisation (von Braun, Bouis and Kennedy, 1994). However, the drawback of this perspective is that it does not adequately explain why smallholder farmers under these same exogenous factors differ in terms of their degree of commercialisation.

The second perspective is the '*profit motive'* perspective, built on the inadequacy of the 'marketable surplus' perspective in explaining the motive behind smallholder farmers' participation in the market.

According to this, commercialisation should be based on the principles of profit maximisation – a household is fully commercialised if and only if its objective is to maximise profit (Pingali and Rosegrant, 1995). This places emphasis on market signals to drive the commercialisation process, and the drivers include: on the supply side, the factors of production (land, labour, capital, entrepreneurship), and on the demand side, market information, availability, and accessibility (Pingali and Rosegrant, 1995). However, the drawback is a strong assumption of profit maximisation which in most cases may not fit with the contexts of smallholder farmers (Timmer, 1997; Pender and Alemu, 2007).

The third perspective is the '*livelihood strategy'* perspective. It is different from the two perspectives discussed above as it focuses on factors that impede commercialisation rather than those that promote it. According to Timmer (1997), farmers are reluctant to engage in any market activity for fear of adverse outcomes and the risk of bankruptcy or starvation. This assumes that farmers' market participation is motivated by risk minimisation. In an instance, where markets, particularly food markets are unreliable, inefficient, or highly volatile, then farm households will prioritise feeding themselves (subsistence farming), and hence will only cultivate very small quantities for sale as they anticipate a food deficit (Leavy and Poulton, 2007; Fafchamps, 2009). In this regard, the drivers of agricultural commercialisation could include welfare indicators or factors such as household food security, education, health status and living standards. Additionally, the phenomenon of 'distress selling' is evident when households sometimes engage in the market as a short-term survival strategy, rather than as a result of the need to gain profit (Leavy and Poulton, 2007; Jayne, Mather, and Mghenyi, 2010). The challenge here is that it is difficult to determine the levels of commercialisation as there is no clear distinction between farmers that engage in the market for commercial purposes and those that engage with markets as a livelihood strategy.

Lastly, according to Pingali, Khwaja and Meijer (2005), the determinants of agricultural commercialisation can be drawn from the *'transactional cost'* perspective. The main assumption of this theory is that farmer participation in the market is hindered by the costs that are incurred in the process of commercialisation. Some of the determinants from this perspective include education, social networks and organisations, credit facilities, market information and aids to trade that smoothen and reduce transaction costs.

The different perspectives have all received mixed attention in the literature. In an analysis of transactions and opportunity costs associated with commercialisation, Heltberg and Tarp (2002)

found that non-price factors such as risks, technology, and transport infrastructure limited agricultural commercialisation in Mozambique. Similarly, Kirui and Njiraini (2013) found that the time taken to reach the market, and distance to a bank, negatively affected agricultural commercialisation. Osmani and Hossain's (2016) examination of commercialisation from the marketable surplus perspective found that farm size, and off-farm income increased commercialisation. Others like Mulwafu, Krishnankutty and Krishnan (2013) determined commercialisation from a profit maximisation perspective finding that, on the one hand, credit facilities, farmer business orientation, innovativeness, monthly income, extension, and access to information positively influenced the transition from subsistence to semi-commercial farming; while, on the other hand, commodity transportation negatively influenced commercialisation. In another study, Mather, Boughton and Jayne (2013) found that increases in farm level productivity and resource endowments, like land, complemented by market access, increased the extent of commercialisation in Kenya, Mozambique and Zambia. In our analysis of agricultural commercialisation in Ghana, Malawi and Nigeria, we draw from this body of literature, focusing closely on context-specific factors driving and explaining patterns of commercialisation.

3. Agricultural commercialisation in Ghana

3.1. Introduction

In Ghana, agricultural commercialisation dates to the colonial era, when coercive and incentive structures were often used to induce farmers into engaging in the production of commercial crops such as oil palm and cocoa (Adu-Boahen, 2000; Yaro, Teye, and Torvikey, 2017). Recently, agricultural market participation has improved significantly, underpinned by the presence of improved output markets, supermarkets and specialised wholesalers, as well as capital investments in the form of processors and agro-exporters in the sector (Barrett et al., 2012). The surge in agricultural commercialisation is partly attributable to the rising opportunity costs of family labour vis-à-vis increasing off-farm employment opportunities, as well as increased market demand for food and other agricultural products from increasing urbanisation and trade liberalisation (Martey, Al-Hassan and Kuwornu, 2012). Furthermore, interventions by state and non-state actors have expanded the input and output market space.

Ghana's agricultural commercialisation has been characterised by significant regional variation, owing especially to differences in the number of agricultural input dealers as well as in the types of products they sell (Krausova and Banful, 2010). These differences also owe in part to national and donor support to establish farms in favourable ecological zones (Amanor and Diderutuah, 2001).

This chapter examines these recent patterns of agricultural commercialisation in Ghana using key indicators based on disaggregation by crops and regions. We use household level data drawn from the two rounds of the GLSS in 2012/2013 and 2016/2017 (GLSS6 and GLSS7) in understanding the patterns.

Using pooled data across the two years, we find hired labour, poverty status and asset ownership as key characteristics that explain differences in commercialisation across farm households. But, when we account for differences across regions with regional fixed effects, we find that poverty status and assets are no longer significant – suggesting the importance of differences in supply-side factors across regions, such as access to markets, driving differences in commercialisation. Interestingly, when we control for differences across ecological zones, the above results for asset ownership as a significant factor driving commercialisation persists.

The remainder of this chapter is organised as follows. Section 2 presents the details about data and methodology. Section 3 outlines the descriptive analysis. Section 4 discusses the results from the

estimation of the drivers of commercialisation. Finally, Section 5 concludes with a discussion of the implications of this research for enabling smallholders to move onto higher levels of commercialisation.

3.2. Data and methodology

The data for this study are derived from GLSS data. We begin by outlining the data and the samples. Then, we outline the methodology for studying the drivers of agricultural commercialisation.

3.2.1. Data and sample

We use the sixth and the seventh rounds of GLSS data; a nationwide household survey designed to generate information on living conditions in the country, conducted in 2012/2013 and 2016/2017 respectively. The GLSS survey in 2012/2013 covered a nationally and regionally representative sample of 16,772 households, while the GLSS 2016/2017 survey covered 14,009 households. The data covers a repeated cross-section of households across the two periods.

Not all households in the GLSS sample are engaged in crop farming activities, hence we begin by creating a sub-sample of crop farmers from the GLSS6 and GLSS7 in **Table 1**. The total sample for crop farmer households is 7,764 in 2012/2013, while the total farmer household sample for 2016/2017 is 5,497. Further, using our sub-samples, we examine the distribution of the households by region and crops (**Table A1** in Appendix Section IA reports these figures for 2013 in Panel A and for 2017 in Panel B).

Table 1: Sample distribution by year and region

Region	2013	2017
Western	671	419
Central	533	458
Greater Accra	49	36
Volta	720	661
Eastern	905	614
Ashanti	712	331
Brong Ahafo	947	611
Northern	1290	868
Upper East	823	682
Upper West	1,114	817
Total	**7,764**	**5,497**

Source: GLSS data

Additionally, **Table A2** in the Appendix reports the sample distribution using two categories: first, by sex of household head – male and female-headed households; second, by farm classification – 'smallholder' and 'medium to large'[1] farmer households based on farm size.

3.2.2 Methodology

We present the analysis in this chapter in three parts. First, we examine the agricultural commercialisation indicators using different levels of disaggregation including region and crops, gender and farm classification (land size). Second, we examine poverty and extreme poverty indicators. Finally, we examine drivers of commercialisation using pooled data with region and year fixed effects.

To understand commercialisation patterns, we begin by examining production and sales reported by the households. These are then used to compute our key commercialisation measure – the household commercialisation index (HCI) that ranges between zero and 100 (Leavy and Poulton 2007), defined as:

$$HCI_{ij} = \frac{\sum_{j=1}^{n} gvs_i}{\sum_{j=1}^{n} gvp_i}$$

HCI_{ij} = HCI of i^{th} household across all $j = 1,,,n$ crops; gvs_i = gross value of all crop sales for the i^{th} household; gvp_i = gross value of all crop production for the i^{th} household.

Next, the measurement of poverty by the Ghana Statistical Service (GSS) is essentially based on consumption poverty, where the poor are considered as persons who lack command over basic consumption needs, including food and non-food components. To identify the poor, the poverty line is computed, that is, the expenditure on a minimum consumption basket required by an individual to meet basic food and non-food requirements. Thus, per adult equivalent, consumption is used to measure poverty by first dividing the total household consumption by the number of adult equivalents in the household. The practice in Ghana over the years has been to compute two poverty lines – an upper poverty line (referred to as the poverty incidence line) and a lower poverty line (referred to as extreme poverty line). Based on the total consumption expenditure per adult equivalent and the estimated poverty line, the poverty rates or the population below the poverty lines are then estimated.

[1] Based on Food and Agriculture Organization of the United Nations (FAO) country level classification: a smallholder farmer has less than 3.64ha under crop cultivation, and a medium to large-scale farmer has at least 3.64ha under crop cultivation.

The poverty incidence rate is therefore the proportion of the total population whose consumption expenditure per adult equivalent falls under the upper poverty line, while the extreme poverty rate is the proportion of the total population whose consumption expenditure per adult equivalent falls below the lower poverty line. This is the head-count ratio, mathematically expressed as: $P_0 = \frac{q}{n}$. Where P_0 is the measure of poverty, *n* is the total population and *q* is the number of poor (that is, those whose consumption expenditure per adult equivalent fall below the poverty line). According to GSS (2018), the upper poverty line is GH₵1,314, and the lower poverty line is GH₵792.05 for 2012/13; while the upper and lower poverty lines for 2016/17 are GH₵1,760.86 and GH₵984.16 per year respectively.

We also identify asset ownership by aggregating across various household assets that include: furniture (stuffed), furniture (not stuffed), sewing machine, stove (gas), fan, radio, three-in-one-radio system/home theatre, VCD/DVD/mp3/mp4 player/iPad, satellite dish, television, electric iron, bicycle, motor cycle, house, land, food processor/blender, rice cooker, box iron, mobile phone, jewellery, clothes (wax print, *kente*, etc.), clock (watch), utensils, poultry, tree crop plantation, and bed furniture. We construct the index using principal component analysis (PCA).

To analyse the drivers of commercialisation, we model commercialisation, measured by HCI for household *i* for year *t*, estimating the following specification:

$$HCI_{it} = \beta_0 + \beta_1 Hired\ labour_{it} + \beta_2 Poverty_{it} + \beta_3 Assets_{it} + \rho x_{it} + \nu_j + \gamma_t + \varepsilon_{it}$$

Our key explanatory variables are *Hired labour* – proxied by the cost of hired labour incurred by the household; *Poverty*, using consumption-based poverty status of household in a given year; *Assets*, proxied by asset index of the household; *xit* is a set of control variables that includes various household characteristics that also affect commercialisation; *vj* is the region fixed effect or the fixed effect for ecological zone; γ_t is the year fixed effect; ε_{it} is the error term. The full list of variables is reported in **Table 2**.

Table 2: Description of regression variables

Variables	Description
HCI	This takes values between 0 and 1, and measured as (gross value of crop sales/gross value of crops produced) * 100
Female head	1 if household head is female, 0 if household head is male
(log) Age of head	Log of household head's age in years
Land holding	Household's total land size under crop cultivation
(log) Land productivity	Log of value of crop output per hectare, computed as crop output divided by cultivated plot size
Processing	1 if household is engaged in crop processing, 0 otherwise

Couple households	1 if household head has a spouse, 0 otherwise
Household size	Number of members in a household
Migrant household	1 if household head is a migrant at current location, 0 otherwise
Bank account	1 if any household member has a bank account, 0 otherwise
Literacy of head	1 if household head can read and write, 0 otherwise
Non-farm participation	1 if any household member participates in a non-farm activity, 0 otherwise
Agriculture household	1 if agriculture is the main occupation of household head, 0 otherwise
Salary household	1 if any household member is a salary worker, 0 otherwise
Poverty status of household	1 if household is poor (based on the absolute national poverty line), 0 otherwise
Asset index	Computed based on the ownership of a number of household assets using PCA, values ranged between 1 (for asset-poor households) to 5 (for asset-rich) households
Western Region	1 if household is located in the Western Region, 0 otherwise
Region	These were the 10 administration regions of Ghana during the time of the surveys
Ecological zone	1 if household is located in the coastal ecological zone, 2 for forest, 3 for savannah and 4 for the Greater Accra Metropolitan Area
(log) Hired labour cost	Log of total amount (in Ghana Cedis) spent by farm households on hired labour for crop production
Year dummy (2013)	2013 for GLSS6 survey households and 2017 for GLSS7 survey households

Source: Authors' own

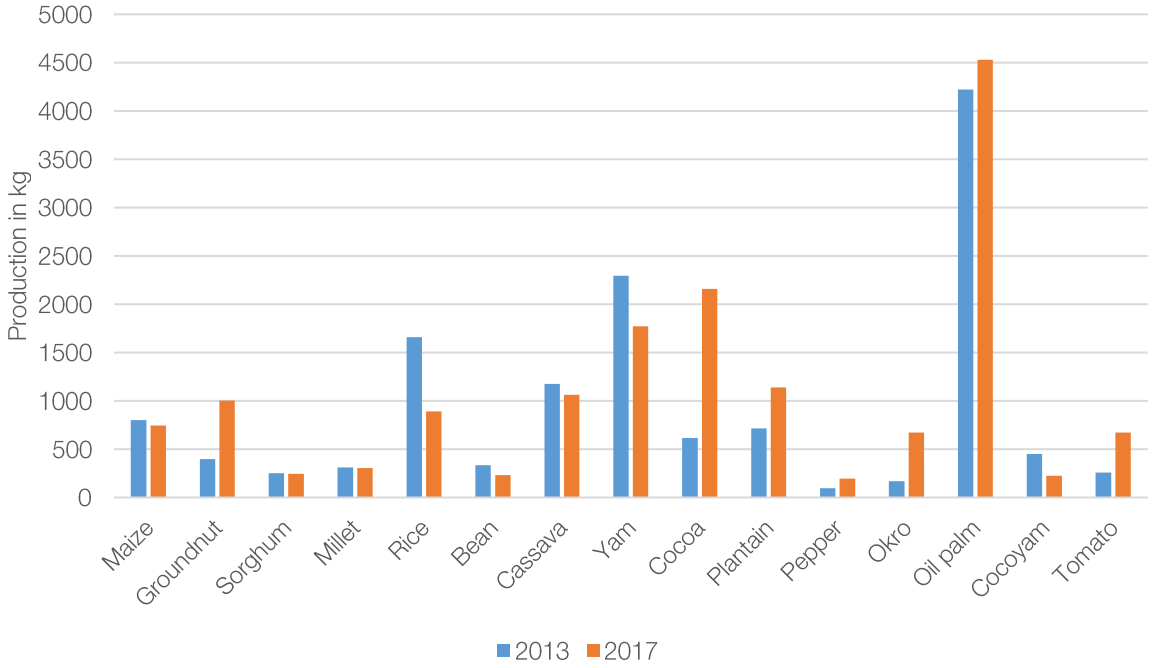
3.3. Descriptive analysis

In this section, we analyse commercialisation indices across crops using different levels of disaggregation including region, sex of household head and farm classification.

3.3.1. Analysis by regions

We begin by examining the average quantity of crop production and sales, along with the average value of production and sales, before reporting the HCI. **Figure 1** illustrates crop production for the two years, and across all regions in Ghana – we note oil palm, cocoa, yam, cassava and groundnuts as prominent crops in terms of production quantities.

Figure 1: Production in kg and by crops – 2013 and 2017



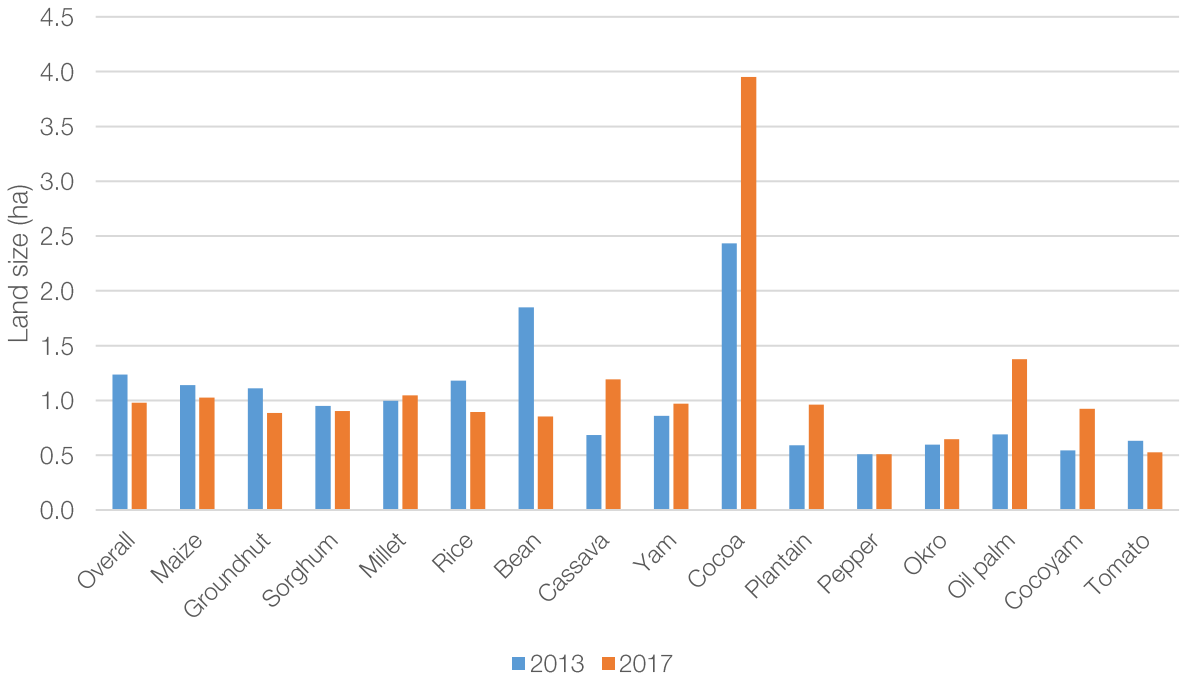
Source: GLSS data, 2013 and 2017

Table A3 in Section I of the Appendix reports the breakdown of crop production by different regions. On average, production has gone up across many regions – especially for oil palm, plantain and yam, with noticeable differences across regions. The Western Region has witnessed substantial increases in production of groundnut, oil palm, okro and cassava among others. In the Central Region of Ghana, oil palm production has also gained prominence with cassava production. The corresponding average value of oil palm also grew significantly between 2013 and 2017. Examining the key crops to look at the changes in production over time, we note that all regions have been growing maize at consistent levels, with the exception of Greater Accra that had a substantial increase between 2013 and 2017. Groundnut production has increased a lot, especially in Western and Eastern regions. No groundnut production is observed in the Central or Greater Accra regions – and this remains the same for 2013–2017. Oil palm production was concentrated in the West, East, and Brong Ahafo regions in 2013 – but appears to have increased on average by 2017, especially in the eastern areas. Pepper production shows an increase in the Greater Accra and Eastern regions of Ghana. All regions of Ghana are producing cassava – with Ashanti showing a huge jump in average production from 2013 to 2017. Okro appears to be an emerging crop.

Tables A4 and **A5** in Section I of the Appendix help draw a comparison of the production values with sales values across the regions. Examining the changes in average value of production and value of sales for some of the key crops across regions, between 2013 and 2017, it is interesting to note that on average, the highest value of oil palm is being produced in Eastern Region, with higher-than-average sales values also observed in Western Region. Groundnut is a high value crop, especially in Ashanti Region. The highest values of cassava sales on average appear to be in Brong Ahafo and Ashanti regions. The Eastern Region generally dominates in terms of high value crop production and sales.

Next, examining the average plot size (**Figure 2**) across the regions and crops, shows that while average land size devoted to plantains, maize, pepper and cocoyam have increased, the average size for oil pam, groundnut, and okro has gone down, indicating possible intensification in production.

Figure 2: Land sizes across regions by crop, 2013 and 2017

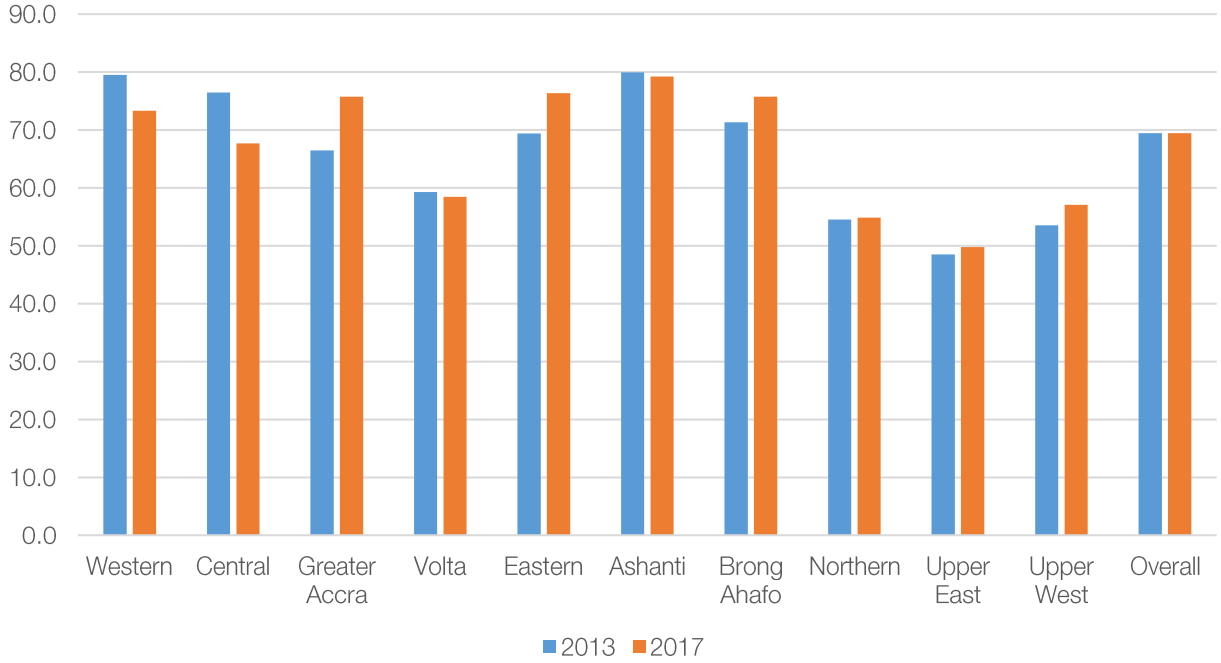


Source: GLSS data, 2013 and 2017

We examine the HCI by regions, crop and household farm size. First, the overall average HCI levels for all crops included in the analysis is 51.1%, showing that the Western Region (73.7%) is most commercialised comparative to the other regions, followed by the Ashanti (63%) and Central (62.4%)

regions. It is remarkable that Northern Ghana generally reported the least level of commercialisation, with the Upper East, Upper West, and Northern regions reporting an average HCI of 20.2%, 30.4% and 34.3% respectively; they are the least commercialised regions in the country.

Figure 3: HCI by regions in Ghana – 2013 and 2017



Source: GLSS data, 2013 and 2017

Table A6 in Section I the Appendix reports HCI by crop and region. It is not surprising that cocoa (87.6%) is the most commercialised among all crops in the study, since cocoa is primarily a non-food cash crop. The 2017 sample reported the overall average HCI at 49.2%, slightly lower than the 2013 level recorded. Greater Accra reported the highest level of HCI in 2017 (69.9%), closely followed by the Ashanti (68.8%), and Eastern (61.6%) regions. Again, the regions in northern Ghana reported the lowest levels of commercialisation in the sample, respectively recording average HCI of 15.8%, 30.3% and 32.0% for the Upper East, Upper West, and Northern regions. This reflects a decline in the level of overall output commercialisation for the three northern regions comparative to 2013. Indeed, with exception to the Western, Central, Volta and Ashanti regions, all other regions showed improved levels of commercialisation over the 2013 figures.

3.3.2. Analysis by sex of household head and farm classification

Next, we examine production, sales and average commercialisation levels by crop, household head and household farm size. **Table A7** in Section I of the Appendix reports the HCI using the gender of the head of household and the broad classification between smallholders and medium/large-scale farmers. We find that for oil palm, sales were comparable across smallholder farmers and medium/large-scale farmers in 2013, however by 2017, the medium-scale/large farmers were selling significantly higher quantities of oil palm. However, HCI is higher for smallholders, suggesting that these farmers are selling higher proportions of their production. Average HCI is significantly higher for smallholders producing maize by 2017. HCI for smallholder farmers is significantly higher for groundnut in 2017 – a clear shift from 2013. Smallholders and medium/large-scale farmers have been selling comparable proportions of sorghum, yam, cocoa, plantain, okro, cocoyam and tomatoes since 2013 – and this was unchanged in 2017.

For gender differences by household head, in 2013 there appears to be a significant difference in average production across most crops; there are fewer crops where male-headed households produced higher quantities on average by 2017. This suggests there may be a relationship between increasing commercialisation and corresponding changes in household decision-making. The differences are less when we examine the average value of crop sold across 2013 and 2017 (**Table C4** in Section I Appendix). It is also interesting to note that female-headed households appear to be selling marginally higher quantities on average, both in 2013 and 2017 – the differences persist especially for groundnut.

3.3.3. Hired labour

Next, we find significant differences when examining differences in hired labour across regions and by gender of household head and farm classification (**Table 3**). In 2013, female-headed households had much lower levels of hired labour than male-headed households. These differences persist but are less stark by 2017. By farm classification, there is a clear and statistically significant difference in smallholder's ability to hire labour vis-à-vis medium to large-scale farmers.

Table 3: Average number of workers hired by sex of household head and farm classification, 2013 and 2017

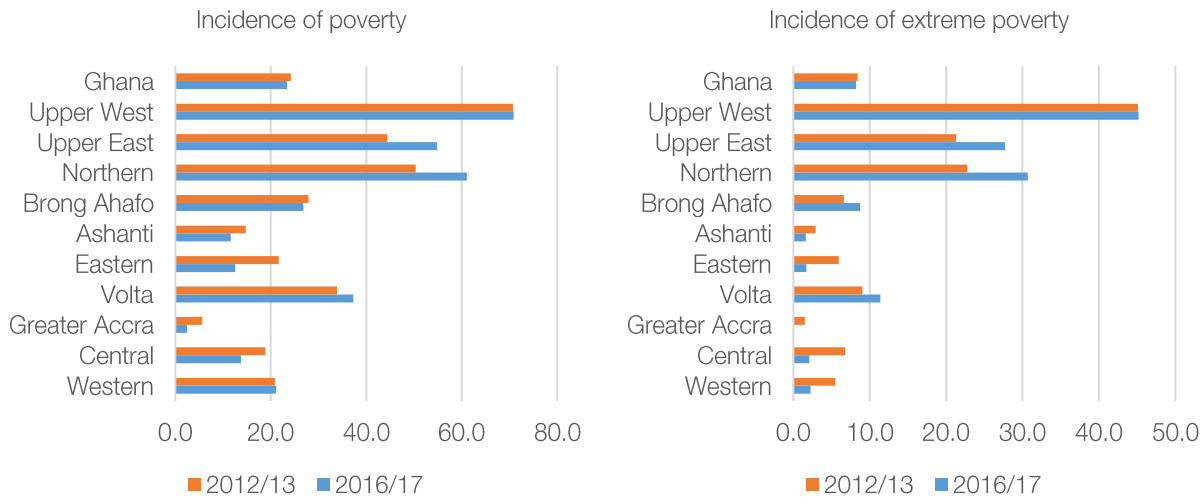
Panel A: 2013							
	Headship				Farm classification		
Type	Overall	Male	Female	P-value	Small	Medium to large	P-value
Male hired labour	5.7	6.6	2.8	**0.000**	4.0	11.7	**0.000**
Female hired labour	6.0	6.5	4.4	**0.000**	4.3	11.8	**0.000**
Total hired labour	11.8	13.1	7.3	**0.000**	8.2	23.4	**0.000**
Panel B: 2017							
	Headship				Farm classification		
Type	Overall	Male	Female	P-value	Small	Medium to large	P-value
Male hired labour	2.9	3.3	1.6	0.152	2.2	5.8	**0.006**
Female hired labour	2.9	3.4	1.3	0.317	2.3	5.6	0.155
Total hired labour	5.8	6.8	3.0	0.131	4.5	11.4	**0.013**

Source: GLSS data, 2013 and 2017

3.3.4. Poverty

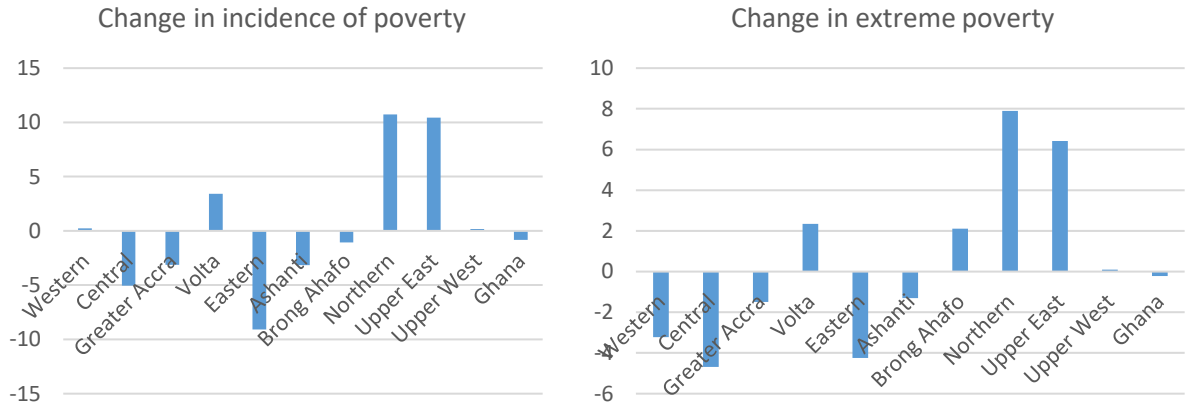
In terms of poverty incidence overall, 23-25% of the population is below the poverty line (**Table 4**). The incidence of extreme poverty is at 8%. Across regions (**Figure 4** and **5**), there have been changes in poverty incidence – we note that the Northern, Upper East and Volta region made significant jumps in poverty incidence across the two years.

Figure 4: Incidence of poverty and extreme poverty in Ghana by region, 2012/13 and 2016/17



Source: GLSS data, 2013 and 2017

Figure 5: Changes in the incidence of poverty and extreme poverty in Ghana by region, 2012/13 and 2016/17



Source: GLSS data, 2013 and 2017

Table 4: Incidence of poverty and extreme poverty in Ghana by region, 2012/13 and 2016/17

	Incidence of poverty			Incidence of extreme poverty		
Region	**2012/13**	**2016/17**	**Change**	**2012/13**	**2016/17**	**Change**
Western	20.9	21.1	0.2	5.5	2.3	-3.2
Central	18.8	13.8	-5.1	6.8	2.1	-4.7
Greater Accra	5.6	2.5	-3.1	1.5	0.0	-1.5
Volta	33.8	37.3	3.4	9.0	11.4	2.4
Eastern	21.7	12.6	-9.1	6.0	1.7	-4.2
Ashanti	14.8	11.6	-3.2	2.9	1.6	-1.3
Brong Ahafo	27.9	26.8	-1.1	6.6	8.7	2.1
Northern	50.4	61.1	10.7	22.8	30.7	7.9
Upper East	44.4	54.8	10.4	21.3	27.7	6.4
Upper West	70.7	70.9	0.2	45.1	45.2	0.1
Ghana	**24.2**	**23.4**	**-0.8**	**8.4**	**8.2**	**-0.2**

Note: The upper poverty line is GH₵1,314, and the lower poverty line is GH₵792.05 for 2012/13; while the upper and lower poverty lines for 2016/17 are GH₵1760.86 and GH₵ 984.16 respectively.

Source: GLSS data, 2013 and 2017

3.4. Determinants of commercialisation

Table 5 reports summary statistics for all years and is also disaggregated by the two years. Overall, average HCI across both years is at 44 and about 25% of the population is below the poverty line. We also note differences in household-level characteristics across the two years, especially in land holdings and land productivity. Additionally, we focus our results on the Western Region that includes 10% of our sample and has been examined in earlier work by authors.

Table 5: Summary statistics

	Mean (Std. Dev.)		
Variables	**All years**	**2013**	**2017**
HCI	43.74 (35.78)	45.46 (35.69)	41.31 (35.77)
(log) Hired labour cost	4.87 (1.23)	2.99 (1.42)	3.00 (1.41)
Poverty status of household	0.25 (0.43)	0.24 (0.43)	0.26 (0.44)
Asset index	3.00 (1.42)	4.62 (1.23)	5.21 (1.15)
Household characteristics			
Female head	0.30 (0.46)	0.28 (0.45)	0.31 (0.46)
(log) Age of head	3.77 (0.35)	3.77 (0.35)	3.77 (0.35)
Land holding	1.49 (11.21)	1.54 (5.58)	1.42 (15.45)
(log) Land productivity	6.30 (1.24)	6.17 (1.19)	6.50 (1.29)
Processing	0.38 (0.49)	0.38 (0.49)	0.39 (0.49)
Couple households	0.66 (0.47)	0.67 (0.47)	0.64 (0.48)
Household size	4.24 (2.82)	4.26 (2.78)	4.20 (2.87)
Migrant household	0.42 (0.49)	0.43 (0.50)	0.39 (0.49)
Bank account	0.52 (0.50)	0.48 (0.50)	0.56 (0.50)
Literacy of head	0.43 (0.49)	0.45 (0.50)	0.40 (0.49)
Non-farm participation	0.43 (0.50)	0.45 (0.50)	0.41 (0.49)
Agriculture household	0.52 (0.50)	0.62 (0.49)	0.41 (0.49)
Salary household	0.29 (0.45)	0.26 (0.44)	0.33 (0.47)
Region/zone			
Western Region	0.10 (0.30)	0.10 (0.30)	0.10 (0.29)
Region	5.44 (2.81)	5.36 (2.79)	5.53 (2.83)
Ecological zone	2.33 (0.84)	2.41 (0.85)	2.23 (0.82)

Source: GLSS data, 2013 and 2017

Table 6 reports the regression results for the pooled data with fixed effects for region, ecological zone, and time. Column 1 includes the variables of interest – (log) hired labour cost and poverty status; with controls for household characteristics; column 2 introduces the asset index; column 3 includes a dummy for the Western Region; column 4 includes fixed effects for regions; and, finally, column 5 introduces fixed effects for ecological zones.

The most robust result is for hired labour costs, as we find a positive and significant relationship between commercialisation and hiring of labour. Poverty status of the household is negative and significant, suggesting poverty as a constraint to commercialisation. The asset index is a positive and significant driver of commercialisation, indicative of a farming household's capacity to commercialise (Sekyi, Abu and Nkegbe, 2020; Saha, Sabates-Wheeler and Thompson, 2021) – however, it is no longer significant when we include the regional fixed effects. This result suggests that once we control for differences across regions, poverty and assets are no longer significant

drivers of agricultural commercialisation. This is the case largely due to the spatial distribution of the poor in Ghana, where the poor mostly live in rural settings (Senadza, 2012). However, accounting for differences across ecological zones, the results for asset ownership persists. The negative association between poverty and HCI may be partly explained by the poor's lack of access to productive inputs and general risk aversion which constrains them to subsistence production (Leavy and Poulton, 2007; Sekyi, Abu and Nkegbe, 2020).

Further, our results show that the HCI is significantly constrained by sex of household head (i.e., female-headed household), participation in own processing, household size, non-farm participation and household participation in salary work. Yet, land productivity and being a migrant household positively affects household commercialisation. More specifically, regression models 4 and 5 in Table 6, households headed by females are less commercialised by more than four mean points compared to male-headed households. Similarly, salary earning households are less commercialised by more than three mean points (**Table 6**).

These findings generally align with earlier studies in Ghana which find that gender, household size, farm size, household location, and land productivity (Martey, Al-Hassan and Kuwornu, 2012; Asuming-Brempong, et al., 2013; Abu and Haruna, 2017; Dzanku et al., 2020; Sekyi, Abu and Nkegbe, 2020) are critical determinants of crop commercialisation among Ghanaian smallholders. Similar findings were observed among smallholders in other developing countries such as Ethiopia, Nigeria, Pakistan and Zimbabwe (Pender and Alemu, 2007; Agwu, Anyanwu and Mendie, 2013; Rabbi et al., 2019; Rubhara and Mudhara, 2019).

Table 6: Drivers of commercialisation: pooled with region, ecological zone and time fixed effects

Variables	(1)	(2)	(3)	(4)	(5)
(log) Hired labour cost	4.71***	4.52***	4.53***	3.32***	4.43***
	(0.40)	(0.40)	(0.40)	(0.40)	(0.40)
Poverty status	-3.37***	-2.22**	-1.86**	1.01	-0.07
	(0.90)	(0.92)	(0.92)	(0.91)	(0.92)
Asset index		1.98***	1.75***	0.50	1.13***
		(0.40)	(0.39)	(0.38)	(0.39)
Household characteristics					
Female head	-1.84	-1.83	-1.96	-5.28***	-4.36***
	(1.30)	(1.30)	(1.30)	(1.24)	(1.29)
(log) Age of head	2.04	2.21*	2.69**	0.90	0.26
	(1.29)	(1.28)	(1.28)	(1.24)	(1.26)
Land holding	0.27	0.26	0.26	0.28	0.28
	(0.21)	(0.21)	(0.20)	(0.22)	(0.22)

Land productivity	5.74***	5.57***	5.15***	4.26***	5.03***
	(0.42)	(0.42)	(0.42)	(0.42)	(0.42)
Processing	-18.64***	-18.34***	-16.38***	-10.10***	-14.58***
	(1.04)	(1.04)	(1.07)	(1.08)	(1.07)
Couple households	-0.88	-1.15	-1.19	-1.57	-1.33
	(1.28)	(1.29)	(1.28)	(1.22)	(1.26)
Household size	-1.00***	-1.05***	-1.07***	-0.68***	-0.75***
	(0.15)	(0.15)	(0.14)	(0.14)	(0.14)
Migrant household	5.84***	6.05***	5.10***	1.22	3.69***
	(0.82)	(0.82)	(0.82)	(0.81)	(0.81)
Bank account	-0.35	-1.65*	-1.47*	-0.66	-1.48*
	(0.84)	(0.87)	(0.86)	(0.84)	(0.85)
Literate head	3.79***	2.78***	2.69***	0.45	0.18
	(0.94)	(0.96)	(0.95)	(0.92)	(0.96)
Non-farm participation	-3.43***	-3.98***	-4.06***	-3.68***	-4.50***
	(1.02)	(1.03)	(1.01)	(0.98)	(1.01)
Agriculture household	9.27***	9.96***	9.54***	5.14***	8.16***
	(1.78)	(1.78)	(1.78)	(1.74)	(1.76)
Salary household	-3.47***	-4.34***	-4.22***	-4.03***	-4.37***
	(1.19)	(1.21)	(1.20)	(1.16)	(1.19)
Region/zone/year					
Western			14.60***	42.11***	
			(1.51)	(1.94)	
Region FE	No	No	No	Yes	No
Ecological zone FE	No	No	No	No	Yes
Year FE (2013)	Yes	Yes	Yes	Yes	Yes
Constant	-6.90	-10.22*	-10.78*	-12.19**	3.86
	(6.04)	(6.02)	(6.00)	(5.85)	(6.27)
Observations	6,919	6,919	6,919	6,919	6,919
R-squared	0.20	0.20	0.21	0.28	0.23

Note: Dependent variable is the HCI. Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1 represent statistical significance at the 1%, 5% and 10% levels respectively.

Source: GLSS data, 2013 and 2017

3.5. Concluding remarks

This chapter examined patterns of agricultural commercialisation in Ghana using key indicators based on disaggregation by crops and regions, using household level data from the two rounds of GLSS in 2012/2013 (GLSS6) and 2016/2017 (GLSS7).

In examining the drivers of commercialisation, we find hired labour, poverty status and asset ownership as key characteristics that explain differences in commercialisation across farm households. But, when we account for differences across regions, we find that poverty and assets are no longer significant – suggesting the importance of differences in supply-side factors across regions, such as access to markets, driving differences in commercialisation. Interestingly, when we

control for differences across ecological zones, the above results for asset ownership as a significant factor driving commercialisation persists.

Our results are in broad coherence with regional patterns observed in Ghana. However, we note the important and persistent link between hired labour and asset ownership with agricultural commercialisation. While this confirms the rising opportunity costs of family labour vis-à-vis off-farm employment in Ghana, it also offers important insights on the importance of access to labour and assets being critical to the processes of agricultural commercialisation (Wiggins et al., 2011; Saha, Sabates-Wheeler and Thompson, 2021). Hence, the design of interventions should be better targeted to capacity-building measures that address these differences and protect against any risks from commercialisation.

4. Agricultural commercialisation in Nigeria

4.1. Introduction

In Nigeria, agricultural commercialisation dates to the colonial political economy, and is defined by mechanisation, large-scale agriculture, and market production. The post-colonial state in Nigeria was founded, nurtured, and sustained on peasant agricultural accumulation like its colonial predecessor. The leading agricultural export crops for Nigeria have been cocoa, oil palm, and rubber; with cocoa contributing the highest foreign exchange earnings. Though it also embraced agricultural commercialisation for rapid industrialisation and development, this was short-lived following the discovery of crude oil in commercial quantities in 1958. The oil economy not only engendered a rentier state, but, like other resource abundant economies, it produced the Dutch-disease with the destructive effects on other sectors (Odukoya, 2020).

Over the past three decades, with strong government support, agricultural commercialisation appears to be flourishing in Nigeria, notwithstanding certain emerging concerns. According to Odukoya (2020), the political class and foreign capital interests are driving agricultural commercialisation in Nigeria to the detriment of smallholders who are losing their farmlands due to land grabbing. Considering this, the need to understand the dynamics of agricultural commercialisation among smallholders in Nigeria becomes imperative.

This chapter examines these recent patterns of agricultural commercialisation in Nigeria using key indicators based on disaggregation by crops and zones. We use household level data drawn from two rounds of Nigeria's GHS-Panel in 2010/2011 and 2015/2016 to understand the patterns of agricultural commercialisation across the two years. Specifically, we focus on three broad questions: First, what are the patterns of agricultural commercialisation across zones and crops? Second, what are the differences by gender of household head and by farm classification? Third, how has the incidence of poverty changed across the two years? Finally, what are the drivers of commercialisation?

Using panel data across the two years, we find hired labour, poverty status and asset ownership as key characteristics that explain differences in commercialisation across farm households. Interestingly, as we account for differences across zones with zonal fixed effects, we find that hired labour, poverty status and assets are no longer significant – suggesting the importance of differences

in supply-side factors across zones, such as access to markets, driving differences in commercialisation.

The remainder of this article is organised as follows. Section 2 presents the details about data and methodology. Section 3 outlines the descriptive analysis. Section 4 discusses the results from the estimation of the drivers of commercialisation. Finally, Section 5 concludes with a discussion of the implications of this research for enabling smallholders to move into higher levels of commercialisation.

4.2. Data and methodology

The data for the study was derived from the Nigeria GHS-Panel data. We begin by outlining the details about the data and the samples. Then, we outline the methodology for studying the drivers of agricultural commercialisation.

4.2.1. Data and sample

We use the first and the third waves of the Nigeria GHS-Panel data, a nationwide household survey designed to generate information on living conditions in the country, collected in 2010 and 2015, respectively. The GHS-Panel surveys form part of a larger, regional project supported by the World Bank, through funding from the Bill and Melinda Gates Foundation in sub-Saharan Africa (SSA)[2] to improve agricultural statistics. This regional project, the LSMS Integrated Surveys on Agriculture, has the overarching objective of improving understanding of agriculture in SSA – specifically, its role in household welfare and poverty reduction. The GHS-Panel survey covered 4,916 households in 2010/11 and 4,581 households in 2015/16.

Not all households in the GHS-Panel sample are engaged in the cultivation of key crops included in this study, hence we begin by creating a sub-sample of crop farmers from the 2010/11 and 2015/16 samples in **Table 7**. The total sample for crop farmers in our study is 3,039 for 2010 and 2,855 for 2015. Using our samples, we examine the distribution of the households by zones and key crops. **Table A1** in Section II of the Appendix reports these figures for 2010 in Panel A and 2015 in Panel B.

[2] The SSA countries involved are Ethiopia, Malawi, Mali, Niger, Nigeria, Tanzania and Uganda.

Table 7: Sample distribution by year, by zone

Zone	2010	2015
	N	N
North Central	509	485
North East	644	489
North West	653	730
South East	605	569
South South	379	377
South West	249	205
Overall national sample	3,039	2,855

Source: Nigeria GHS-Panel, 2010 and 2015

Additionally, **Table A2** in Section II of the Appendix reports the sample distribution using two categories: First, by sex of household head – male and female headed households. Second, by farm classification – 'smallholder' and 'medium to large' farmer households based on farm size. The second is based on Food and Agriculture Organization of the United Nations (FAO) country level classification:[3] a smallholder farmer has less than 3.64ha under crop cultivation, and a medium to large-scale farmer has at least 3.64ha under crop cultivation.

4.2.2. Methodology

We present the analysis in this chapter in three parts. First, it examines the agricultural commercialisation indicators using different levels of disaggregation including zone and crops, gender and farm classification (land size). Second, we examine poverty and extreme poverty indicators. Finally, we examine drivers of commercialisation using panel data with zone and year fixed effects.

To understand commercialisation patterns, we begin by examining production and sales reported by the households. These are then used to compute our key commercialisation measure – the HCI that ranges between zero and 100 (Leavy and Poulton, 2007). HCI is defined as:

$$HCI_{ij} = \frac{\sum_{j=1}^{n} gvs_i}{\sum_{j=1}^{n} gvp_i}$$

HCI_{ij} = HCI of i^{th} household across all $j = 1, .., n$ crops; gvs_i = gross value of all crop sales for the i^{th} household; gvp_i = gross value of all crop production for the i^{th} household.

[3] https://www.fao.org/family-farming/data-sources/dataportrait/farm-size/en/

Next, measurement of poverty in this study follows the relative poverty measurement used by the Nigeria National Bureau of Statistics over the years. The relative poverty measurement is based on household consumption expenditures. Based on the total consumption expenditure per adult equivalent and the estimated poverty line, the poverty rates or the population below the poverty lines are then estimated. We defined an upper and lower poverty line. The upper poverty line is estimated at two-thirds of the mean per capita national consumption expenditure; and the lower poverty line is one-third of the mean per capita national consumption expenditure. The poverty incidence rate is therefore the proportion of the total population whose consumption expenditure per capita falls under the upper poverty line, while the extreme poverty rate is the proportion of the total population whose consumption expenditure per capita falls below the lower poverty line. This is the head-count ratio. Mathematically expressed as: $P_0 = \frac{q}{n}$. Where P_0 is the measure of poverty, *n* is the total population and *q* is the number of poor (that is, those whose consumption expenditure per capita falls below the poverty line). Accordingly, the upper poverty line used in this study is ₦57,925.33, and the lower poverty line is ₦28,962.66 for 2010/11; while the upper and lower poverty lines for 2015/16 are ₦109,899.00 and ₦54,949.50 per year respectively.

We also identify asset ownership by aggregating across various household assets that include: furniture (stuffed), furniture (chair), furniture (table), mattress, bed furniture, mat, sewing machine, stove (kerosine), fridge, freezer, fan, radio, VCD/DVD/mp3/mp4 player/iPad, sound system, microwave, recorder, television, electric iron, bicycle, motor bike, and other assets. We construct the index using PCA.

To analyse the drivers of commercialisation, we model commercialisation, measured by HCI for household *i* and for year *t*, estimating the following specification:

$$HCI_{it} = \beta_0 + \beta_1 Hired\ labour_{it} + \beta_2 Poverty_{it} + \beta_3 Assets_{it} + \rho x_{it} + \nu_j + \gamma_t + \varepsilon_{it}$$

Our key explanatory variables are *Hired labour* – proxied by the cost of hired labour incurred by the household; *Poverty*, using consumption-based poverty status of a household in a given year; *Assets*, proxied by asset index of the household; *xit* is a set of control variables that includes various household characteristics that also affect commercialisation; *vj* is the zonal fixed effect or the fixed effect for ecological zone; γ_t is the year fixed effect; and ε_{it} is the error term. The full list of variables is reported in **Table 8**.

Table 8: Description of regression variables

Variables	Description
HCI	This takes values between 0 and 1, and measured as (gross value of crop sales/gross value of crops produced) * 100
Female head	1 if household head is female, 0 if household head is male
(log) Age of head	Log of household head's age in years
Land holding	Household's total land size under crop cultivation
(log) Land productivity	Log of value of crop output per hectare, computed as crop output divided by cultivated plot size
Processing	1 if household is engaged in crop processing, 0 otherwise
Household size	Number of members in a household
Migrant household	1 if household head is a migrant at current location, 0 otherwise
Bank account	1 if any household member has a bank account, 0 otherwise
Literacy of head	1 if household head can read and write, 0 otherwise
Agriculture household	1 if agriculture is the main occupation of household head, 0 otherwise
Salary household	1 if any household member is a salary worker, 0 otherwise
Poverty status of household	1 if household is poor (based on the absolute national poverty line), 0 otherwise
Asset index	Computed based on the ownership of the number of household assets using PCA, values ranged between 1 (for asset-poor households) to 5 (for asset-rich) households
South Western Zone	1 if household is in the South Western Zone, 0 otherwise
Zone	These were the six administrative zones of Nigeria during the time of the surveys
Rural household	1 if household is in a rural enumeration area, 0 otherwise
(log) Hired labour cost	Log of total amount (in Naira) spent by farm households on hired labour for crop production
Year dummy (2010)	2010 for GHS-Panel Wave 1 survey households and 2015 for GHS-Panel Wave 3 survey households

Source: Authors' own

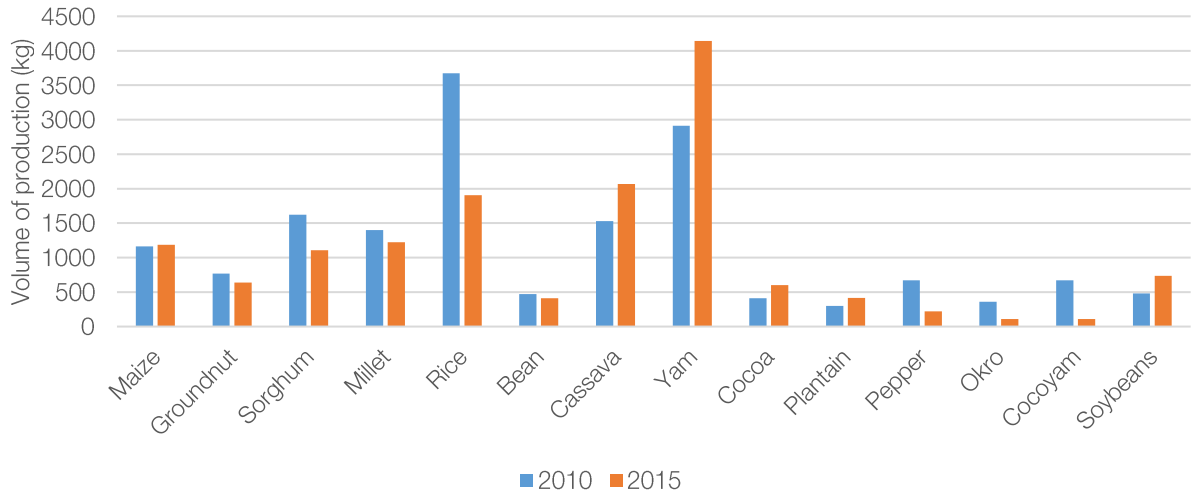
4.3. Descriptive analysis

In this section, we analyse commercialisation indices across crops using different levels of disaggregation including zone, sex of household head and farm classification.

4.3.1. Analysis by zones

We begin by examining the average quantity of crop production and sales, along with the average value of production and sales, before reporting the HCI. **Figure 6** illustrates crop production for the two years and across all zones in Nigeria – we note yam, rice, cassava, sorghum, millet, and maize as prominent crops in terms of production quantities.

Figure 6: Production in kg and by crops – 2010 and 2015



Source: Nigeria GHS-Panel, 2010 and 2015

Table A3 in Section II of the Appendix reports the breakdown of crop production by different zones. Overall, average production has gone up for maize, cassava, yam, cocoa, plantain, and soybeans. On average, production has increased for the South West, North West, North Central and South South zones over the period – especially for maize, yam, cassava, okro, rice, and beans, with noticeable differences across zones. The South West Zone has witnessed a substantial increase in production of maize, groundnut, bean, cassava, pepper, okro, cocoyam and soybean. In the North Central Zone of Nigeria, sorghum production also gained prominence with yam production between 2010 and 2015.

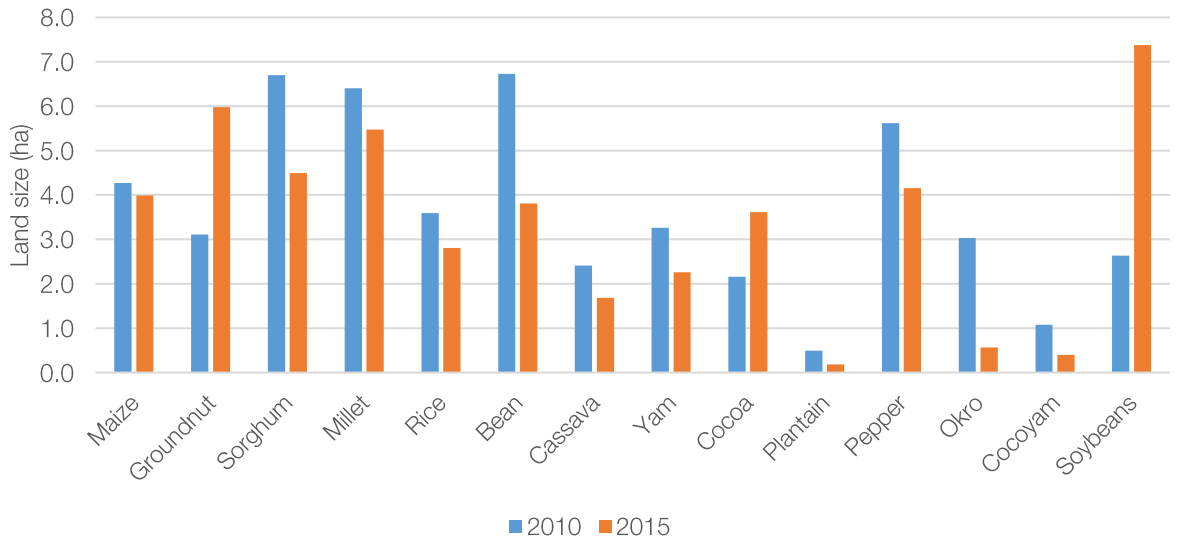
Examining the key crops to look at the changes in production over time, we note that all zones have been growing maize at consistent levels, except for the North Central and South East zones which experienced declines in production over the 2010–2015 period. Except for the South West Zone, groundnut production generally declined for all zones between 2010 and 2015. Production of sorghum and millet is concentrated in the northern zones, while cocoa is concentrated in the southern zones. Bean production recorded increases in average production volumes for North Central, South and South West zones. Rice experienced increases in average production volumes for the northern zones, while cassava posted increases for the southern zones. Yam production generally saw a rise in production for all zones, except for the South East and South West zones over the period, recording a significant jump in average production volumes for the North Central Zone. Plantain remains largely concentrated in the southern zones, with increases in average

production for the South and South West zones. Except for the North Central zones, average pepper production declined for all zones over the period. Okro production significantly dipped for the South East Zone and slightly for the North East Zone, yet recorded slight increases for the rest of the zones, aside from the South West Zone which posted a sharp increase in average production volumes. Similarly, average production volumes for cocoyam shows an increase for the North East and North West zones, while recording declines for the rest of the zones. Soybean appears to be an emerging crop in the South West and North West zones.

Tables A4 and **A5** in Section II of the Appendix help draw a comparison of the production values with sales values across the zones. Examining the changes in average value of production and value of sales for some of the key crops across zones, between 2010 and 2015, it is interesting to note that the top three high value crops for 2010 are cassava, cocoa and yam; and for 2015 are cocoa, yam, and rice, showing rice as an emerging high value crop in Nigeria. According to this data (**Tables A4** and **A5** in Section II of the Appendix), the South West Zone dominates in terms of average value of production and sales.

Examining the average plot size (**Figure 7**) across the zones and crops, reveals that while average land size devoted to most crops has gone down, the average land size devoted to groundnut, cocoa and soybeans increased over the period, indicating possible intensification in production.

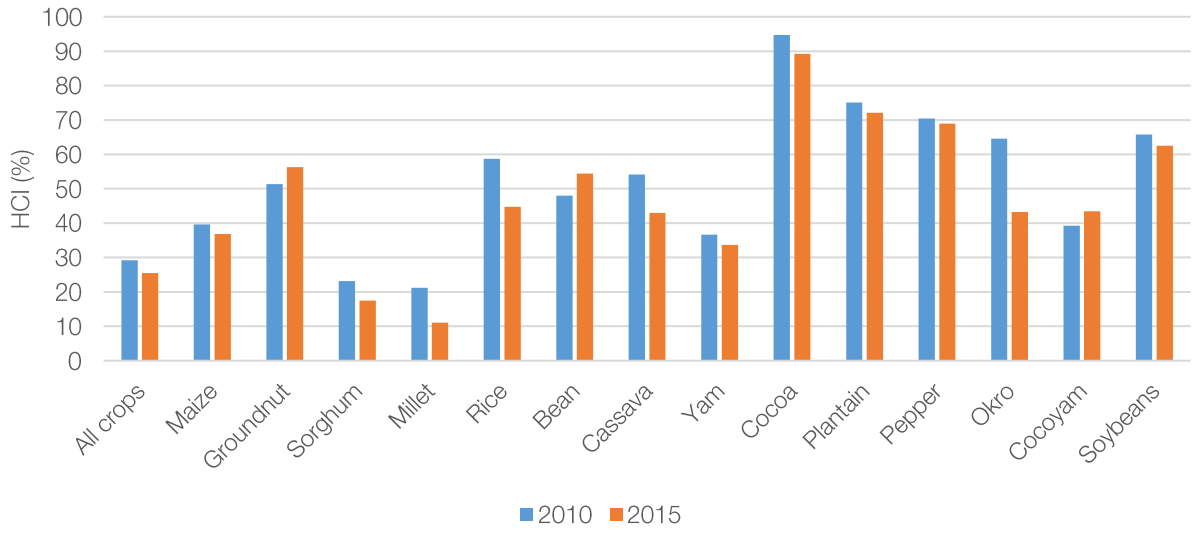
Figure 7: Land sizes across zones by crop 2010 and 2015



Source: Nigeria GHS-Panel, 2010 and 2015

Next, we examine the HCI by zones, crop and household farm size (**Figure 8**). First, the overall average HCI levels for all crops included in the analysis is 29.2% for 2010 and 25.5% for 2015, showing a general decline in the aggregate level of commercialisation over the period. Except for groundnut and cocoyam, there has been a general decline in the level of commercialisation for all other crops.

Figure 8: HCI by zones in Nigeria – 2010 and 2015



Source: Nigeria GHS-Panel, 2010 and 2015

Tables A6 in Section II of the Appendix reports HCI by crop and zones. It is not surprising that cocoa (94.7% in 2010 and 89.3% in 2015) is the most commercialised among all crops in the study, since cocoa is primarily a non-food cash crop. Overall, the South West Zone is the most commercialised comparative to the other zones. Over the period, the HCI increased for the South West and South East zones, while declining for the rest of the zones. Generally, the northern zones reported lower levels of commercialisation comparative to those in the south. Millet, a crop predominantly cultivated in the northern zones, emerged as the least commercialised crop over the period (declining from 21.2% in 2010 to 11.1% in 2015).

4.3.2. Analysis by sex of household head and farm classification

Next, we examine production, sales and average commercialisation levels by crop, household head and household farm size. **Table 9** reports the HCI using the gender of the head of household and the broad classification between smallholders and medium-scale farmers.

Table 9: Average HCI by sex of household head and farm classification, 2010 and 2015

Panel A: 2010							
	Headship				Farm classification		
Crop	Overall	Male	Female	P-value	Small	Medium	P-value
All crops	29.2	29.4	27.7	0.446	28.8	27.0	0.320
Maize	39.6	38.3	49.4	**0.011**	32.5	38.0	0.136
Groundnut	51.3	51.4	49.9	0.910	42.4	69.3	**0.000**
Sorghum	23.1	22.8	41.4	0.081	21.6	20.0	0.602
Millet	21.2	20.9	42.5	0.170	22.8	17.5	0.200
Rice	58.7	58.7	59.4	0.962	59.4	56.2	0.773
Bean	48.0	48.2	43.3	0.643	45.2	51.1	0.111
Cassava	54.1	54.7	50.8	0.495	51.0	56.3	0.358
Yam	36.7	38.4	25.7	**0.002**	34.8	34.8	0.988
Cocoa	94.7	96.4	79.5	**0.005**	95.1	89.3	0.503
Plantain	75.1	75.9	68.2	0.403	74.4	74.8	0.977
Pepper	70.4	69.6	85.0	0.286	72.8	61.1	0.205
Okro	64.6	65.4	62.0	0.714	64.8	57.5	0.578
Cocoyam	39.3	44.5	29.1	0.063	32.1	78.6	0.002
Soybeans	65.8	65.6	75.5	0.713	67.9	65.3	0.755
Panel B: 2015							
	Headship				Farm classification		
Crop	Overall	Male	Female	P-value	Small	Medium	P-value
All crops	25.5	25.0	28.4	**0.043**	25.3	24.5	0.595
Maize	36.8	34.5	50.3	**0.000**	35.5	27.8	**0.007**
Groundnut	56.3	56.3	55.4	0.927	55.4	57.2	0.710
Sorghum	17.5	17.4	20.9	0.567	13.6	23.5	**0.000**
Millet	11.1	11.4	0.0	0.077	7.9	15.2	**0.001**
Rice	44.8	44.7	45.4	0.941	44.8	42.6	0.703
Bean	54.4	54.0	62.8	0.223	53.6	54.8	0.728
Cassava	42.9	44.9	36.7	0.067	40.8	55.3	**0.019**
Yam	33.7	35.1	28.1	**0.029**	31.7	34.6	0.487
Cocoa	89.3	90.3	75.9	0.179	88.7	99.6	0.345
Plantain	72.1	72.9	68.9	0.460	71.0	91.8	0.128
Pepper	68.9	70.2	57.0	0.149	68.3	66.5	0.806
Okro	43.2	42.9	44.4	0.807	44.3	39.2	0.548
Cocoyam	43.4	42.9	44.6	0.754	40.9	42.6	0.927
Soybeans	62.5	62.8	56.6	0.658	65.7	57.5	0.212

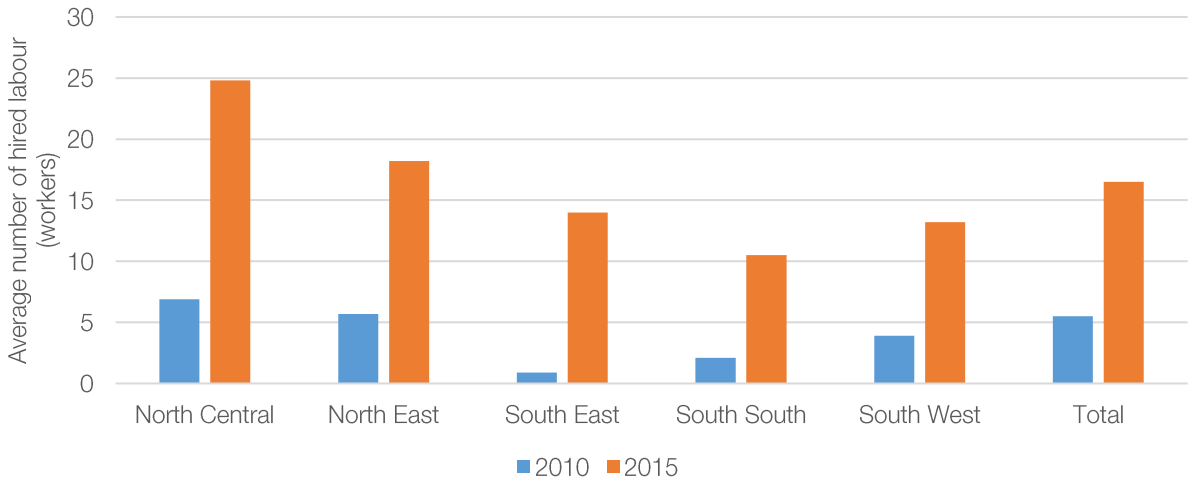
Source: Nigeria GHS-Panel, 2010 and 2015

For gender differences by household head, it is interesting to note that female-headed households have a higher HCI for maize comparative to households headed by males for both 2010 and 2015; while male-headed households are significantly more commercialised for yam than their female counterparts. Further, medium-scale farmers were more commercialised than smallholders for groundnut in 2010, and for millet and cassava in 2015. For maize, however, smallholders appear comparatively more commercialised in 2015.

4.3.3. Hired labour

Next, we find significant differences when examining differences in hired labour across zones, and by gender of household head and farm classification. Overall, the average number of hired labour employed by farmers increased over the 2010–2015 period across all zones and gender, with the North Central Zone posting the highest increase over the period (**Figure 9**).

Figure 9: Hired labour by zones in Nigeria – 2010 and 2015



Source: Nigeria GHS-Panel, 2010 and 2015

Generally, compared to households headed by males, female-headed households have much lower levels of hired labour. These differences persist, but were less stark by 2015, with female-headed households engaging with comparatively more hired labour in the North West and South East zones in 2015. Interestingly, we see a comparatively higher share of female hired labour for female-headed households in 2015. **Table 10** shows that the significant gender differences in households' use of hired labour in 2010 had eroded by 2015. By farm classification, there is a clear statistically significant difference in smallholder's ability to hire labour vis-à-vis medium-scale farmers, though there is no significant difference for female hired labour.

Table 10: Average number of hired labour by zone and sex of household head, 2010 and 2015

Panel A: 2010									
	Male hired labour			Female hired labour			Total hired labour		
Zone	**Male**	**Female**	**Total**	**Male**	**Female**	**Total**	**Male**	**Female**	**Total**
North Central	3.0	1.8	3.4	3.4	1.6	3.4	6.6	3.5	6.9
North East	3.5	1.3	3.7	1.3	0.3	1.5	5.4	1.6	5.7
North West	4.2	4.2	4.4	2.3	0.0	2.1	7.9	4.2	7.4
South East	0.2	0.2	0.5	0.1	0.2	0.3	0.3	0.4	0.9
South South	0.9	0.7	1.1	0.5	0.4	0.6	1.3	1.3	2.1
South West	1.5	2.2	2.7	0.7	0.3	1.2	2.3	2.5	3.9
Total	3.3	1.3	3.2	2.0	0.6	1.8	5.8	2.0	5.5
Panel B: 2015									
	Male hired labour			**Female hired labour**			**Total hired labour**		
Zone	**Male**	**Female**	**Total**	**Male**	**Female**	**Total**	**Male**	**Female**	**Total**
North Central	19.4	13.6	18.5	5.7	5.8	5.7	25.8	19.6	24.8
North East	11.8	6.5	11.4	3.9	2.1	3.8	18.7	10.5	18.2
North West	12.6	16.0	12.7	2.0	4.8	2.0	16.4	27.0	16.7
South East	7.5	8.3	7.8	5.4	5.8	5.6	13.6	14.7	14.0
South South	7.5	4.9	6.8	3.8	2.6	3.5	11.5	7.6	10.5
South West	11.8	7.3	11.3	1.8	1.1	1.8	13.8	8.7	13.2
Total	12.2	8.6	11.6	3.4	4.6	3.6	17.0	13.9	16.5

Source: Nigeria GHS-Panel, 2010 and 2015

Table 11: Average number of hired labour by sex of household head and farm classification, 2010 and 2015

Panel A: 2010							
	Headship				Farm classification		
Type	**Overall**	**Male**	**Female**	**P-value**	**Small**	**Medium**	**P-value**
Male hired labour	3.2	3.3	1.3	**0.000**	3.1	4.3	**0.000**
Female hired labour	1.8	2.0	0.6	**0.013**	2.0	1.9	0.802
Total hired labour	5.5	5.8	2.0	**0.000**	5.5	6.9	**0.036**
Panel B: 2015							
	Headship				**Farm classification**		
Type	**Overall**	**Male**	**Female**	**P-value**	**Small**	**Medium**	**P-value**
Male hired labuor	11.6	12.2	8.6	0.152	11.3	17.1	**0.006**
Female hired labour	3.6	3.4	4.6	0.317	3.3	4.4	0.155
Total hired labour	16.5	17.0	13.9	0.131	15.5	24.4	**0.013**

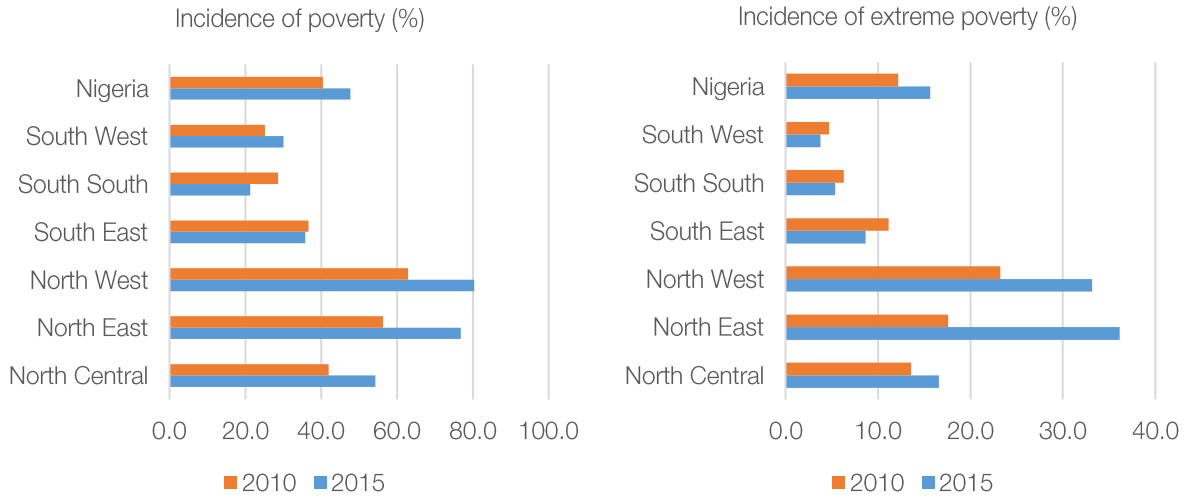
Source: Nigeria GHS-Panel, 2010 and 2015

4.3.4. Poverty

In terms of poverty incidence overall, 40.5% and 47.7% of the population fell below the poverty line in 2010 and 2015 respectively (**Table 12**). The incidence of extreme poverty increased from 12.2% in 2010 to 15.5% in 2016. Indeed, poverty incidence increased over the 2010–2015 period in Nigeria

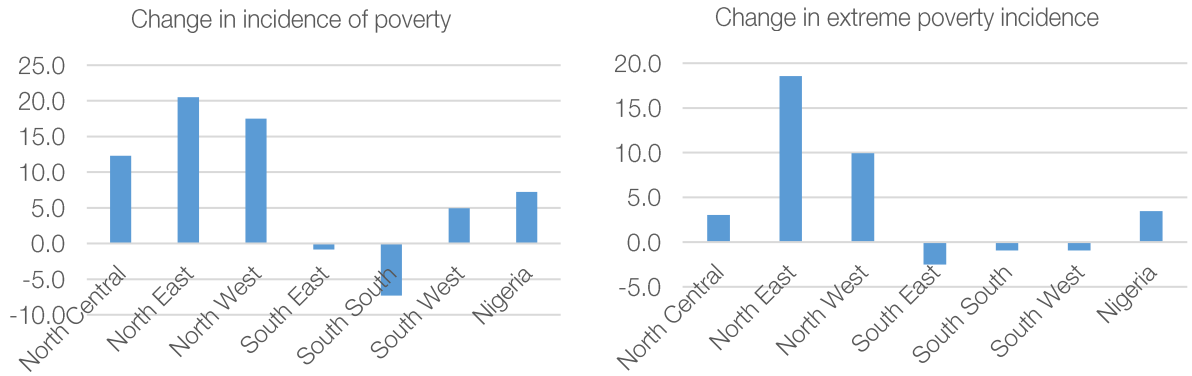
(**Figure 10** and **11**). Across zones, the South East and South South zones saw some significant declines in poverty incidence across the two years; while the North Central, North East, North West, and South West zones reported significant increases in poverty incidence. Similar observations are made for extreme poverty rates, except for the South West Zone.

Figure 10: Incidence of poverty and extreme poverty in Nigeria by zone, 2010 and 2015



Source: Nigeria GHS-Panel, 2010 and 2015

Figure 11: Changes in the incidence of poverty and extreme poverty in Nigeria by zone, 2010 and 2015



Source: Nigeria GHS-Panel, 2010 and 2015

Table 12: Incidence of poverty and extreme poverty in Nigeria by zone, 2012/13 and 2016/17

Zone	Incidence of poverty			Incidence of extreme poverty		
	2010	2015	Change	2010	2015	Change
North Central	42.0	54.3	12.3	13.6	16.6	3.0
North East	56.3	76.8	20.5	17.6	36.2	18.6
North West	62.9	80.4	17.5	23.2	33.2	9.9
South East	36.7	35.8	-0.9	11.2	8.7	-2.5
South South	28.7	21.3	-7.3	6.3	5.4	-1.0
South West	25.2	30.1	5.0	4.7	3.8	-0.9
Nigeria	**40.5**	**47.7**	**7.2**	**12.2**	**15.6**	**3.5**

Source: Nigeria GHS-Panel, 2010 and 2015

4.4. Drivers of commercialisation

We begin by examining the data for the variables of interest across the two years. **Table 13** reports summary statistics for all years and is disaggregated by the two years. Overall, the average HCI across both years is 25.8 and about 47% of the population fell below the poverty line. It is worth noting the escalation in the poverty rate in Nigeria between 2010 and 2015. We also note differences in household-level characteristics across the two years, especially in land holdings and land productivity.

Table 13: Summary statistics

Variables	Mean (Std. Dev.)		
	All years	2010	2015
HCI	25.76(31.06)	29.19 (34.07)	25.67 (31.00)
(log) Hired labour cost	9.92 (1.51)	9.89 (1.68)	9.92 (1.51)
Poverty status of households	0.47 (0.50)	0.40 (0.49)	0.47 (0.50)
Asset index	3.18 (1.41)	3.16 (1.41)	3.18 (1.41)
Household characteristics			
Female head	1.21 (0.41)	1.16 (0.36)	1.21 (0.41)
(log) Age of head	3.93 (0.29)	3.86 (0.32)	3.93 (0.29)
Land holding	3.61 (6.53)	4.32 (7.34)	3.60 (6.47)
(log) Land productivity	11.15 (1.45)	10.39 (1.98)	11.15 (1.45)
Processing	0.16 (0.36)	0.62 (0.49)	0.16 (0.36)
Couple households	0.74 (0.44)	1.00 (0.02)	0.74 (0.44)
Household size	5.63 (3.21)	5.38 (2.98)	5.63 (3.21)
Bank account	0.42 (0.49)	0.35 (0.48)	0.42 (0.49)
Literacy of head	0.66 (0.47)	0.66 (0.47)	0.66 (0.47)
Agriculture household	0.56 (0.50)	0.55 (0.50)	0.56 (0.50)
Zone			

South West	0.25 (0.43)	0.26 (0.44)	0.25 (0.44)
Zone	3.85 (1.74)	3.87 (1.72)	3.85 (1.74)
Rural	0.60 (0.49)	0.59 (0.49)	0.60 (0.49)

Source: Nigeria GHS-Panel, 2010 and 2015

Table 14 reports the regression results for the panel data with fixed effects for zones. Column 1 includes the variables of interest – (log) hired labour cost and poverty status; with controls for household characteristics; column 2 introduces the asset index; column 3 includes a dummy for the South West Zone; column 4 includes fixed effects for zones; and, finally, column 5 introduces fixed effects for zones. We find a positive and significant relationship between commercialisation and hiring labour cost. Poverty status of the household is negative and significant, suggesting poverty as a constraint to commercialisation. The asset index is a positive and significant driver of commercialisation, indicative of farmers' capacity to commercialise (Saha, Sabates-Wheeler and Thompson, 2021) – however, it is no longer significant when we include the zonal fixed effects. Thus, once we control for differences across zones, poverty and assets are no longer significant drivers of agricultural commercialisation in Nigeria. This is partly explained by the spatial nature of poverty and asset ownership in Nigeria (Sowunmi et al., 2012; Sowunmi, 2016).

Additionally, we find that household size and participation in own-processing constrained household agricultural commercialisation. Particularly, given that our commercialisation index is measured as the share of the value of total output sold, it is expected that households that chose to process their own output would be least commercialised based on our commercialisation indicator. Further, households' land holding, and land productivity are positively associated with the HCI. These findings closely relate to earlier findings assessing the determinants of crop commercialisation in the context of Nigeria (Otekunrin at al., 2022)

Table 14: Drivers of commercialisation: pooled with zone and time fixed effects

Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
(log) Hired labour cost	***0.90****	***0.87****	***0.87****	***0.57***	***0.82****
	(0.49)	***(0.50)***	***(0.50)***	***(0.47)***	***(0.47)***
Poverty status	***-7.10******	***-4.20****	***-4.09****	***-2.03***	***-0.30***
	(1.78)	***(1.95)***	***(1.94)***	***(1.76)***	***(1.73)***
Asset index		***1.03****	***0.83****	***1.03****	***0.48***
		(0.50)	***(0.50)***	***(0.43)***	***(0.43)***
Household characteristics					
Female head	5.10	5.31	5.41*	5.80**	-0.09
	(3.21)	(3.26)	(3.26)	(2.91)	(2.96)

(log) Age of head	2.96	2.96	2.80	-2.37	-7.64***
	(2.57)	(2.63)	(2.63)	(2.44)	(2.46)
Land holding	0.19*	0.20**	0.21**	0.15*	0.17
	(0.10)	(0.10)	(0.10)	(0.09)	(0.10)
Land productivity	1.99***	1.87***	1.89***	0.77	-0.30
	(0.51)	(0.52)	(0.52)	(0.51)	(0.55)
Processing	-3.37*	-3.38*	-3.36*	-4.67***	-5.07***
	(1.87)	(1.87)	(1.87)	(1.68)	(1.69)
Household size	-0.87***	-1.15***	-1.13***	-0.32	-0.07
	(0.25)	(0.27)	(0.27)	(0.24)	(0.23)
Bank account		3.71	3.64	0.59	-1.03
		(2.77)	(2.77)	(2.49)	(2.35)
Literate head		0.85	0.68	-0.50	-0.56
		(1.63)	(1.63)	(1.50)	(1.47)
Agriculture household	14.46	15.55	15.49	11.74	10.16
	(9.43)	(10.04)	(10.21)	(9.80)	(8.70)
Rural household			-5.21*	-2.02	-2.78
			(2.76)	(2.53)	(2.53)
Zone					
South West Zone				48.24***	
				(2.94)	
Zone FE	NO	NO	NO	NO	YES
Year 2010 FE	YES	YES	YES	YES	YES
Constant	-24.93	-25.56	-20.84	5.58	46.37***
	(15.22)	(15.88)	(16.20)	(15.32)	(15.93)
Observations	1,723	1,719	1,719	1,719	1,719
R-squared	0.05	0.06	0.06	0.21	0.25

Note: Dependent variable is the HCI. Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1 represent statistical significance at the 1%, 5% and 10% levels respectively.

Source: Nigeria GHS-Panel, 2010 and 2015

4.5. Concluding remarks

In this chapter we examined agricultural commercialisation in Nigeria using key indicators based on disaggregation by crops and zones using household level data from the two rounds of Nigeria's GHS-Panel in 2010/2011 (GHS-Panel 1) and 2015/2016 (GHS-Panel 3).

We examined the drivers of commercialisation and find that hired labour, poverty status and asset ownership as key characteristics that explain differences in commercialisation across farm households. Yet, when we account for differences across zones, we find that these are no longer significant – suggesting the importance of differences in supply-side factors across zones, such as

access to markets, driving differences in commercialisation. More specifically, we find that higher expenditure on hired labour and higher asset ownership have a positive effect on HCI; while poor households are less commercialised compared to their non-poor counterparts. This may be the case since poor households often lack critical production inputs to participate in commercialised agriculture.

Additionally, our findings identify other factors such as household size, land holding, land productivity, and own output processing as significant drivers of household commercialisation. While household size and own output processing have a negative effect on HCI, land holding and land productivity posted a positive effect.

Our results are in broad coherence with zonal patterns observed in Nigeria. However, we note the differential links between hired labour and asset ownership with agricultural commercialisation, with hints to the rising opportunity costs in terms of labour and land in Nigeria. Hence, the design of interventions should be better targeted to these heterogeneities, addressing these differences and protect against any risks from commercialisation.

5. Agricultural commercialisation in Malawi

5.1. Introduction

From 1980, the government of Malawi revised its role in the agricultural sector, from being both the formulator and implementer of agriculture policy, to primarily being a policy regulator (GoM, 2016). This meant reduced government operations through such institutions as the Agricultural Development and Marketing Corporation (ADMARC), and the removal of restrictions in commodity marketing to allow for the involvement of more diverse players. However, 'market liberalisation' did not attain the expected benefits, and instead, for instance, Bezuneh and Yiheyis (2014) report of negative impacts on food availability in 37 countries including Ghana, Nigeria and Zambia in Southern Africa. Similarly, the removal of price controls gave impetus to many private traders to offer low produce prices to farmers (Chirwa et al., 2008), affecting realised incomes. In response the government started setting minimum prices for various crops, however, traders rarely adhere to such prices and enforcement mechanisms on the government side are lacking. The low prices are among the sources of disincentives to smallholder farmers to produce crops for sale.

As part of the 'market liberalisation', the government also scaled down provision of farming extension services (Masangano and Mthinda, 2012), affecting adoption of technologies to enhance crop production (Ragasa and Niu 2017). The 2000 government policy, allowing various stakeholders to provide extension services, has been marred by challenges of coordination and harmonisation of extension messages (Ragasa, Mazunda and Kadzamira, 2015). In addition, the seed industry collapse due to Structural Adjustment Policies (SAPs) has had consequences on the production of improved seeds for food crops, such as legumes, especially given increased preoccupation with staple crops by both government and multinational companies who are currently investing in seed technologies (Chinsinga, 2011). Amidist these developments, the country's population has drastically increased, placing unprecedented demands to meet food requirements in contexts characterised by rooted poverty, missing or imperfect markets and rudimentary progress towards agricultural market infrastructure development, especially in rural areas (GoM, 2016). Thus, the problems of inadequate infrastructure, limited access and poor quality of marketing services and policy incoherencies that negatively affect marketing persist (GoM, 2016). As such, incentives for, and abilities of, farmers to increase their participation in agricultural value chains for both domestic and export markets are limited (GoM, 2016).

In recent years, Malawi has made efforts to promote the commercialisation of smallholder farmers through various interventions and related agricultural policies. The National Agriculture Policy has made agriculture market development a priority area and aims to foster the growth and development of efficient and inclusive agricultural value chains that ensure competitive and fair pricing of agricultural commodities (GoM, 2016). Similarly, the government is playing a facilitation role to create new structured markets, especially for legumes, oilseeds, horticulture, livestock, and fisheries products. Reforms are also implemented to improve the efficiency of ADMARC whose role has dwindled overtime following the implementation of SAPs in the 1980s. Another objective envisaged in the policy relates to the strengthening and harmonisation of agricultural market information systems through platforms like agricultural commodity exchanges. This is complemented by the National Export Strategy (GoM, 2012), whose focus is boosting Malawi's export base. These different efforts to contribute to the improvement of food security and agricultural growth are consolidated and harmonised through the Agricultural Sector Wide Approach and are prioritised in the Malawi Growth and Development Strategies. The ultimate aspirations for wealth creation and becoming a self-reliant nation are detailed in the Malawi 2063 vision, which contains further emphasis on the importance of having a commercially-driven agriculture sector (GoM, 2020).

Despite Malawi's investments in agriculture, the level of subsistence farming remains high – a key factor associated with the persistence of poverty in rural areas, estimated at 42% (NSO, 2017). A majority of farmers have little or no crop surplus for marketing, with the overall HCI at 17.6% in 2017 (Carletto, Corral and Guelfi, 2017). This figure might, however, inflate the extent of commercialisation as it includes cash crops like tobacco that are grown by a few smallholder farmers. For instance, in the 2015/2016 growing season only 4.2% of plots with an average acreage of 0.48ha were under tobacco cultivation. Additionally, there are proper market structures and institutions supporting tobacco production and marketing unlike for other crops like legumes. Usually, most tobacco growers have ready markets granted by contract farming and their produce is then sold at auction floors. That said, a more accurate picture of the extent of commercialisation could be 10% for food crops only (Carletto, Corral, and Guelfi, 2017). In comparison with other African countries, Malawi is trailing behind Tanzania and Uganda with a HCI of about 28% and 26%, respectively (Carletto, Corral, and Guelfi, 2017). This, therefore, shows that there is evident subsistence farming in Malawi.

In Malawi, Chirwa and Matita (2012) concluded that households that are food secure and had more assets were more likely to commercialise than those that were food insecure or lacking in assets. Likewise, the cultivation of other highly marketed crops, like legumes, has been shown to be more

feasible when households meet their maize food requirements (Matita et al., forthcoming). Additionally, households that had large family sizes and those that were headed by an older household member were unlikely to commercialise, possibly due to greater food requirements and labour constraints (Mather, Boughton and Jayne, 2013). Other studies find that farmers that use commercial fertiliser as an input are more likely to commercialise than those that use government subsidised fertiliser (Chirwa and Matita, 2012; Ochieng et al., 2016).

In this chapter, we conduct an analysis of drivers of commercialisation in Malawi. We begin by establishing trends in commercialisation outcome indicators, particularly relating to poverty and inequality, employment and labour, and food and nutrition security. Further, analysis is provided for commercialisation indices and outcome indicators using different levels of disaggregation: regions, land sizes, gender, key agricultural crops, and other socio-economic characteristics. We conclude with econometric analysis of the drivers of commercialisation among smallholder farmers.

The remainder of the chapter is organised as follows: Section 2 explains the methods and materials used in the study. The results of the study are reported in Section 3 and discussed in Section 4 which ends with concluding remarks.

5.2. Data and methodology

5.2.1. Data and variables

The source of data used in this analysis from Malawi was IHPS, which are part of LSMS and are collected by the National Statistical Office with technical support from the World Bank. We used three-year panel data for the years 2010, 2013 and 2016. The IHPS are nationally representative, with samples drawn with regional and rural-urban divide strata. Initially, in 2010, a sample of 204 enumeration areas (EA) were drawn, consisting of 3,246 households. This sample was followed in 2013, and 4,000 households were interviewed that could be traced back to 3,104 baseline households. For the 2016 survey, the number of sampled EAs was reduced to 102 out of the 204 EAs due to constraints, and a total of 2,508 households were surveyed. We obtained a usable unbalanced panel sample of 5,411 households for our analysis. Unlike cross-section data, panel data gives more information and offers advantages such as controlling for individual heterogeneity and is well placed to study the dynamics of change (Deaton, 1997).

Our dependent variable is the HCI, defined as the ratio of the value of all crop sales over the production value. The index measures the degree of commercialisation and ranges from 0 to 1,

whereby 0 indicates that the household did not sell any produce and 1 represents a highly commercialised households that sells all produce. The HCI is a commonly used measure to determine the extent of commercialisation (Agwu, Anyanwu and Mendie, 2013; Carletto, Corral and Guelfi, 2017), though some studies use modifications that allow for the calculation of individual crop marketing quantities (Sibande, Bailey and Davidova, 2017), or others just employ a dummy variable to determine market participation (Abdullah et al., 2019).

The main explanatory variables for this study were welfare outcome variables. These variables include food and nutrition security indicators, poverty, household assets, and the nature of employment activities. Several measures were used to capture the poverty status of households. These include the poverty head count, the poverty gap, the multidimensional poverty index (MPI) and subjective poverty assessment. The poverty head count defined the number of people that live below the poverty line (Foster, Greer and Thorbecke, 2010). The following formula was used to establish the poverty head count: $P_0 = \frac{q}{n}$

Where P_0 is the measure of poverty, n is the total population and q is the number of people whose consumption expenditure per adult equivalent falls below the poverty line.

Another measure that was used is the poverty gap, which indicates the intensity of poverty, i.e., on average how far a household is from the poverty line. Thus, the amount of income that would be required to move a household from a state of extreme poverty up to the poverty line. We also employed the MPI; a holistic measure of poverty that captures deprivations in three critical dimensions namely: education, health and living standard indicators. The MPI was established by Alkire and Santos (2014). Furthermore, the subjective poverty assessment which recognise personal and experiential definition of poverty as explained by Ravallion and Lokshin (2001) was used.

Other covariates used in this study include measures of food and nutrition security, such as the Food Consumption Score (FCS), which is based on dietary diversity, food frequency and the relative nutritional importance of different food groups consumed in the household during the previous seven days (WFP, 2008). A summary description of all variables used in the different estimated models is presented in **Table 15**.

Table 15: Description of variables used in models

Variables	Description
HCI	Gross value of crop sales/gross value of crops produced * 100; takes values [0,1]
Male-headed household	1 if household head is male, 0 otherwise
Age of head	Age of household head in years
Household size	Adult equivalents
Education of household head	Years of schooling
Land holding	Total land holding size in hectares under crop cultivation by household, measured by GPS
(Log) Land productivity	Value of crop output per hectare
Purchased commercial fertiliser	1 if purchased commercial fertiliser, 0 otherwise
Farm Input Subsidy Programme (FISP) beneficiary	1 if received subsidised fertiliser under FISP, 0 otherwise
Hired labour	1 if hired agricultural labour, 0 otherwise
Access to credit	1 if household obtained credit, 0 otherwise
Receipt of market extension	1 if household received any market related extension messages, 0 otherwise
Poverty status of household	1 if household is poor, 0 otherwise (alternative measures used – head count, poverty gap, multidimensional poverty, subjective poverty assessment)
Main economic activity	1 if main economic activity of household head is agriculture, 0 otherwise (other main economic activities for which dummy variables were created are wage-occupation, casual labour/*ganyu*[4] and business). *Ganyu* was used as base category
Asset index	Computed based on the ownership of several household assets, using PCA
Region	1 if household resides in the south, 0 otherwise (other regions for which dummies were created are centre and north; the north was used as the base category)

Source: Authors' own

The empirical approach uses both descriptive and econometric analysis. For the descriptive analysis, the focus was on analysing the trends in the commercialisation indices over the years and outcome indicators using different levels of aggregations like gender, farm size, and socio-economic characteristics. The regression estimation strategy uses fixed effects as recommended by Woodridge (2010), given that we are using panel data. Previous studies employing cross-sectional data implemented multiple linear regressions (Agwu, Anyanwu and Mendie, 2013) and Tobit models (Dube and Guveya, 2016).

[4] '*Gunyu*' commonly refers to piece work that is informal, often offered as agricultural labour but also in off-farm activities (Dimowa, Michaelowa and Weber, 2010).

5.2.2. Empirical specification

To analyse the drivers of commercialisation we model the relationship with various factors consistent with other literature (Ogutu and Qaim, 2019) as follows.

$$HCI_{it} = \alpha_i + hh_{it} + pov_{it} + cp_{it} + mkt_{it} + e_{it}$$

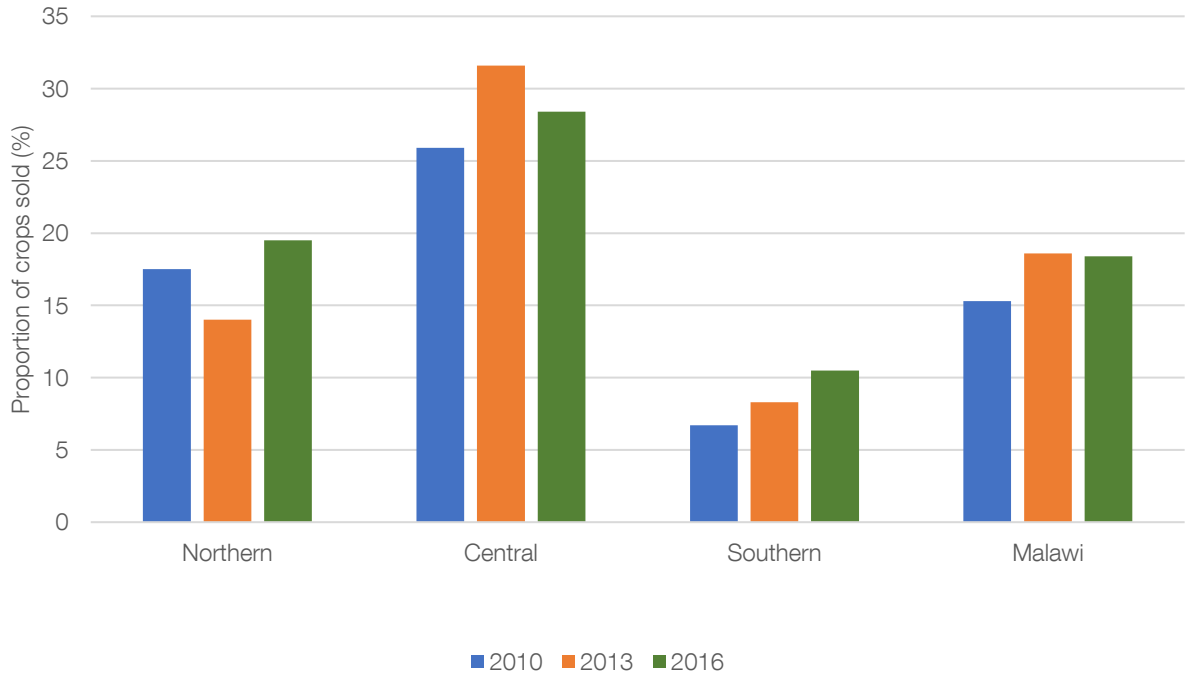
Where HCI_{it} is HCI for household i at time t defined as proportion of crops harvested that is sold; hh is a vector of household socioeconomic characteristics including asset holding, poverty status, household size; cp is a vector representing cropping patterns such as hiring of agricultural labour, and use of commercial fertiliser; mkt stands for factors facilitating market participation like access to market information and credit; and e is the error term. The analysis further controls for fixed effects to account for different agroecological capacities and infrastructure variations by including regional dummies. A detailed description of key variables and their measurement is presented in Section 5.2.1. These variables have been identified based on literature suggesting that they drive agricultural commercialisation (von Braun, Bouis and Kennedy, 1994; von Braun, 1995; Pingali and Rosegrant, 1995b; Sibande, Bailey and Davidova, 2017; Abdullah et al. 2019; Ogutu and Qaim, 2019).

5.3. Descriptive analysis

5.3.1. Trends in commercialisation

Figure 12 presents the HCI for Malawi as a whole and its three regions for three study years. Across the regions, the lowest HCI is registered in the Southern Region, whilst the Central Region has the highest level of commercialisation. This may well reflect the long-term challenge of high population pressure on land in the south (Place and Otsuka, 2001) and the agroecological advantage that offers production efficiency in the Central Region over other parts of Malawi (Asfaw et al., 2017). Over the years, levels of commercialisation have fluctuated, particularly in the Northern and Central regions. For instance, the Northern Region registered a lower HCI in 2013 compared to 2010, which then picked up in 2016. While the Central Region registered a higher HCI in 2013 than 2010, it then later declined in 2016. Overall, in Malawi, the HCI increased between 2010 and 2013, and remained steady in 2016, at slightly under 20%.

Figure 12: Trends in HCI (2010–2016)



Source: Authors' own

5.3.2. Commercialisation and outcome indicators

This study assessed the relationship between commercialisation and poverty outcomes using different measures of poverty. **Table A1** in Section III of the Appendix shows that there has been a 2% increase in the incidence of poverty. In addition, there has been a general decrease in poverty levels over the years, including the intensity of poverty which dropped by 17%. This is consistent with estimates at a national level which show that poverty has slightly declined from 50.7% in 2010 to 42% in 2016 (NSO, 2017). However, the unequal access to income has widened over the years, measured by the change in the Gini Coefficient between 2013 and 2016 from 0.798 to 0.864. The World Bank (2016)[5] however estimates a lower Gini-coefficient of 0.447 for Malawi, which is a slight decline from 0.455 in 2010.

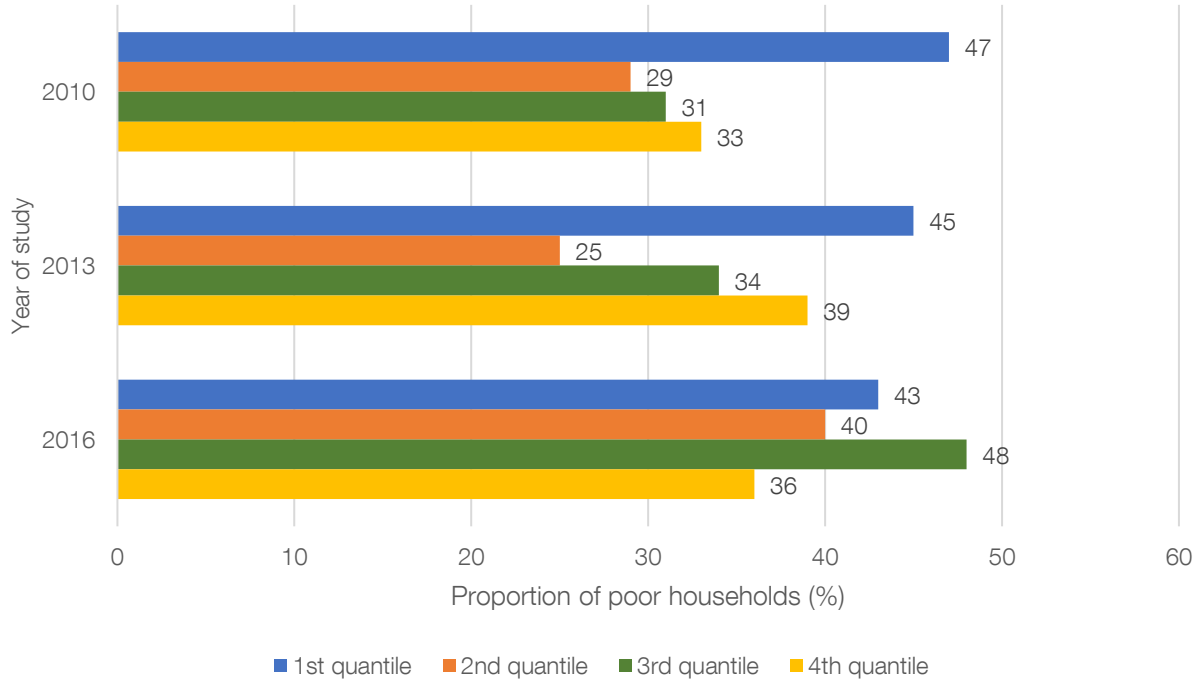
The multidimensional measure of poverty, using a cut-off point of 33% in the aggregated indicators, shows that the MPI was on average 35, 38 and 33 in 2010, 2013 and 2016, respectively. On average, in Malawi, 67%, 73% and 67% of households were multi-dimensionally poor in 2010, 2013 and 2016, respectively (**Figure A1** in Section III of the Appendix). Across the regions, the Northern

[5] https://data.worldbank.org/indicator/SI.POV.GINI?locations=MW

Region has the lowest multidimensional poverty rate compared to the other regions, which has also shown no significant change over the years. The proportion of households in poverty in the centre of the country has significantly increased from 70% of household in 2010, to 82% in 2016; a similar increasing trend is observed for the Southern Region.

Figure 13 presents incidence of income poverty per HCI quantile in Malawi. Households in the 1st quantile sold less of their produce compared to those at the highest quantile (4th quantile). Overall, the incidence of poverty is high among households selling less than a quarter of their crop produce, though with slight declines over time. The prevalence of poverty is more pronounced in 2010 and 2013 among household in the 1st quantile than in 2016. Households that are highly commercialised (in the 4th quantile) experienced an increase in poverty between 2010 and 2013 but a decline in 2016. Those in the 3rd quantile of crop sales, have largely experienced an increase in their poverty levels, from 31%, to 34%, to 48% of the households in 2010, 2013 and 2016, respectively. The pattern of poverty prevalence is generally not consistent among the households in different HCI quantiles.

Figure 13: Poverty incidence per HCI quantile for 2010, 2013 and 2016



Source: Authors' own

Using the MPI, **Table 16** presents trends in commercialisation for different poverty groups. There is an increase in commercialisation level among non-poor households over the years, from 13.83% in

2010, to 16.04% in 2013 and to 17.21% in 2016. Similarly, ultra-poor households have experienced an increase in commercialisation levels, whilst the moderately poor have maintained a steady level of commercialisation at about 19% of their crop production. These changes over the years are, however, not statistically significant.

Table 16: Incidence of multidimensional poverty (%) and commercialisation level by groups

Poverty group	MPI (%)	HCI (mean)	HCI SD
Ultra-poor/poorest (2010)	13.13	10.63	24.61
Moderately poor (2010)	53.81	19.07	32.27
Non-poor (2010)	33.06	13.83	27.34
Ultra-poor/poorest (2013)	11.52	15.04	27.81
Moderately poor (2013)	61.29	19.56	32.61
Non-poor (2013)	27.19	16.04	31.32
Ultra-poor/poorest (2016)	10.02	18.23	27.38
Moderately poor (2016)	56.56	17.94	30.62
Non-poor (2016)	33.42	17.21	29.84

Notes: SD = standard deviation

Source: Authors' own

Food and nutrition security

Table 17 presents the FCS for households under this study. Overall, there is no food insecurity as the average FCS is above 35 (47.67 for 2010, 51.06 for 2013 and 42.64 for 2016). Even though there is no indication of food insecurity, significant disparities exist, depending on the gender of the household head. Male-headed households have better food consumption scores, including the variety of food items they consume, than female-headed households. For instance, the FCS for 2010, 2013 and 2016 of 48.98, 52.29 and 44.22 for male-headed compared to 43.75, 47.19 and 39.01 for female-headed households, respectively. The proportion of households with poor food consumption has been fluctuating but remained below 6% between 2010 and 2016. Households with acceptable food consumption increased in 2013 from what was registered in 2010 but declined again in 2016. A comparison of FCS and dietary diversity by quantile of HCI (**Table A3** in Section III of the Appendix) shows a mixed pattern. Whilst in 2010 households with a higher HCI had a better consumption score, this was not the case in 2013, especially for the 4th quantile.

Table 17: Food consumption over the years

	FCS						Proportion of households in FCS category		
Year	Mean	SD	Min	Max	Male	Female	Poor	Borderline	Acceptable
2010	47.68	17.72	12.5	109	48.98	43.75***	4.14	21.47	74.4
2013	51.06	17.38	10	112	52.29	47.19***	1.31	16.39	82.3
2016	42.64	17.44	6.5	112	44.22	39.01***	5.85	32.74	61.41

Notes: SD = standard deviation. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Source: Authors' own

Hiring of agricultural labour and employment

Figure A2 in Section III of the Appendix shows trends in hiring of agricultural labour by gender categories – children, women, and men – for different HCI quantiles. At least 30% of the households reported hiring some agricultural labour in each of the study years. As depicted in **Figure A2** in Section III of the Appendix, men seem to have provided more labour man-days relative to women and children. There is also an increasing trend in the number of days of agricultural labour hired between 2010 and 2016, especially of by men. Considering the quantiles of commercialisation, those households that are highly commercialised (3rd and 4th quantile) hired more agricultural labour.

Figure A3 in Section III of the Appendix shows the wage rates for the labour. Again, there is an increase in wages provided, and the increase is substantial between 2010 and 2016, particularly for men; rates for women and children have fluctuated. Men also have the highest wages in comparison to women and children, which is possibly a reflection of their negotiation skills for better pay, or the prowess in their labour provision.

Tables A4, **A5** and **A6** in Section III of the Appendix present households' economic activities by HCI quantiles for the three study years. In general, most households (over 60%) are engaged in unpaid agricultural work regardless of the observed extent of commercialisation. Comparing the HCI quantiles based on a particular economic activity reveals that households that sell 75% and above of their agricultural produce engage the most in unpaid agricultural work. And households that sell 25% or less of their agricultural produce are mostly involved in wage employment.

Commercialisation by gender of household head and location of residence

In **Tables A7**, **A8** and **A9** in Section III of the Appendix, we present average HCI disaggregated by gender of the household head and location of residence for the study years. Overall, crop commercialisation has increased significantly from about 15.3% in 2010 to about 18% in subsequent

years. The increase between 2013 and 2016 is very small and insignificant. In these years women have lagged behind male-headed households in the amount of produce marketed. For instance, female-headed households marketed 13.6% and 7.9% of their crops in 2016 and 2010; compared to 21% and 18.3% for male-headed households. Irrespective of this, both male and female heads have seen their marketed produce proportion increase over the years, with a significant increase for female-headed households between 2010 and 2016 (from 7.9% to 13.6%).

Differences exist in how crop commercialisation has varied over time. Maize, the main staple food in Malawi, is the least commercialised crop, with proportions marketed below 10% over the years. The most heavily marketed crop, apart from tobacco which is the country's main forex earner, is soya beans with 47.5%, 69.8% and 68.2% marketed in 2010, 2013 and 2016, respectively. This is followed by groundnuts with 33%, 41.8% and 51.4% marketed over the same years. About a fifth of pigeon peas produced were marketed in 2016 with the other years registering 14%.

With respect to the gender of the household head, there have been significant differences in market engagement. Male-headed households have significantly increased the proportion of soyabeans that they market, from as low as 49.3% in 2010 to 72.2% in 2013, before declining slightly to 67.6% in 2016. For groundnuts, statistically significant amounts ($p<0.05$) were marketed by male-headed households (54%) in 2016 compared to female-headed households (41%). Again, the proportions of groundnuts marketed by male-headed households in 2010 (35.1%) was significantly higher than what female headed households sold on the market (23.8%).

Commercialisation levels also seems to vary by location of residence. The Central Region consistently surpasses the other regions in this regard, whilst the Southern Region tends to market significantly less than the Northern Region. For instance, in 2010 the overall HCIs 17.5, 25.9 and 6.7 for the north, centre and south compared to 14, 31.6 and 8.3 for 2013, and 19.5, 28.4 and 10.5 for 2016. The extent of commercialisation in the north has not changed significantly over the years, while in the centre, differences in levels of commercialisation were only significant between 2010 and 2013 ($p<0.05$). In the south these differences are only statistically substantial between the years 2010 and 2016 ($p<0.01$). The level of groundnut commercialisation in the south has not significantly changed over the years with about 20% marketed. On the other hand, the centre has seen significant increases from 40.3% in 2010, to 54.6% in 2013, and to 58.7% in 2016. The differences between 2010 and the other years are significant. The amount of soya beans marketed in the centre has significantly increased between levels in 2010 (54.2%), 2013 (71.8%), and 2016 (76.9%).

Commercialisation by farm size classification

Table A10 in Section III of the Appendix depicts HCI for the crops according to farm size classification. Farms have been classified into two categories: where farmland is up to 1 acre (0.4ha) is classified as small, and any farmland between 1–10 acres (0.4–4.04ha) is classified as medium. In general, medium-size farms have a higher HCI relative to small farms, particularly in 2010 and 2013 where this difference is statistically significant. Similarly, for groundnuts, significantly higher amounts were marketed in 2013 among medium-size farms relative to small farms. Medium-size farms marketed more maize, soya beans and tobacco in 2010, compared to maize, groundnuts, soyabeans and pigeon peas in 2013. We further observe in 2016 that there is no statistically significant difference between the small and medium-sized farms in terms of their extent of commercialisation. Medium-size farms had an average HCI of 18.75, while the small farms had an average HCI of 16.22. Specifically, only pigeon peas registered a significant difference ($p<0.05$) between the HCI of medium-sized farms (19.31), and small farms (28.62).

5.3.3. Description of the study sample

Table 18 presents the descriptive statistics for the exogenous variables employed in the econometric analysis. To begin with, the sample contains 77%, 76%, and 70% of male-headed households for the 2010, 2013, and 2016 period. The average age of the household head was 43 in 2010 and 2013, and 47 in 2016. On average, the head of households had seven years of schooling in 2010 and 2013 and six years in 2016. The average household size in all years was five members. The average land holding sizes for 2010, 2013 and 2016 were 0.81, 0.78 and 0.91, respectively. There is, therefore, a general increase in land holding size. Overall, land productivity declined. This is evidenced by a downward change from 6.25 in 2013 to 5.93 in 2016. The asset index has been negligible for all the study years; 0.01 in 2010 and 2016 and 0.02 in 2013. About 40% of the households were income poor in each of the study years. In terms of MPI, close to 14%, 10% and 15% were classified as ultra-poor in 2010, 2013 and 2016 respectively.

Table 18: Descriptive statistics for variables used in models

Variable category	2010		2013		2016	
	Mean	SD	Mean	SD	Mean	SD
Age of the household-head (years)	43.35	16.18	43.47	15.82	46.76	15.65
Years of schooling for the head	6.77	3.87	7.1	4.11	6.08	3.64
Household size	4.99	2.23	5.15	2.27	5.32	2.27
Land holding size (ha)	0.81	0.74	0.78	0.69	0.91	0.74
Land productivity (MK/ha)	6.17	1.17	6.25	1.16	5.93	1.27

Asset index	0.01	0.11	0.02	0.14	0.01	0.12
Income poor (0/1)	46	0.50	42	0.49	44	0.50
Obtained credit (0/1)	13	0.33	23	0.42	25	0.43
Received market extension (0/1)	6	0.23	33	0.47	9	0.29
Region-North (0/1)	9	0.29	10	0.30	8	0.26
Region-Centre (0/1)	43	0.49	42	0.49	42	0.49
Region-South (0/1)	48	0.50	48	0.50	51	0.50
Redeemed FISP fertiliser (0/1)	55	0.50	38	0.49	35	0.48
Purchased commercial fertiliser (0/1)	80	0.40	39	0.49	22	0.42
Hired agricultural labour (0/1)	39	0.49	37	0.48	35	0.48
Main activity (wage) (0/1)	13	0.34	17	0.37	9	0.29
Main activity (business) (0/1)	12	0.33	12	0.33	11	0.31
Main activity (agriculture) (0/1)	57	0.49	67	0.47	68	0.47
Number of observations	1304		1599		1231	

Notes: SD = standard deviation. Dummy variables are indicated with 0/1 in brackets.

Source: Authors' own

We also see a declining proportion of households purchasing commercial fertiliser from 80% of households in 2010, to 39% in 2013, and 22% in 2016. The numbers of beneficiaries of FISP have also declined, from an estimated 55% of sample households in 2010, to 38% in 2013 and 35% in 2016 consistent with the scaling down of the programme (Logistics Unit, 2017). Close to 40% of households hired agricultural labour in the different study years. Increasing numbers of households are also receiving credit, estimated at 13%, 23% and 25% for the 2010, 2013 and 2016 study periods, respectively. Access to market extension has varied over the years, with 6%, 33% and 9% of households reporting receiving extension support in 2010, 2013 and 2016, respectively. Most households are mainly engaged in agricultural activities with, on average, 57%, 67% and 68% reporting agriculture as their main economic activity for the year 2010, 2013 and 2016, respectively.

5.4. Drivers of commercialisation

Table 19 presents the determinants of agricultural commercialisation from the fixed effect estimation. The realised coefficients in the models are statistically different from zero, judged by the F-statistic ($p<0.01$). We use different definitions of poverty, such as MPI, subjective poverty assessment and income poverty in the models I, II and III, respectively. For most variables, the direction of relationship and significance is consistent, though the margin of effect varies.

Table 19: Determinants of agricultural commercialisation

	Model I Coef.	Model II Coef.	Model III Coef.
Male-headed household (0/1)	5.310**	6.645***	3.653***
	(2.193)	(1.417)	(1.405)
Age of household head (years)	0.470	-0.090	-0.408*
	(0.501)	(0.250)	(0.242)
Age squared	-0.007	-0.001	0.001
	(0.005)	(0.003)	(0.002)
Household size (adult equivalents)	-0.403	0.008	0.167
	(0.536)	(0.334)	(0.325)
Years of schooling for head	-0.239	-0.241	-0.459***
	(0.291)	(0.174)	(0.167)
MPI (moderate poor) (0/1)	0.551	-	-
	(2.203)		
MPI (ultra-poor) (0/1)	-5.094	-	-
	(3.345)		
Subjective poverty (poor) (0/1)	-	0.942	-
		(2.384)	
Income poor (0/1)	-	-	-25.36***
			(1.173)
Main activity (wage) (0/1)	-4.899*	-3.943*	-3.799*
	(2.948)	(2.143)	(2.040)
Main activity (business) (0/1)	-0.677	0.439	-1.129
	(2.905)	(2.110)	(2.028)
Main activity (agriculture) (0/1)	8.832***	7.575***	4.846***
	(2.160)	(1.578)	(1.534)
Land holding (ha)	0.001	0.004	-0.016
	(0.033)	(0.032)	(0.030)
(Log) Land productivity	-0.001	-0.001	-0.002**
	(0.001)	(0.001)	(0.001)
Asset index (PCA)	-1.623	-1.110	-0.994
	(2.666)	(1.983)	(2.059)
Asset squared	0.040	0.026	0.020
	(0.080)	(0.060)	(0.062)
Received market extension (0/1)	5.459**	5.505***	3.837***
	(2.239)	(1.513)	(1.426)
Obtained credit (0/1)	-2.036	-1.161	-2.855**
	(1.963)	(1.362)	(1.321)
Hired agricultural labour (0/1)	3.939**	4.520***	1.260
	(1.760)	(1.219)	(1.175)
Redeemed FISP fertiliser (0/1)	3.777**	4.997***	3.420***
	(1.681)	(1.165)	(1.127)
Purchased commercial fertiliser (0/1)	4.625**	5.312***	2.194*
	(1.930)	(1.303)	(1.254)
Central Region (0/1)	9.919***	10.455***	10.470***
	(2.929)	(2.028)	(1.909)
Southern Region (0/1)	-9.31***	-9.859***	-6.652***
	(2.910)	(2.016)	(1.909)
Constant	0.733	8.848	35.861***
	(11.186)	(6.420)	(5.708)
Adjusted R squared	0.141	0.156	0.294
F – statistic	11.621	26.360	52.540

Prob>F	0.000	0.000	0.000
Number of observations	1352	2742	2477

Notes: Dummy variables are indicated with 0/1 in brackets. SE = standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$ represent statistical significance at the 10%, 5% and 1% levels, respectively.

Source: Authors' own

We find commercialisation is significantly driven by the gender of the household head, receipt of market-related extension services, hiring of agricultural labour, access to fertiliser both through redemption of subsidy coupons and commercial purchases on the market, among other factors. Male-headed households are associated with higher HCIs than female-headed households in all of the models estimated. For instance, in Model I, male-headed households have a 5.3 mean point higher commercialisation level relative to females. Household heads whose main economic activity is agricultural work also have higher commercialisation levels compared to those engaged in piecework '*ganyu*' work. But engagement in wage employment as a main economic activity is associated with a significant decline in commercialisation. Receipt of market-related extension is positively and significantly associated with the extent of commercialisation. Households that received market extension services have, on average, a 4-point higher HCI than those that did not receive extension services about markets. Redemption of subsidised fertiliser under FISP is positively significant at 1%. Thus, on average, FISP beneficiaries had between a 3–5-point higher HCI than non-beneficiaries. Further, the purchase of commercial fertiliser significantly increased commercialisation by 2–5 mean points.

In models I and II, hiring of agricultural labour is significant and positively associated with commercialisation. This is not the case in model III where we define poverty by income. There are also regional differences with households in the Southern Region, associated with a significant decline in commercialisation relative to the Northern Region. This is contrary to the Central Region which shows a significant and positive relationship compared to the Northern Region. Residence in the south for instance, in Model I is associated with a reduction in commercialisation by 9.3 mean points, while Central Region residence sees households with a 9.9 point higher commercialisation, on average, compared to those living in the Northern Region.

The results also show that commercialisation is significantly constrained by levels of schooling, income poverty, wage employment and asset holding. Access to credit has a significant negative effect on commercialisation. Model III results indicate that households that accessed any form of

credit had a 2.9 lower mean point HCI than those that did not receive any form of credit. Though not consistent, the results may reflect limited agricultural financing in rural Malawi. Whilst we find assets have no effect on commercialisation, the productivity of land significantly reduced commercialisation in Model III. Again, in this model, the education of the household's head limits the extent of commercialisation. The longer the household head stayed in school the less the HCI by 0.5 points, possibly showing a preference for enterprises outside of agriculture for educated household heads. We also find that young household heads experience significantly less commercialisation. This was observed only in Model III, but it showed that over time their commercialisation increased, though not significantly. Results also indicate poverty constrains engagement with markets, though not significantly for multidimensional and subjective poverty definitions. Only income poverty was found to significantly reduce commercialisation in Model III by 25 points on average.

5.5. Discussion and concluding remarks

5.5.1 Patterns of commercialisation over time

This chapter explored the drivers of agricultural commercialisation and its pattern over time in Malawi. It further assessed commercialisation effects on some outcome indicators. We find that whilst poverty had declined marginally over the years, it is still highly prevalent, especially in the Southern Region, and that poverty is associated with low levels of commercialisation. Households that were deprived consistently marketed less than those that were non-poor (defined in this chapter using different measure of poverty). Overall, commercialisation increased overtime but to a different extent for various poverty groups, with the non-poor and ultra-poor (as defined by MPI) experiencing increases in commercialisation, whilst a more steady trend was observed for the moderate poor. About food and nutrition security, a mixed pattern was observed except for 2010. The results of this study indicate that households with higher levels of commercialisation also had a high FCS.

In terms of gender, male-headed households tended to commercialise more than female-headed households, and the same was true in terms of food consumption supporting previous studies (Kilic, Palacios-Lopez and Goldstein, 2015; Ali et al., 2016; Djurfeldt et al., 2018). However, there were some crops (pigeon peas, beans, and sweet potato) for which female-headed households registered higher HCIs than male-headed households (though differences were not significant). Across the regions, the Central Region had the highest HCI in comparison to the other regions, which is possibly a reflection of the dominance of tobacco cultivation – the main cash crop in Malawi in this region as well as the agroecological advantage alluded to earlier which enables relatively more efficient

production. Maize, which is a staple food and is commonly grown, had the lowest HCI, probably because of its food security role (Edelman et al., 2016; Sibande, Bailey and Dovidova, 2017). Households with medium-size farms had a significantly higher HCI than those with small farms, likely due to the subsistence orientation of smallholder farmers in Malawi.

The study also established a link between HCI and employment avenues. Generally, unpaid agricultural work is the main employment activity that households are engaging in, regardless of the degree of their market participation. Yet households in the lowest quantile (with HCI<=25%) were least engaged in agricultural activities than those in highest quantile (with HCI>=75%), which were, on average, mostly engaged in agricultural activities. Those in lowest quantile were engaged in non-agricultural wage employment more than any other employment category, and those in the highest quantile were least engaged in non-agricultural wage employment.

5.5.2. Drivers of agricultural commercialisation

Regarding the drivers of commercialisation, we found that male-headed households are more likely to commercialise than female-headed households, which is consistent with previous literature (Agwu, Anyanwu and Mendie, 2013; Abdullah et al., 2019). Ragasa, Kinwa-muzinga and Ulimwengu (2012) pointed out that these existing gender disparities are a result of several factors that correlate with being a woman, like social and cultural factors that put women at a disadvantage in attaining resources that enhances market participation. Additionally, women have been found to lag behind men in terms of crop productivity (Karamba and Winters, 2015; Kilic, Palacios-Lopez and Goldstein, 2015) and therefore may not have an adequate marketable surplus.

Young household heads are associated with negative levels of commercialisation, potentially because they lack experience (Agwu, Anyanwu and Mendie, 2013; Abdullah et al., 2019), they are excluded from extension services (Ragasa and Niu, 2017), or because they have limited entitlement to land for agriculture itself (Matita et al., 2021b). Older farmers tend to have more experience of farming and are aware of changes in the weather and other conditions affecting production. Additionally, younger people tend to opt for off-farm employment rather than farming enterprises (Leavy and Hossain, 2014). However, in other studies (Randela, et al., 2008) younger farmers have been found to be more innovative, adaptable to rapid and frequent changes, and aware of the benefits of commercialisation.

Education of the household head has a negative effect on commercialisation, indicating that households whose head stayed longer in school register lower levels of commercialisation. This is in line with Dube and Guveya (2016) and Muhammad-Lawal et al. (2014) who explained that educated members of the households tend to shun rural agricultural life and instead prefer faster paying professions. Kirui and Njiraini (2013), however, found education to have a positive effect on commercialisation. One explanation is that education improves human capital, hence productivity improves as farmers have greater knowledge in both production and marketing. In any case, education could affect commercialisation positively if the education or training received is relevant to the process of commercialisation. Household heads whose main economic activity was wage employment were associated with lower levels of commercialisation as they devoted more time to their occupations and less to their agricultural enterprises.

Contrary to expectations, land holding sizes were not crucial for commercialisation in Malawi, but we found that productivity negatively affects commercialisation in one of the models. This can be explained by the fact that productivity increases were mainly registered for crops like maize that have low individual HCIs as they are staple foods. For instance, Dorward and Chirwa (2011) established that productivity increases in maize occurred as productivity-enhancing inputs like fertilisers were usually allocated to maize. This is particularly so for the FISP beneficiaries. Though such increases in maize production are modest with repeated access to FISP (Ricker-Gilbert and Jayne, 2017). Thus, even if households have large land holdings, if land productivity does not correspond to these land holding sizes, then commercialisation may be negatively affected.

In this study, fertiliser obtained through FISP and commercial purchases had a positive effect on the degree of commercialisation. Comparing the impact that FISP and commercial fertilisers had on commercialisation, it was found that households which purchased commercial fertiliser had a higher HCI than FISP beneficiaries. This corroborates Chirwa and Matita (2012) who also found that access to fertilisers (whether subsidised, or accessed with cash or credit) was associated with greater levels of commercialisation, and that fertiliser acquired by credit, followed by cash, had a greater impact on commercialisation than fertiliser obtained by redeeming subsidised coupons. According to Chirwa and Matita (2012) the lower marginal effects of subsidised fertiliser than cash and credit reflected the limited amounts of fertiliser acquired by households using this channel. Substantiating this, Nepal and Thapa (2009) found that an increment in the amount of fertiliser applied increased the level of commercialisation. This suggests that having a low universal price of commercial fertiliser, that is used efficiently, might enable households to access adequate amounts of fertiliser which, in turn,

would have a greater effect on commercialisation than FISP which has restricted package. Such a strategy, however, might increase the displacement of unsubsidised fertiliser sales in Malawi, as FISP has not been accompanied by increases in commercial fertiliser purchases, even amidst its scaling down. Perhaps addressing farmers' income constraints in general – by enabling access to diversified sources of income, including strengthening of non-agricultural enterprises in the rural economy – would support improved access to production inputs for agriculture.

Poverty status negatively affected agricultural commercialisation, meaning that poor households have lower levels of commercialisation than non-poor households. This can be explained by the livelihood strategy perspective whereby it states that poor farmers are generally risk averse, hence production is mainly for their sustenance rather than commercial purposes (Leavy and Poulton, 2007). In keeping with this, Carletto, Corral and Guelfi (2017) explain that most of what is sold by smallholder farmers in Malawi is from what is produced for own consumption which may explain the high likelihood of hanging in or barely surviving, observed by Matita et al. (2021b) using longitudinal study data. Irrespective of such scenario, studies like Ogutu and Qaim (2019) in a rural Kenyan context found that the poorest households are the ones that benefit more from commercialisation in terms of reduced deprivation, defined by MPI. There are also regional differences in the degree of commercialisation – signifying the agroecological and market infrastructure disparities among other aspects in different locations of Malawi. Moreover, cropping patterns are different in various regions, and the Central Region produces and markets greater volumes of tobacco and legumes, such as soya beans and groundnuts, than the other regions (Dzanja et al. 2017). This has prompted other studies like Asfaw et al. (2017) to recommend modifications to FISP to take advantage of the efficiency in production showcased in the Central Region.

In conclusion, the study has established that firstly, commercialisation has gradually been increasing over time, but mixed results correspond to its outcomes. This concurs with findings from a longitudinal study by Matita et al. (2021b) which found that households tend to hang on to their agricultural livelihoods for mere survival, irrespective of the extent of commercialisation. Secondly, the study uncovered several factors affecting the degree of commercialisation which are household specific, farm specific and region specific. This signifies that to ensure the promotion of agricultural commercialisation, a holistic approach that will tackle bottlenecks at all levels is crucial.

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Appendix

I. Ghana

A: Main tables

Table A1: Sample distribution of households by region and crop, 2013 and 2017

Panel A: 2013											
Crop	**Western**	**Central**	**Greater Accra**	**Volta**	**Eastern**	**Ashanti**	**Brong Ahafo**	**Northern**	**Upper East**	**Upper West**	**Total**
Maize	133	347	38	558	521	411	578	1038	455	570	4649
Groundnut	10	1	0	160	31	15	138	481	238	667	1741
Sorghum	0	0	0	13	0	0	17	184	54	124	392
Millet	1	0	0	11	4	0	16	187	126	68	413
Rice	1	3	6	56	5	16	56	273	175	138	729
Bean	7	1	0	73	14	21	93	264	140	380	993
Cassava	148	80	5	113	232	171	220	76	0	3	1048
Yam	18	9	0	57	32	39	113	201	0	23	492
Cocoa	549	257	2	42	339	334	218	0	0	0	1741
Plantain	131	38	0	10	142	114	157	0	0	1	593
Pepper	24	14	6	52	26	19	102	52	35	6	336
Okro	17	1	1	39	12	11	72	64	23	11	251
Oil palm	26	41	0	22	51	25	37	0	0	0	202
Cocoyam	26	9	0	0	30	45	106	0	0	0	216
Tomato	22	12	5	46	6	10	29	15	30	0	175
Panel B: 2017											
Crop	**Western**	**Central**	**Greater Accra**	**Volta**	**Eastern**	**Ashanti**	**Brong Ahafo**	**Northern**	**Upper East**	**Upper West**	**Total**
Maize	55	242	10	436	356	125	344	440	194	287	2489
Groundnut	1	5	0	99	56	14	69	338	113	455	1150
Sorghum	0	0	0	5	0	0	10	152	89	89	345
Millet	0	0	0	1	0	0	11	172	115	65	364
Rice	3	0	0	48	5	9	19	171	254	51	560
Bean	1	2	0	37	2	1	17	240	164	184	648
Cassava	216	139	13	90	155	81	65	73	0	22	854
Yam	2	5	1	65	23	13	100	150	0	71	430
Cocoa	152	142	2	41	202	133	188	0	1	0	861
Plantain	102	119	1	26	95	83	59	0	0	0	485
Pepper	5	21	14	24	31	21	32	36	15	2	201
Okro	5	7	9	40	14	18	19	34	10	14	170

Oil palm	4	45	1	6	58	10	4	0	0	0	128
Cocoyam	16	15	0	2	29	4	4	0	0	0	70
Tomato	4	13	9	18	3	3	0	0	1	3	54

Source: GLSS data, 2013 and 2017

Table A2: Sample distribution of households by crop, sex and farm classification, 2013 and 2017

Crop	Panel A: 2013					Panel B: 2017				
	Total	Sex		Farm classification		Total	Sex		Farm classification	
		Male	Female	Small	Medium to large		Male	Female	Small	Medium to large
All crops	7764	6247	1517	5748	2016	5497	4244	1253	4270	1227
Maize	4649	3807	842	3424	1225	2489	1981	508	1897	592
Groundnut	1741	1504	237	1050	691	1150	948	202	773	377
Sorghum	392	359	33	212	180	345	308	37	197	148
Millet	413	361	52	225	188	364	322	42	206	158
Rice	729	650	79	389	340	560	474	86	362	198
Bean	993	882	111	527	466	648	548	100	406	242
Cassava	1048	787	261	685	363	854	607	247	640	214
Yam	492	453	39	181	311	430	387	43	249	181
Cocoa	1741	1411	330	1167	574	861	685	176	586	275
Plantain	593	454	139	341	252	485	345	140	348	137
Pepper	336	261	75	150	186	201	149	52	145	56
Okro	251	213	38	103	148	170	138	32	111	59
Oil palm	202	172	30	110	92	128	104	24	88	40
Cocoyam	216	156	60	119	97	70	60	10	43	27
Tomato	175	153	22	70	105	54	34	20	47	7

Source: GLSS data, 2013 and 2017

Table A3: Average quantity of crop produced (in kg) by region and crop – 2013 and 2017

Panel A: 2013											
Crop	**Western**	**Central**	**Greater Accra**	**Volta**	**Eastern**	**Ashanti**	**Brong Ahafo**	**Northern**	**Upper East**	**Upper West**	**Total**
Maize	328.1	324.5	378.9	602.0	506.2	882.3	976.7	1390.8	501.2	2095.9	848.0
Groundnut	162.0	14.0	.	380.8	567.8	399.2	411.2	772.0	392.7	676.0	571.2
Sorghum	.	.	.	183.5	.	.	124.0	490.1	168.0	398.5	347.5
Millet	301.2	46.0	.	178.8	190.7	71.8	515.3	593.7	263.2	238.6	358.1
Rice	1500.2	371.8	11203.2	849.5	7556.6	3072.7	1324.3	2844.1	558.2	516.4	1634.2
Bean	75.3	116.0	.	146.6	1239.8	596.1	212.2	583.1	162.9	268.6	351.9
Cassava	1361.3	398.4	353.2	5393.3	905.2	780.0	2199.4	1579.4	.	738.9	1716.7
Yam	138.4	90.2	.	4523.3	652.4	1445.6	1218.4	3215.7	150.1	942.0	1880.6
Cocoa	1070.0	456.2	1341.2	152.0	516.3	457.2	1334.8	192.0	.	.	699.1
Plantain	1081.6	680.7	.	628.2	449.0	411.2	1632.9	.	.	1500.0	824.7
Pepper	49.3	26.2	64.4	128.2	111.3	26.6	53.4	61.4	49.0	24.0	56.2
Okro	68.5	64.0	96.0	150.9	645.4	87.3	91.7	105.1	43.7	35.6	110.0
Oil palm	1037.0	3192.2	.	1148.9	1265.9	7715.8	3088.9	.	48.0	375.4	4214.4
Cocoyam	147.1	165.0	.	67.8	268.8	82.1	715.5	.	.	62.5	305.0
Tomato	102.4	46.4	970.0	126.0	207.7	383.4	78.4	210.2	212.8	44.3	161.7
Panel B: 2017											
Crop	**Western**	**Central**	**Greater Accra**	**Volta**	**Eastern**	**Ashanti**	**Brong Ahafo**	**Northern**	**Upper East**	**Upper West**	**Total**
Maize	378.5	350.1	498.1	466.7	535.5	726.5	842.1	1033.4	423.8	1025.4	666.6
Groundnut	2800.0	25.8	2.0	295.5	1944.0	535.6	468.6	580.1	167.8	621.5	693.5
Sorghum	.	.	.	102.6	.	.	373.0	270.6	192.7	297.5	241.8
Millet	.	.	.	55.4	.	.	563.8	374.2	173.1	207.1	261.5
Rice	2138.1	1346.6	.	1343.7	1042.6	2815.8	2571.2	1972.8	418.7	373.1	1189.7
Bean	125.4	174.8	9.0	139.5	37.2	91.8	249.1	410.7	151.0	160.9	245.3
Cassava	693.6	731.5	2266.0	2993.6	1881.7	752.0	686.0	1412.6	.	3714.1	1238.6
Yam	172.6	108.1	125.0	2751.5	505.7	842.3	2016.7	3242.0	100.0	1053.3	1967.8
Cocoa	828.9	559.4	160.0	451.2	2959.5	635.9	939.2	.	640.0	.	1256.4
Plantain	722.5	694.1	482.8	441.6	1149.1	1200.5	2808.8	.	.	.	1134.9
Pepper	26.8	54.8	149.5	55.1	330.2	61.0	110.8	84.2	110.7	69.0	152.4
Okro	535.9	112.4	316.8	348.8	2626.3	365.5	262.8	92.8	22.3	160.4	514.1
Oil palm	2817.7	5034.1	270.0	1478.1	15063.1	2738.1	5044.0	.	.	.	8765.4
Cocoyam	382.5	131.4	.	48.2	229.7	61.6	96.7	.	.	.	251.1
Tomato	128.9	67.6	64.4	57.6	1628.8	508.4	.	42.0	61.4	728.7	291.2

Source: GLSS data, 2013 and 2017

Table A4: Average value of crop produced (in Ghana Cedis) by region, 2013 and 2017

Panel A: 2013											
Crop	**Western**	**Central**	**Greater Accra**	**Volta**	**Eastern**	**Ashanti**	**Brong Ahafo**	**Northern**	**Upper East**	**Upper West**	**Total**
Maize	1965.6	338.1	638.1	568.0	555.9	716.9	707.8	685.6	399.8	1296.9	716.5
Groundnut	538.0	20.0	.	998.7	850.8	776.8	568.5	703.8	581.0	674.9	706.5
Sorghum	.	.	.	85.8	.	.	373.3	312.4	167.3	292.2	278.2
Millet	320.0	.	.	173.5	270.2	.	480.1	565.1	364.4	300.1	446.5
Rice	3000.0	649.1	5652.8	519.0	6122.5	1892.2	980.5	1082.3	526.6	301.3	909.2
Bean	403.2	266.7	.	236.7	3173.8	1215.3	354.6	574.7	246.1	282.6	468.2
Cassava	395.1	641.7	867.4	1008.9	582.0	187.3	426.3	375.8	.	255.8	461.2
Yam	301.9	124.5	.	3269.6	1453.7	6875.3	1215.3	1589.9	.	643.4	2267.4
Cocoa	3548.7	1498.8	2550.4	391.7	1698.4	1472.6	4728.2	.	.	.	2340.4
Plantain	458.3	262.9	.	326.2	321.7	217.1	498.8	.	.	500.0	348.8
Pepper	71.9	43.6	402.6	330.7	255.0	89.6	142.0	142.5	612.1	163.3	177.4
Okro	61.5	80.0	90.0	183.1	1030.5	546.0	125.8	174.4	82.1	78.9	216.1
Oil palm	596.0	253.0	.	345.0	650.5	556.1	828.2	.	.	.	585.0
Cocoyam	154.3	69.1	.	.	326.8	92.3	279.2	.	.	.	184.2
Tomato	95.1	125.5	1147.2	180.2	206.3	1819.2	159.8	193.5	1377.6	.	310.6
Panel B: 2017											
Crop	**Western**	**Central**	**Greater Accra**	**Volta**	**Eastern**	**Ashanti**	**Brong Ahafo**	**Northern**	**Upper East**	**Upper West**	**Total**
Maize	561.6	511.1	2018.6	864.8	796.8	1130.7	914.6	791.9	569.3	1632.9	850.8
Groundnut	3000.0	76.7	.	695.7	2882.2	1246.7	1093.7	872.7	358.6	1230.6	1272.3
Sorghum	160.0	468.6	.	327.7	137.0	100.0	669.9	1182.8	289.7	387.3	727.5
Millet	.	.	.	127.0	.	.	839.9	603.9	301.8	443.9	508.6
Rice	714.8	486.0	4772.3	1026.5	876.4	911.5	514.8	911.9	.	1805.5	811.3
Bean	.	.	.	106.5	.	.	526.3	344.5	304.2	652.8	366.1
Cassava	1504.4	.	.	1459.5	3119.8	4220.1	3414.9	1315.4	488.1	464.4	1249.8
Yam	6320.6	3337.4	1156.3	3603.3	21871.7	4676.0	6958.8	.	4750.0	.	9441.8
Cocoa	898.1	521.2	525.0	307.3	906.0	1205.6	1025.1	.	.	.	918.9
Plantain	220.7	732.8	250.0	2921.6	573.7	1520.4	2514.4	3593.8	.	4005.8	2746.1
Pepper	219.7	189.8	1714.4	248.6	1946.6	460.6	247.1	327.2	1002.6	1000.2	943.0
Okro	482.3	608.3	242.7	353.9	7255.8	994.6	431.7	264.6	78.6	613.8	1309.2
Oil palm	1604.7	1440.7	600.0	479.4	4450.7	1671.9	2479.9	.	.	.	2901.8
Cocoyam	259.1	287.7	.	74.4	399.3	241.4	116.1	.	.	.	296.1
Tomato	341.2	178.8	521.6	189.1	1312.8	6256.9	.	.	60.0	630.0	1035.6

Source: GLSS data, 2013 and 2017

Table A5: Average value of sales (in Ghana Cedis) by region, 2013 and 2017

Panel A: 2013											
Crop	**Western**	**Central**	**Greater Accra**	**Volta**	**Eastern**	**Ashanti**	**Brong Ahafo**	**Northern**	**Upper East**	**Upper West**	**Total**
Maize	729.8	208.8	480.6	340.4	388.0	732.2	720.4	431.7	313.3	1461.9	555.0
Groundnut	507.5	10.0	.	709.5	578.1	346.5	434.6	419.5	367.0	457.8	471.6
Sorghum	.	.	.	165.7	.	.	114.5	216.7	114.1	176.7	186.0
Millet	240.0	.	.	144.5	150.6	60.0	404.7	286.1	253.1	260.0	266.4
Rice	3000.0	524.9	4944.0	500.5	7308.8	1150.3	828.7	794.7	478.8	193.2	797.2
Bean	290.0	157.6	.	201.4	408.9	970.3	292.1	409.8	171.8	301.6	365.4
Cassava	297.8	458.3	657.0	351.7	655.8	145.3	337.3	261.2	.	147.7	335.8
Yam	177.7	71.3	.	1674.6	775.2	1679.2	1427.8	1737.5	.	302.8	1466.7
Cocoa	3216.7	1349.7	2084.7	327.8	1399.3	1339.5	3604.6	.	.	.	2039.5
Plantain	347.8	241.3	.	353.6	287.1	169.9	500.0	.	.	250.0	295.8
Pepper	83.5	83.6	329.0	339.0	386.9	133.0	201.8	138.4	1089.6	104.8	253.9
Okro	57.6	60.0	75.0	193.3	959.6	119.6	224.5	119.4	241.5	113.4	226.4
Oil palm	657.1	256.0	.	182.0	569.0	236.0	323.9	.	.	.	369.4
Cocoyam	151.5	98.2	.	.	444.6	62.9	224.3	.	.	.	169.1
Tomato	141.4	159.2	1034.9	158.3	323.5	1836.0	316.1	353.4	743.9	.	443.9
Panel B: 2017											
Crop	**Western**	**Central**	**Greater Accra**	**Volta**	**Eastern**	**Ashanti**	**Brong Ahafo**	**Northern**	**Upper East**	**Upper West**	**Total**
Maize	437.7	341.3	21129.3	703.8	653.8	1184.1	1295.7	502.3	384.7	1732.3	906.0
Groundnut	2250.0	95.5	.	1010.7	2916.9	10229.1	1068.9	597.2	215.1	533.1	1611.9
Sorghum	100.0	290.4	.	240.8	78.8	100.0	741.5	590.4	158.3	670.9	464.3
Millet	.	.	.	125.0	.	.	715.7	540.0	159.8	260.5	486.5
Rice	764.6	396.1	4055.0	537.0	549.7	659.1	460.4	656.2	.	1565.9	639.3
Bean	.	.	.	51.2	.	.	329.1	281.2	191.6	506.7	282.3
Cassava	1016.1	.	.	985.7	1976.5	2458.8	2493.1	541.0	352.2	332.3	782.2
Yam	12508.6	4949.5	1156.3	3017.2	15177.8	4100.3	6571.2	.	1425.0	.	8760.0
Cocoa	627.7	378.8	350.0	248.4	748.2	1123.9	1079.6	.	.	.	785.0
Plantain	158.5	728.5	200.0	2332.7	431.7	1592.2	2303.6	2126.8	.	902.7	1951.9
Pepper	248.7	196.1	982.2	180.4	1931.9	356.2	366.9	241.3	947.3	871.6	1022.2
Okro	488.0	483.2	180.6	410.5	8408.4	1021.7	735.7	228.7	89.4	765.7	1670.3
Oil palm	1828.0	1237.1	600.0	127.5	1448.1	1633.2	2321.4	.	.	.	1397.6
Cocoyam	308.9	248.0	.	128.8	320.4	180.5	139.8	.	.	.	277.5
Tomato	335.7	181.7	402.2	190.5	2964.5	6174.7	.	.	60.0	720.0	1587.7

Source: GLSS data, 2013 and 2017

Table A6: HCI by regions – 2013 and 2017

Panel A: 2013											
Crop	**Western**	**Central**	**Greater Accra**	**Volta**	**Eastern**	**Ashanti**	**Brong Ahafo**	**Northern**	**Upper East**	**Upper West**	**Total**
All crops	73.7	62.4	55.6	38.9	53.2	63.0	54.0	34.3	20.2	30.4	51.1
Maize	50.8	49.5	46.7	34.5	40.9	56.4	57.0	25.2	29.6	40.1	42.9
Groundnut	76.6	.	.	64.2	59.6	72.8	56.4	55.7	45.1	51.0	56.1
Sorghum	.	.	.	61.1	.	.	50.5	49.5	18.1	38.0	44.3
Millet	.	.	.	57.2	58.4	.	63.8	49.3	25.5	46.6	43.0
Rice	.	64.8	85.4	61.7	83.3	49.0	72.7	57.3	45.7	45.0	57.0
Bean	65.3	75.0	.	53.1	59.1	73.6	52.5	52.5	23.7	23.8	46.1
Cassava	55.2	52.9	59.0	45.3	56.1	58.1	47.7	56.3	.	27.9	54.1
Yam	52.4	51.0	.	45.9	62.7	77.3	67.7	60.2	.	32.8	61.3
Cocoa	90.1	87.4	89.5	68.5	83.5	90.6	81.6	.	.	.	87.6
Plantain	57.3	60.1	.	70.2	61.5	64.3	66.9	.	.	50.0	62.8
Pepper	55.7	76.2	79.5	72.2	73.2	86.2	69.6	67.8	59.7	58.3	71.4
Okro	62.7	75.0	83.3	68.1	80.7	79.2	72.4	52.9	59.9	61.4	68.1
Oil palm	66.7	81.6	.	62.4	75.8	68.2	64.5	.	.	.	71.0
Cocoyam	63.2	73.4	.	.	56.0	64.2	60.2	.	.	.	62.1
Tomato	61.4	69.3	86.9	69.4	65.6	89.0	67.9	70.4	69.9	.	70.8
Panel B: 2017											
Crop	**Western**	**Central**	**Greater Accra**	**Volta**	**Eastern**	**Ashanti**	**Brong Ahafo**	**Northern**	**Upper East**	**Upper West**	**Total**
All crops	51.2	48.5	69.9	33.1	61.6	68.8	59.3	32.0	15.8	30.3	49.2
Maize	33.7	42.7	64.1	27.6	44.4	59.8	50.9	23.7	22.9	33.8	39.9
Groundnut	75.0	.	.	59.9	95.1	79.0	65.3	59.1	24.7	54.6	66.1
Sorghum	.	.	.	42.0	.	.	59.3	45.9	24.3	43.5	42.0
Millet	.	.	.	62.5	.	.	81.4	57.4	25.0	20.5	48.0
Rice	57.8	.	.	41.3	67.0	54.5	65.4	45.1	39.0	46.0	45.2
Bean	62.5	54.3	.	51.2	13.4	100.0	60.8	51.3	38.9	34.7	47.4
Cassava	41.2	49.1	74.6	46.2	53.3	58.4	65.5	39.0	.	48.6	50.2
Yam	79.3	64.0	80.0	54.7	48.9	59.7	52.3	48.2	.	42.5	51.6
Cocoa	88.5	81.4	100.0	80.8	84.7	91.1	93.2	.	30.0	.	87.9
Plantain	37.2	41.5	66.7	74.5	58.7	54.9	52.7	.	.	.	49.1
Pepper	49.7	66.9	72.3	36.8	88.7	82.9	53.3	66.4	88.7	86.0	73.4
Okro	92.4	80.5	69.4	62.6	91.4	84.1	53.7	52.6	56.9	77.8	70.8
Oil palm	91.6	60.3	100.0	39.3	73.3	89.8	71.9	.	.	.	71.1
Cocoyam	29.7	56.7	.	69.0	47.7	70.7	78.5	.	.	.	45.0
Tomato	98.2	59.0	78.0	71.8	81.1	74.9	.	.	.	93.3	74.5

Source: GLSS data, 2013 and 2017

Table A7: Average HCI by sex of household head and farm classification, 2013 and 2017

Panel A: 2013							
	Headship				Farm classification		
Crop	Overall	Male	Female	P-value	Small	Medium to large	P-value
All crops	69.5	69.2	70.2	0.312	69.9	68.2	0.074
Maize	58.8	58.6	59.4	0.642	59.3	57.0	0.112
Groundnut	71.7	69.9	77.9	**0.000**	74.0	66.6	**0.000**
Sorghum	61.4	61.2	68.4	0.454	60.5	62.1	0.662
Millet	65.8	66.3	56.6	0.237	64.1	67.0	0.459
Rice	52.1	52.5	48.4	0.270	51.7	52.6	0.702
Bean	57.2	58.2	49.0	0.020	53.8	61.1	**0.003**
Cassava	64.9	65.5	63.6	0.338	65.0	64.7	0.890
Yam	58.8	58.2	67.0	0.075	57.7	60.3	0.311
Cocoa	89.6	89.0	91.7	0.107	90.9	86.8	0.006
Plantain	61.6	61.8	61.1	0.756	60.0	64.8	0.040
Pepper	80.3	80.7	79.4	0.762	82.9	69.5	0.004
Okro	75.9	75.0	80.9	0.278	77.4	73.5	0.355
Oil palm	75.1	74.1	79.6	0.404	73.4	78.7	0.335
Cocoyam	66.1	69.0	55.3	0.088	62.2	71.7	0.161
Tomato	78.7	83.5	68.7	**0.006**	79.2	76.0	0.648
Panel B: 2017							
	Headship				Farm classification		
Crop	Overall	Male	Female	P-value	Small	Medium to large	P-value
All crops	62.4	61.9	63.7	0.104	62.7	61.5	0.292
Maize	46.6	46.9	45.4	0.394	47.3	44.2	0.060
Groundnut	68.5	66.3	76.2	**0.000**	70.5	64.0	**0.001**
Sorghum	41.4	42.2	29.3	0.131	39.0	43.4	0.281
Millet	53.3	54.1	41.3	0.134	49.5	56.4	0.096
Rice	47.7	47.8	46.1	0.677	46.5	49.3	0.249
Bean	48.3	49.0	42.3	0.119	44.2	53.4	**0.001**
Cassava	53.5	51.8	57.5	0.028	54.1	52.0	0.439
Yam	51.8	52.0	49.4	0.622	50.8	53.0	0.447
Cocoa	88.6	88.0	90.8	0.122	89.9	86.0	0.018
Plantain	52.3	51.5	54.2	0.367	50.2	56.8	**0.025**
Pepper	71.4	71.0	72.3	0.814	74.7	58.3	0.005
Okro	69.6	69.1	72.3	0.628	69.4	70.1	0.891
Oil palm	66.8	65.3	74.2	0.271	67.4	65.6	0.777
Cocoyam	47.9	47.5	49.5	0.856	44.2	53.5	0.279
Tomato	75.3	82.4	61.8	**0.002**	75.9	71.9	0.661

Source: GLSS data, 2013 and 2017

Table A8: Average number of hired labour by region and sex of household head, 2013 and 2017

Panel A: 2013									
	Male hired labour			Female hired labour			Total hired labour		
Region	**Male**	**Female**	**Total**	**Male**	**Female**	**Total**	**Male**	**Female**	**Total**
Western	7.0	3.4	6.3	5.2	4.6	5.1	12.1	8.0	11.4
Central	2.9	1.3	2.5	2.3	1.8	2.2	5.2	3.1	4.7
Greater Accra	2.5	3.2	2.7	0.9	2.1	1.3	3.4	5.3	3.9
Volta	4.7	1.2	3.9	5.2	3.0	4.7	9.9	4.2	8.7
Eastern	4.8	2.1	4.1	3.3	2.6	3.1	8.0	4.7	7.3
Ashanti	5.2	2.5	4.4	3.9	4.3	4.0	9.2	6.7	8.4
Brong Ahafo	9.3	3.5	7.8	6.8	6.1	6.6	16.2	9.6	14.5
Northern	7.4	2.8	7.2	11.9	7.3	11.7	19.3	10.1	18.9
Upper East	10.4	6.9	9.6	9.9	7.6	9.3	20.3	14.5	18.9
Upper West	11.0	5.0	10.1	13.7	7.3	12.7	24.8	12.4	22.7
Total	6.6	2.8	5.7	6.5	4.4	6.0	13.1	7.3	11.8
Panel B: 2017									
	Male hired labour			Female hired labour			Total hired labour		
Region	**Male**	**Female**	**Total**	**Male**	**Female**	**Total**	**Male**	**Female**	**Total**
Western	1.4	1.0	1.3	0.4	0.2	0.4	1.8	1.2	1.7
Central	9.1	1.4	6.4	1.0	0.6	0.9	10.1	2.0	7.2
Greater Accra	1.8	4.8	2.7	1.2	1.6	1.3	3.0	6.4	4.0
Volta	1.6	1.0	1.5	1.8	1.5	1.7	3.4	2.5	3.1
Eastern	3.5	2.4	3.2	1.9	0.7	1.6	5.4	3.0	4.8
Ashanti	2.6	1.8	2.3	1.4	1.3	1.3	3.9	3.1	3.6
Brong Ahafo	5.2	1.2	4.2	3.3	1.4	2.8	8.5	2.6	7.1
Northern	2.9	1.6	2.8	6.2	2.1	5.9	9.1	3.7	8.7
Upper East	2.7	2.3	2.6	3.5	2.5	3.3	6.2	4.9	5.9
Upper West	1.5	1.2	1.4	20.3	5.2	17.3	21.8	6.4	18.7
Total	3.3	1.6	2.9	3.4	1.3	2.9	6.8	3.0	5.8

Source: GLSS data, 2013 and 2017

B: Additional tables – by crops and regions

Table B1: Average quantity of crop sold (in kg) by region – 2013 and 2017

Panel A: 2013											
Crop	Western	Central	Greater Accra	Volta	Eastern	Ashanti	Brong Ahafo	Northern	Upper East	Upper West	Total
Maize	295.9	223.0	307.6	385.0	477.7	1058.8	1068.8	840.4	511.7	2852.9	801.4
Groundnut	163.4	7.0	.	274.5	426.0	301.2	321.2	474.4	355.4	472.2	397.2
Sorghum	.	.	.	236.4	.	.	41.7	302.1	112.2	307.1	251.2
Millet	279.0	.	.	139.3	105.0	46.0	420.9	357.2	266.0	338.0	310.9
Rice	3750.0	308.3	9729.0	786.3	10880.9	1690.9	1147.0	2133.8	761.0	428.5	1659.6
Bean	119.6	501.8	.	125.2	165.4	707.0	221.9	462.5	128.9	330.5	333.7
Cassava	1142.3	309.8	228.4	1852.1	928.6	697.8	2571.2	1243.3	.	461.4	1174.1
Yam	116.0	41.3	.	2498.2	897.2	1950.1	1851.6	3518.8	.	379.5	2294.4
Cocoa	970.6	412.1	1092.8	115.9	426.2	418.0	1016.1	.	.	.	615.0
Plantain	914.1	662.6	.	862.3	486.3	335.1	1457.6	.	.	750.0	715.9
Pepper	62.8	53.7	53.6	130.5	176.4	45.3	83.5	86.0	119.1	20.5	96.0
Okro	81.0	48.0	80.0	164.9	658.7	72.8	168.9	91.7	41.2	62.0	170.1
Oil palm	1331.1	3156.1	.	980.1	1222.0	11283.2	2424.4	.	.	.	4222.1
Cocoyam	223.2	276.8	.	.	313.7	48.9	1059.9	.	.	.	450.9
Tomato	178.3	59.6	875.0	117.0	374.2	809.8	184.3	224.6	316.9	.	258.3
Panel A: 2017											
Crop	Western	Central	Greater Accra	Volta	Eastern	Ashanti	Brong Ahafo	Northern	Upper East	Upper West	Total
Maize	459.5	270.9	11260.0	426.1	473.7	881.8	1309.6	538.6	312.2	1835.3	744.6
Groundnut	2100.0	79.4	.	424.2	1985.4	5527.4	498.7	387.0	133.3	543.8	1002.4
Sorghum	.	.	.	51.2	.	.	255.5	233.5	137.5	507.2	243.2
Millet	.	.	.	70.0	.	.	624.8	314.5	128.6	170.3	304.9
Rice	1221.8	.	.	880.1	760.7	1701.3	2006.4	1042.5	342.1	436.2	891.7
Bean	75.0	250.1	.	106.6	22.5	58.0	465.9	296.1	88.7	285.2	232.4
Cassava	824.0	639.9	2370.4	2303.5	1549.1	616.7	675.8	1100.0	.	4174.5	1064.2
Yam	70.2	97.4	100.0	2439.9	449.4	1034.3	1857.5	2168.8	.	475.4	1771.8
Cocoa	1699.1	859.0	160.0	413.0	5965.8	557.1	887.1	.	192.0	.	2158.8
Plantain	528.2	580.5	450.0	439.8	1001.7	1549.0	2634.1	.	.	.	1138.2
Pepper	54.5	63.8	108.3	35.0	343.9	55.7	204.3	83.7	184.3	225.0	195.1
Okro	531.9	105.7	103.9	196.0	3144.0	396.7	528.3	83.1	31.1	307.8	672.1
Oil palm	3167.2	3136.8	270.0	345.6	6101.9	3125.8	6636.9	.	.	.	4531.0
Cocoyam	326.6	145.3	.	269.0	221.8	75.8	162.3	.	.	.	225.4
Tomato	205.9	68.3	84.0	57.5	2118.3	1081.4	.	.	100.8	1000.0	672.0

Source: GLSS data, 2013 and 2017

Table B2: Average plot sizes (in ha) by region, 2013 and 2017

Crop	Western	Central	Greater Accra	Volta	Eastern	Ashanti	Brong Ahafo	Northern	Upper East	Upper West	Total
All crops	3.0	1.4	2.7	2.6	2.1	2.6	3.3	5.8	2.1	3.2	3.0
Maize	0.8	0.5	1.7	1.1	0.9	1.0	1.3	1.9	0.9	1.3	1.1
Groundnut	0.6	0.1	.	1.3	0.6	0.4	0.9	1.5	0.6	1.1	1.1
Sorghum	.	.	.	0.7	.	.	0.5	1.5	0.5	0.6	0.9
Millet	0.1	0.3	.	0.8	0.5	0.3	1.0	1.7	0.7	0.6	1.0
Rice	1.4	0.8	3.0	1.2	0.7	1.3	1.4	1.9	0.5	0.5	1.2
Bean	2.1	0.3	.	0.9	0.5	0.7	0.9	4.7	0.7	0.6	1.8
Cassava	0.5	0.5	0.9	0.9	0.6	0.6	0.8	1.3	.	0.3	0.7
Yam	0.4	0.4	.	1.6	1.1	0.6	0.8	1.0	0.6	0.4	0.9
Cocoa	2.2	1.7	6.9	2.6	2.3	2.5	3.9	1.2	.	.	2.4
Plantain	0.5	0.4	.	0.5	0.5	0.6	0.8	.	.	0.2	0.6
Pepper	0.4	0.2	1.4	0.8	0.8	0.2	0.5	1.6	0.1	0.2	0.5
Okro	0.4	0.1	0.4	1.1	0.9	0.3	0.5	1.1	0.3	0.3	0.6
Oil palm	0.5	0.6	.	1.1	1.3	0.4	0.8	.	0.0	0.5	0.7
Cocoyam	0.4	0.3	.	0.2	0.7	0.4	0.8	.	.	0.2	0.5
Tomato	0.5	0.2	1.5	0.8	1.1	0.4	0.4	2.3	0.2	0.3	0.6

Crop	Western	Central	Greater Accra	Volta	Eastern	Ashanti	Brong Ahafo	Northern	Upper East	Upper West	Total
All crops	5.3	1.3	7.7	1.9	2.3	2.2	2.8	4.3	1.9	2.7	2.8
Maize	0.5	0.4	0.7	1.1	0.8	0.9	1.3	1.6	0.7	1.1	1.0
Groundnut	0.0	0.1	0.2	1.0	0.9	0.6	0.6	1.2	0.5	0.9	0.9
Sorghum	.	.	.	0.4	.	.	0.7	1.3	0.6	0.8	0.9
Millet	.	.	.	1.0	.	.	0.7	1.7	0.6	1.0	1.0
Rice	1.3	0.7	.	0.9	0.9	1.0	1.6	1.5	0.4	0.6	0.9
Bean	0.1	0.3	0.2	0.7	0.3	0.9	0.6	1.3	0.5	0.7	0.9
Cassava	1.3	0.4	30.2	0.9	0.9	0.7	0.9	1.0	.	0.7	1.2
Yam	1.0	0.6	0.2	1.0	1.1	1.0	0.8	1.3	0.2	0.5	1.0
Cocoa	10.6	1.7	1.7	1.2	2.1	2.4	3.4	.	1.2	.	4.0
Plantain	0.8	0.4	0.4	0.6	1.1	0.9	2.3	.	.	.	1.0
Pepper	0.4	0.3	0.9	0.5	0.5	0.7	0.4	0.5	0.2	0.3	0.5
Okro	0.3	0.2	1.2	0.8	0.9	0.8	0.4	0.6	0.2	0.4	0.6
Oil palm	1.4	1.0	4.0	1.5	1.5	1.4	1.9	.	.	.	1.4
Cocoyam	0.7	0.3	.	0.9	0.9	1.0	3.5	.	.	.	0.9
Tomato	0.8	0.3	0.3	0.4	0.8	0.8	1.0	0.2	0.4	0.3	0.5

Source: GLSS data, 2013 and 2017

C: Additional tables – sex and farm classification

Table C1: Average quantity of crop produced (in kg) by sex of household head and farm classification, 2013 and 2017

		Headship			Farm classification		
Crop	**Overall**	**Male**	**Female**	**P-value**	**Small**	**Medium to large**	**P-value**
All crops							
Maize	848.0	978.5	355.6	0.000	535.5	1814.7	0.000
Groundnut	571.2	617.4	279.5	0.000	408.5	823.6	0.000
Sorghum	347.5	371.2	157.9	0.000	217.8	541.2	0.000
Millet	358.1	384.2	180.4	0.000	230.9	600.8	0.000
Rice	1634.2	1775.3	582.4	0.000	882.2	2804.2	0.000
Bean	351.9	386.6	89.5	0.000	185.6	565.1	0.000
Cassava	1716.7	1981.3	961.3	0.000	1610.4	1921.1	0.323
Yam	1880.6	2199.8	461.8	0.000	1209.8	2433.5	0.000
Cocoa	699.1	768.0	448.7	0.000	434.6	1269.5	0.000
Plantain	824.7	808.6	871.0	0.734	518.3	1336.9	0.000
Pepper	56.2	62.2	38.9	0.052	42.5	71.3	0.006
Okro	110.0	124.9	53.5	0.011	119.8	99.7	0.381
Oil palm	4214.4	3351.0	7046.5	0.177	3022.9	5470.0	0.291
Cocoyam	305.0	348.3	216.1	0.047	302.5	309.1	0.918
Tomato	161.7	174.5	105.4	0.158	147.8	175.2	0.470

		Headship			Farm classification		
Crop	**Overall**	**Male**	**Female**	**P-value**	**Small**	**Medium to large**	**P-value**
Maize	666.6	763.7	319.0	0.000	474.7	1405.1	0.000
Groundnut	693.5	708.1	645.0	0.252	605.2	919.4	0.000
Sorghum	241.8	262.7	110.3	0.001	167.7	356.0	0.000
Millet	261.5	290.4	104.7	0.000	163.1	428.9	0.000
Rice	1189.7	1326.8	465.9	0.000	743.6	2131.9	0.000
Bean	245.3	268.1	124.8	0.000	140.3	433.6	0.000
Cassava	1238.6	1285.7	1124.7	0.432	992.8	2048.0	0.000
Yam	1967.8	2125.7	795.6	0.000	1362.0	2969.5	0.000
Cocoa	1256.4	1453.5	538.1	0.392	474.2	2881.3	0.010
Plantain	1134.9	1163.5	1069.0	0.697	721.1	2186.7	0.000
Pepper	152.4	165.6	111.7	0.105	141.1	193.3	0.134
Okro	514.1	580.0	246.5	0.238	193.2	1202.0	0.000
Oil palm	8765.4	10688.1	2292.1	0.203	4123.9	18547.5	0.014
Cocoyam	251.1	269.6	196.4	0.536	175.5	382.2	0.051
Tomato	291.2	414.3	47.5	0.219	163.7	931.1	0.041

Source: GLSS data, 2013 and 2017

Table C2: Average quantity of crop sold (in kg) by sex of household head and farm classification, 2013 and 2017

		Headship			Farm classification		
Crop	**Overall**	**Male**	**Female**	**P-value**	**Small**	**Medium to large**	**P-value**
Maize	801.4	896.3	378.8	0.000	479.0	1631.6	0.000
Groundnut	397.2	422.1	216.1	0.000	280.4	545.0	0.000
Sorghum	251.2	263.6	86.5	0.082	137.0	352.7	0.000
Millet	310.9	327.3	123.1	0.011	195.1	422.5	0.000
Rice	1659.6	1744.5	721.3	0.023	1014.7	2321.6	0.000
Bean	333.7	354.2	92.7	0.090	188.0	463.4	0.001
Cassava	1174.1	1316.5	764.9	0.002	1034.7	1437.5	0.014
Yam	2294.4	2445.5	762.2	0.109	1918.4	2515.4	0.337
Cocoa	615.0	669.8	422.2	0.000	393.7	1079.0	0.000
Plantain	715.9	744.6	633.1	0.480	474.8	1068.2	0.000
Pepper	96.0	108.0	59.5	0.134	68.6	116.6	0.089
Okro	170.1	188.7	83.0	0.133	219.6	134.8	0.118
Oil palm	4222.1	4575.8	2670.3	0.409	4777.6	3599.5	0.513
Cocoyam	450.9	530.1	281.4	0.076	588.0	302.2	0.028
Tomato	258.3	275.3	147.1	0.252	289.5	242.0	0.554
		Headship				**Farm classification**	
Crop	**Overall**	**Male**	**Female**	**P-value**	**Small**	**Medium to large**	**P-value**
Maize	744.6	854.3	306.7	0.038	483.1	1606.3	0.000
Groundnut	1002.4	786.9	1741.3	0.000	1070.4	850.9	0.325
Sorghum	243.2	245.0	195.9	0.864	159.0	308.4	0.174
Millet	304.9	316.2	112.8	0.074	171.7	401.5	0.000
Rice	891.7	957.0	321.1	0.007	599.0	1281.6	0.000
Bean	232.4	249.5	94.6	0.061	118.1	365.5	0.000
Cassava	1064.2	1121.6	944.0	0.353	876.0	1558.8	0.001
Yam	1771.8	1856.6	662.3	0.051	1043.1	2695.7	0.000
Cocoa	2158.8	2557.2	728.4	0.336	833.6	4940.8	0.014
Plantain	1138.2	1106.0	1207.8	0.736	625.4	2191.6	0.000
Pepper	195.1	221.6	123.6	0.052	183.7	243.2	0.298
Okro	672.1	746.1	288.6	0.240	286.8	1312.7	0.000
Oil palm	4531.0	5237.9	1408.7	0.028	2590.0	8857.4	0.000
Cocoyam	225.4	246.2	150.9	0.408	118.3	383.0	0.005
Tomato	672.0	892.7	51.5	0.142	270.9	1602.4	0.013

Source: GLSS data, 2013 and 2017

Table C3: Average value of crop produced (in Ghana Cedis) by sex of household head and farm classification, 2013 and 2017

Crop	Overall	Headship		P-value	Farm classification		P-value
		Male	Female		Small	Medium to large	
Maize	716.5	823.2	308.6	0.002	480.4	1414.6	0.000
Groundnut	706.5	755.3	386.4	0.000	512.1	984.8	0.000
Sorghum	278.2	294.9	128.1	0.000	194.6	391.4	0.000
Millet	446.5	473.7	199.9	0.005	272.9	641.0	0.000
Rice	909.2	976.4	362.9	0.000	592.5	1315.5	0.000
Bean	468.2	508.2	110.4	0.002	241.2	699.7	0.000
Cassava	461.2	505.4	338.3	0.019	445.4	491.4	0.487
Yam	2267.4	2597.6	438.0	0.044	996.2	3244.3	0.004
Cocoa	2340.4	2586.3	1453.2	0.000	1426.8	4298.3	0.000
Plantain	348.8	363.6	305.6	0.213	265.1	490.3	0.000
Pepper	177.4	191.8	130.7	0.316	173.2	181.1	0.880
Okro	216.1	255.8	56.8	0.012	282.2	166.7	0.070
Oil palm	585.0	578.4	608.7	0.905	427.6	755.7	0.117
Cocoyam	184.2	196.1	156.7	0.355	163.0	216.5	0.181
Tomato	310.6	335.7	161.3	0.187	388.2	255.6	0.159

Crop	Overall	Headship		P-value	Farm classification		P-value
		Male	Female		Small	Medium to large	
Maize	850.8	941.6	532.5	0.000	676.9	1472.3	0.000
Groundnut	1272.3	1290.3	1214.3	0.627	1074.7	1749.4	0.000
Sorghum	727.5	751.8	563.7	0.408	410.7	1195.3	0.000
Millet	508.6	558.2	176.9	0.017	368.8	671.5	0.005
Rice	811.3	862.3	691.2	0.220	684.9	1200.8	0.000
Bean	366.1	386.9	177.2	0.039	272.6	462.9	0.002
Cassava	1249.8	1342.5	629.1	0.004	1012.3	1664.1	0.000
Yam	9441.8	10950.2	3988.9	0.410	3418.9	21929.8	0.013
Cocoa	918.9	968.2	808.3	0.249	674.5	1510.4	0.000
Plantain	2746.1	3009.5	781.3	0.007	1844.5	4163.6	0.000
Pepper	943.0	961.8	886.6	0.701	902.3	1093.4	0.356
Okro	1309.2	1444.8	695.4	0.291	425.0	3179.4	0.000
Oil palm	2901.8	3451.6	470.5	0.157	1618.1	5281.9	0.032
Cocoyam	296.1	313.7	227.1	0.596	213.3	433.2	0.103
Tomato	1035.6	1479.1	144.0	0.103	1045.4	972.6	0.949

Source: GLSS data, 2013 and 2017

Table C4: Average value of crop sold (in Ghana Cedis) by sex of household head and farm classification, 2013 and 2017

		Headship			Farm classification		
Crop	**Overall**	**Male**	**Female**	**P-value**	**Small**	**Medium to large**	**P-value**
Maize	555.0	614.6	289.4	0.000	382.9	998.3	0.000
Groundnut	471.6	497.4	283.7	0.000	327.5	653.9	0.000
Sorghum	186.0	193.4	87.2	0.060	111.7	252.0	0.000
Millet	266.4	279.4	117.5	0.016	173.7	355.8	0.000
Rice	797.2	827.6	461.5	0.110	571.5	1028.9	0.000
Bean	365.4	389.9	78.5	0.030	208.8	504.9	0.000
Cassava	335.8	367.0	246.0	0.064	326.9	352.6	0.669
Yam	1466.7	1548.7	634.6	0.098	1171.2	1640.3	0.151
Cocoa	2039.5	2225.9	1384.9	0.000	1279.9	3632.3	0.000
Plantain	295.8	312.4	248.0	0.216	229.1	393.4	0.000
Pepper	253.9	278.4	179.2	0.381	266.5	244.5	0.824
Okro	226.4	261.4	62.0	0.051	262.9	200.4	0.429
Oil palm	369.4	405.4	211.5	0.094	286.7	462.1	0.052
Cocoyam	169.1	192.3	119.4	0.277	195.9	140.0	0.371
Tomato	443.9	478.6	217.8	0.168	646.2	338.3	0.022

		Headship			Farm classification		
Crop	**Overall**	**Male**	**Female**	**P-value**	**Small**	**Medium to large**	**P-value**
Maize	906.0	1021.7	444.5	0.155	608.4	1886.7	0.001
Groundnut	1611.9	1236.8	2897.9	0.000	1767.0	1266.0	0.223
Sorghum	464.3	497.8	192.6	0.134	230.2	736.5	0.000
Millet	486.5	507.2	133.1	0.364	412.3	540.2	0.504
Rice	639.3	691.0	531.0	0.238	558.3	852.1	0.038
Bean	282.3	284.0	240.2	0.860	184.7	358.0	0.070
Cassava	782.2	824.8	410.2	0.066	614.0	1006.3	0.004
Yam	8760.0	10085.6	4000.0	0.543	4872.7	16920.5	0.173
Cocoa	785.0	805.1	741.7	0.617	510.1	1349.8	0.000
Plantain	1951.9	2058.5	557.5	0.025	1131.6	2991.9	0.000
Pepper	1022.2	1105.0	798.4	0.144	990.7	1154.9	0.489
Okro	1670.3	1816.9	910.5	0.381	541.4	3546.9	0.000
Oil palm	1397.6	1628.0	380.2	0.036	1071.3	2124.9	0.034
Cocoyam	277.5	299.1	200.0	0.459	175.3	427.8	0.022
Tomato	1587.7	2112.8	110.8	0.059	1286.4	2286.5	0.331

Source: GLSS data, 2013 and 2017

Table C5: Average cultivated plot sizes (in ha) by sex of household head and farm classification, 2013 and 2017

Panel A: 2013							
		Headship			Farm classification		
Crop	Overall	Male	Female	P-value	Small	Medium to large	P-value
All crops	3.0	3.3	1.8	0.000	1.3	8.4	0.000
Maize	1.1	1.2	0.8	0.000	0.7	2.5	0.000
Groundnut	1.1	1.2	0.5	0.000	0.6	2.0	0.000
Sorghum	0.9	1.0	0.5	0.000	0.4	1.7	0.000
Millet	1.0	1.1	0.6	0.000	0.5	1.9	0.000
Rice	1.2	1.3	0.6	0.549	0.5	2.2	0.000
Bean	1.8	2.0	1.0	0.000	0.4	3.7	0.001
Cassava	0.7	0.7	0.5	0.000	0.4	1.2	0.000
Yam	0.9	1.0	0.5	0.000	0.4	1.3	0.000
Cocoa	2.4	2.6	1.7	0.105	1.2	5.1	0.000
Plantain	0.6	0.6	0.5	0.006	0.3	1.0	0.000
Pepper	0.5	0.6	0.4	0.001	0.2	0.8	0.000
Okro	0.6	0.7	0.4	0.066	0.2	1.0	0.000
Oil palm	0.7	0.7	0.5	0.000	0.4	1.0	0.000
Cocoyam	0.5	0.6	0.5	0.182	0.3	1.0	0.000
Tomato	0.6	0.7	0.3	0.013	0.2	1.0	0.000
Panel B: 2017							
		Headship			Farm classification		
Crop	Overall	Male	Female	P-value	Small	Medium to large	P-value
All crops	2.8	3.2	1.6	0.000	1.2	9.6	0.000
Maize	1.0	1.1	0.7	0.000	0.7	2.4	0.000
Groundnut	0.9	1.0	0.6	0.000	0.6	1.6	0.000
Sorghum	0.9	1.0	0.5	0.000	0.5	1.6	0.000
Millet	1.0	1.1	0.5	0.000	0.5	2.0	0.000
Rice	0.9	1.0	0.4	0.000	0.5	1.8	0.000
Bean	0.9	0.9	0.4	0.000	0.4	1.6	0.000
Cassava	1.2	1.4	0.7	0.124	0.5	3.5	0.021
Yam	1.0	1.0	0.8	0.364	0.6	1.6	0.000
Cocoa	4.0	4.5	2.0	0.175	1.3	9.7	0.001
Plantain	1.0	1.0	0.8	0.154	0.5	2.1	0.000
Pepper	0.5	0.5	0.4	0.756	0.4	0.9	0.000
Okro	0.6	0.6	0.7	0.039	0.4	1.2	0.000
Oil palm	1.4	1.5	1.0	0.190	0.7	2.7	0.000
Cocoyam	0.9	0.8	1.2	0.417	0.4	1.9	0.000
Tomato	0.5	0.6	0.4	0.005	0.4	1.0	0.000

Source: GLSS data, 2013 and 2017

II. Nigeria

A: Main tables

Table A1: Sample distribution of households by zone and crop, 2010 and 2015

Panel A: 2010							
Crop	**North Central**	**North East**	**North West**	**South East**	**South South**	**South West**	**Total**
Maize	77	109	82	38	24	18	348
Groundnut	18	48	38	1	1	1	107
Sorghum	74	119	181	0	0	0	374
Millet	24	103	126	0	0	0	253
Rice	33	38	27	8	3	0	109
Bean	28	160	128	0	2	1	319
Cassava	56	3	5	45	82	33	224
Yam	72	4	5	117	60	34	292
Cocoa	0	0	0	0	1	35	36
Plantain	0	0	1	8	6	7	22
Pepper	9	5	13	1	0	3	31
Okro	3	5	4	13	3	1	29
Cocoyam	0	0	1	22	6	6	35
Soybeans	4	5	9	0	0	1	19
Panel B: 2015							
Crop	**North Central**	**North East**	**North West**	**South East**	**South South**	**South West**	**Total**
Maize	138	162	159	25	9	31	524
Groundnut	3	18	10	0	1	2	34
Sorghum	51	73	231	0	0	0	355
Millet	13	131	236	0	0	0	380
Rice	35	30	30	10	1	0	106
Bean	10	17	9	0	0	0	36
Cassava	32	1	1	48	190	18	290
Yam	131	8	5	163	81	25	413
Cocoa	0	0	0	0	3	79	82
Plantain	1	0	0	3	8	4	17
Pepper	4	3	2	1	1	2	13
Okro	3	0	0	1	2	3	9
Cocoyam	0	1	0	34	0	3	38
Soybeans	8	2	16	0	0	1	27

Source: Nigeria GHS-Panel data, 2010 and 2015

Table A2: Sample distribution of households by crop, sex and farm classification, 2010 and 2015

Crop	Panel A: 2010					Panel B: 2015				
	Total	Sex		Farm classification		Total	Sex		Farm classification	
		Male	Female	Small	Medium to large		Male	Female	Small	Medium to large
All crops	2,089	1,902	187	1,565	524	2,339	2,035	304	1,864	475
Maize	353	319	34	265	88	524	477	47	410	114
Groundnut	91	86	5	76	15	34	29	5	27	7
Sorghum	335	327	8	203	132	355	338	17	251	104
Millet	225	221	4	134	91	379	365	14	251	128
Rice	93	89	4	79	14	106	95	11	91	15
Bean	240	234	6	152	88	36	35	1	28	8
Cassava	214	175	39	183	31	281	193	88	252	29
Yam	299	252	47	255	44	410	328	82	362	48
Cocoa	30	25	5	26	4	82	73	9	75	7
Plantain	22	17	5	21	1	17	13	4	17	0
Pepper	29	28	1	22	7	11	11	0	11	0
Okro	28	22	6	25	3	9	4	5	9	0
Cocoyam	58	37	21	57	1	38	24	14	38	0
Soybeans	24	23	1	21	3	27	25	2	16	11

Source: Nigeria GHS-Panel data, 2010 and 2015

Table A3: Average quantity of crop produced (in kg) by zones and crop – 2010 ad 2015

Panel A: 2010							
Crop	**North Central**	**North East**	**North West**	**South East**	**South South**	**South West**	**Total**
Maize	1556.5	1337.5	1028.8	713.5	821.6	1209.2	1162.0
Groundnut	743.0	934.6	682.5	61.5	240.2	229.1	766.5
Sorghum	3031.3	1732.0	1157.8	.	.	247.6	1620.3
Millet	930.6	1105.5	1551.1	.	.	.	1400.8
Rice	1006.9	1306.5	921.0	45693.8	809.6	686.2	3673.0
Bean	340.4	672.0	373.0	30.0	6.5	133.3	469.2
Cassava	2410.9	1533.4	619.6	540.6	756.1	2476.8	1531.6
Yam	5456.8	2186.7	2303.2	933.1	2027.1	4301.5	2913.8
Cocoa	.	.	.	.	526.2	403.2	408.7
Plantain	111.0	.	8400.0	76.3	179.2	489.4	299.5
Pepper	252.7	855.0	672.9	119.1	34.9	1157.0	670.0
Okro	88.7	140.8	142.5	783.4	28.8	394.8	358.6
Cocoyam	361.5	200.0	26.7	811.2	251.3	766.7	672.9
Soybeans	496.8	402.2	500.7	.	.	100.0	478.8
Panel B: 2015							
Crop	**North Central**	**North East**	**North West**	**South East**	**South South**	**South West**	**Total**
Maize	1232.9	1611.2	1529.5	274.9	1298.5	1904.7	1187.2
Groundnut	516.1	706.7	561.6	7.1	101.8	1906.5	636.7
Sorghum	739.5	1060.7	1194.5	.	.	2910.8	1107.4
Millet	1048.2	1091.4	1269.0	.	.	.	1223.3
Rice	1475.8	3046.0	1479.1	2197.9	807.2	.	1907.0
Bean	481.8	586.8	293.6	19.3	85.8	4757.1	408.8
Cassava	1917.3	848.4	548.4	574.4	2345.8	3910.9	2068.8
Yam	10697.2	5162.7	2310.9	922.6	2050.5	3881.7	4144.6
Cocoa	.	.	.	.	237.5	615.9	602.1
Plantain	25.5	.	.	33.0	250.3	958.3	413.9
Pepper	269.9	271.6	399.3	35.6	24.0	156.1	220.5
Okro	103.0	125.9	201.6	52.3	45.5	933.1	110.5
Cocoyam	7.2	340.7	289.0	67.5	192.1	206.8	110.4
Soybeans	405.4	394.2	798.3	.	.	1711.2	737.7

Source: Nigeria GHS-Panel data, 2010 and 2015

Table A4: Average value of crop produced (in Naira) by zone, 2010 and 2015

Panel A: 2010							
Crop	**North Central**	**North East**	**North West**	**South East**	**South South**	**South West**	**Total**
Maize	44,391.78	370,966.30	59,708.39	17,212.48	10,610.49	63,655.03	105,146.50
Groundnut	37,388.46	60,471.31	50,171.27	2,900.42	11,935.33	8,891.43	50,502.56
Sorghum	52,710.21	230,638.90	94,373.89	.	.	20,269.60	115,627.60
Millet	61,407.74	49,850.11	114,261.40	.	.	.	86,389.61
Rice	54,660.15	46,058.40	51,346.96	4,131,603.00	5,543.86	54,166.67	410,866.70
Bean	100,663.30	43,180.92	32,241.34	.	.	10,666.67	45,778.22
Cassava	41,888.96	43,665.99	26,553.16	22,930.10	34,461.92	3,777,297.00	890,869.70
Yam	209,756.10	124,928.20	69,740.46	101,253.50	128,931.00	135,812.40	144,917.50
Cocoa	.	.	.	.	168,469.10	124,483.50	126,450.10
Plantain	5,963.64	.	84,000.00	6,238.36	20,137.56	24,825.36	16,855.99
Pepper	41,883.85	71,045.58	70,127.70	6,457.74	5,416.75	55,913.56	57,942.79
Okro	3,015.08	11,921.60	6,476.00	17,630.36	3,681.20	7,767.04	9,573.41
Cocoyam	4,212.43	.	.	47,973.57	19,245.81	13,978.29	37,091.24
Soybeans	37,984.49	30,729.32	54,234.73	.	.	7,000.00	46,284.16
Panel B: 2015							
Crop	**North Central**	**North East**	**North West**	**South East**	**South South**	**South West**	**Total**
Maize	58,333.41	90,938.56	79,500.97	11,530.99	30,087.62	79,856.16	57,721.12
Groundnut	53,641.14	57,306.41	45,589.58	898.66	7,882.14	225,233.10	55,150.81
Sorghum	55,470.72	48,130.45	56,525.95	.	.	220,142.00	55,578.79
Millet	77,279.47	52,829.69	58,963.80	.	.	.	58,915.06
Rice	99,981.11	152,423.10	104,839.20	102,070.80	108,650.40	.	115,156.70
Bean	52,815.69	58,097.49	31,921.49	4,066.82	5,000.00	972,866.20	47,045.09
Cassava	38,428.42	29,406.27	19,904.18	11,916.05	61,909.92	94,900.54	51,552.69
Yam	365,032.50	191,032.10	40,403.82	43,491.26	122,159.00	323,736.90	176,602.80
Cocoa	.	.	.	.	83,681.88	299,422.50	290,498.00
Plantain	12,896.29	.	.	6,877.29	38,947.33	58,267.75	32,291.60
Pepper	52,297.27	69,331.78	63,681.84	10,739.79	10,511.94	24,024.96	39,398.32
Okro	7,767.21	9,199.01	14,654.44	6,376.69	11,131.61	35,000.00	9,901.03
Cocoyam	2,000.00	15,000.00	15,000.00	7,855.23	14,259.86	15,048.20	10,034.35
Soybeans	51,370.99	33,811.36	64,774.84	.	.	166,067.60	63,891.30

Source: Nigeria GHS-Panel data, 2010 and 2015

Table A5: Average value of sales (in Naira) by zone, 2010 and 2015

Panel A: 2010							
Crop	**North Central**	**North East**	**North West**	**South East**	**South South**	**South West**	**Total**
Maize	22,354.25	17,024.72	18,747.18	6,811.19	10,574.46	66,515.86	20,970.97
Groundnut	20,662.96	31,509.43	40,779.95	2,171.60	9,820.36	8,891.43	30,598.26
Sorghum	17,665.11	9,149.56	10,454.00	.	.	16,121.94	12,201.07
Millet	25,179.26	9,885.21	8,405.24	.	.	.	11,346.27
Rice	75,592.83	18,976.93	48,678.32	86,664.86	14,273.17	65,000.00	52,133.31
Bean	39,567.50	18,066.12	10,189.39	.	.	6,666.67	17,849.67
Cassava	26,279.27	32,634.09	45,758.08	6,950.74	18,472.55	4,352,086.00	1,118,546.00
Yam	53,071.56	184,278.00	61,411.66	67,587.56	73,588.25	178,916.90	85,543.20
Cocoa	.	.	.	.	88,451.74	127,074.20	125,150.40
Plantain	3,659.09	.	84,000.00	5,222.06	12,459.47	23,282.56	14,802.78
Pepper	22,963.07	17,928.93	50,180.60	5,098.93	4,073.40	51,207.18	39,327.93
Okro	1,990.06	9,158.44	6,258.61	3,286.40	3,802.27	6,388.18	4,246.43
Cocoyam	1,264.14	.	.	5,465.27	1,546.28	13,662.05	6,870.37
Soybeans	28,121.89	14,454.33	29,169.26	.	.	7,000.00	26,494.11
Panel B: 2015							
Crop	**North Central**	**North East**	**North West**	**South East**	**South South**	**South West**	**Total**
Maize	14,632.83	19,675.97	24,001.90	8,732.83	25,319.56	68,412.70	21,742.68
Groundnut	38,024.91	25,784.71	33,597.31	.	10,295.65	198,576.40	39,189.58
Sorghum	46,816.62	27,752.59	33,052.86	3,708.15	.	981,090.90	39,455.09
Millet	30,978.22	14,621.68	14,899.93	4,944.19	26,057.20	68,978.71	28,675.82
Rice	14,232.82	5,447.57	14,282.39	.	.	231,131.60	14,809.22
Bean	5,659.40	3,736.90	9,845.85	.	.	.	8,458.30
Cassava	66,567.40	46,654.93	56,305.20	83,437.46	31,113.64	.	58,968.06
Yam	.	.	.	.	-	323,615.30	314,231.40
Cocoa	11,850.24	.	.	5,738.40	36,325.73	53,430.20	33,781.26
Plantain	67,797.50	66,555.50	13,369.47	18,892.74	71,204.86	211,584.50	67,111.97
Pepper	42,440.27	44,106.72	44,339.47	13,126.99	17,378.29	22,386.38	31,928.32
Okro	200.62	72.42	475.98	587.93	262.40	232.41	356.80
Cocoyam	.	10,000.00	.	4,158.08	4,098.77	11,997.87	6,094.09
Soybeans	32,135.45	20,193.79	37,612.84	.	.	157,522.00	42,713.69

Source: Nigeria GHS-Panel data, 2010 and 2015

Table A6: HCI by zones – 2010 and 2015

Panel A: 2010							
Crop	**North Central**	**North East**	**North West**	**South East**	**South South**	**South West**	**Total**
All crops	31.0	21.4	21.9	19.7	35.6	68.7	29.2
Maize	43.5	16.7	28.0	47.7	74.0	69.2	39.6
Groundnut	55.3	47.7	48.1	53.1	74.7	100.0	51.3
Sorghum	33.8	16.5	19.4	.	.	78.4	23.1
Millet	40.4	18.8	17.2	.	.	.	21.2
Rice	74.1	56.1	58.1	51.9	69.7	.	58.7
Bean	57.5	46.4	45.6	.	.	70.0	48.0
Cassava	55.8	40.2	93.1	28.3	48.6	66.9	54.1
Yam	29.3	62.6	49.7	24.7	42.3	61.1	36.7
Cocoa	.	.	.	.	89.1	95.0	94.7
Plantain	62.8	.	100.0	66.4	61.9	88.9	75.1
Pepper	64.5	46.2	67.2	79.1	80.8	86.7	70.4
Okro	61.7	68.5	73.0	51.6	87.9	81.7	64.6
Cocoyam	56.9	.	.	27.1	41.3	64.9	39.3
Soybeans	59.4	50.5	70.7	.	.	100.0	65.8
Panel B: 2015							
Crop	**North Central**	**North East**	**North West**	**South East**	**South South**	**South West**	**Total**
All crops	24.6	15.5	16.6	25.9	31.8	69.7	25.5
Maize	26.3	12.7	23.5	57.0	73.2	71.9	36.8
Groundnut	69.3	49.9	53.2	.	91.0	87.3	56.3
Sorghum	23.0	10.0	17.2	.	.	93.1	17.5
Millet	25.9	4.9	12.0	.	.	.	11.1
Rice	53.1	39.8	42.3	45.4	33.4	.	44.8
Bean	53.5	49.6	56.8	79.9	.	86.0	54.4
Cassava	68.3	47.8	56.9	32.7	29.0	66.4	42.9
Yam	24.0	47.4	34.6	26.4	48.8	55.4	33.7
Cocoa	.	.	.	.	0.0	91.9	89.3
Plantain	90.8	.	.	60.8	73.2	75.5	72.1
Pepper	66.6	61.1	73.8	69.7	65.6	68.4	68.9
Okro	59.0	48.7	46.8	39.9	26.2	100.0	43.2
Cocoyam	.	66.7	.	36.7	41.2	62.1	43.4
Soybeans	52.9	48.4	63.4	.	.	92.7	62.5

Source: Nigeria GHS-Panel data, 2010 and 2015

B: Additional tables – by crops and zones

Table B1: Average quantity of crop sold (in kg) by zone – 2010 and 2015

Panel A: 2010							
Crop	**North Central**	**North East**	**North West**	**South East**	**South South**	**South West**	**Total**
Maize	435.1	196.4	376.3	262.1	1083.2	1503.9	467.2
Groundnut	471.6	382.1	571.2	673.0	238.8	229.5	466.7
Sorghum	401.4	155.7	170.6	.	.	182.4	216.5
Millet	424.1	185.8	136.0	.	.	.	177.9
Rice	1407.0	419.5	947.3	2492.0	489.2	600.0	1026.8
Bean	241.9	276.8	122.9	.	0.0	83.3	202.1
Cassava	1740.0	254.5	710.4	167.3	416.8	2692.0	1267.6
Yam	1350.7	2049.9	4453.6	889.9	1096.1	6817.7	2217.5
Cocoa	.	.	.	.	317.7	397.1	393.2
Plantain	71.5	.	8400.0	60.2	146.2	408.6	322.7
Pepper	293.4	229.5	899.2	111.0	50.0	1243.4	760.2
Okro	68.5	205.4	157.6	384.6	37.3	369.8	225.0
Cocoyam	37.4	.	.	210.9	26.1	981.5	360.3
Soybeans	471.5	147.0	364.0	.	.	100.0	344.4
Panel B: 2015							
Crop	**North Central**	**North East**	**North West**	**South East**	**South South**	**South West**	**Total**
Maize	1248.3	739.5	852.5	210.6	1162.5	1718.3	806.4
Groundnut	447.9	500.1	442.3	.	91.0	1692.5	531.0
Sorghum	463.2	359.0	732.4	.	.	3068.0	688.5
Millet	255.1	316.0	635.2	.	.	.	557.6
Rice	1110.1	1330.1	1070.5	2023.1	502.7	.	1217.8
Bean	361.6	546.3	275.4	22.9	.	4149.3	408.0
Cassava	2004.5	824.3	960.7	368.1	2322.8	4734.8	2247.3
Yam	2529.3	2662.9	1286.7	516.5	3652.4	3219.5	2174.6
Cocoa	.	.	.	.	.	559.0	559.0
Plantain	22.5	.	.	26.9	415.4	1044.4	559.5
Pepper	381.4	174.4	375.9	36.8	76.2	148.7	233.5
Okro	94.0	140.4	160.8	51.5	29.5	933.1	104.4
Cocoyam	.	227.2	.	55.1	245.7	201.8	119.9
Soybeans	331.4	205.2	515.7	.	.	1624.4	542.0

Source: Nigeria GHS-Panel data, 2010 and 2015

Table B2: Average plot sizes (in ha) by zone, 2010 and 2015

Panel A: 2010							
Crop	**North Central**	**North East**	**North West**	**South East**	**South South**	**South West**	**Total**
All crops	4.5	8.1	5.1	1.5	1.7	2.9	4.6
Maize	3.3	6.4	5.0	2.1	1.7	3.9	4.3
Groundnut	3.5	3.5	3.2	0.2	2.0	1.5	3.2
Sorghum	3.8	9.2	5.4	.	.	2.0	5.9
Millet	7.5	12.4	5.3	.	.	.	7.2
Rice	4.1	6.7	5.8	5.7	24.5	.	5.9
Bean	2.1	7.8	5.0	0.2	.	.	5.8
Cassava	4.8	4.3	0.5	0.9	1.5	2.2	2.3
Yam	6.3	3.0	7.1	1.6	1.8	4.8	3.7
Cocoa	.	.	.	.	0.9	1.8	1.7
Plantain	.	.	.	0.0	0.1	0.3	0.2
Pepper	11.5	25.5	2.3	1.1	0.5	4.1	5.0
Okro	1.2	.	9.0	0.7	0.3	.	2.6
Cocoyam	.	.	4.0	0.7	0.2	3.1	1.3
Soybeans	1.4	0.6	4.1	.	.	0.3	2.8
Panel B: 2015							
Crop	**North Central**	**North East**	**North West**	**South East**	**South South**	**South West**	**Total**
All crops	3.2	5.9	4.7	0.7	1.6	2.7	3.6
Maize	1.8	4.8	5.5	0.6	0.9	1.9	4.0
Groundnut	35.4	3.5	5.1	.	1.8	1.0	6.0
Sorghum	1.3	4.8	4.9	.	.	.	4.5
Millet	4.0	10.6	4.1	.	.	.	5.5
Rice	2.6	2.5	3.6	0.2	0.2	.	2.8
Bean	4.3	3.2	4.0	.	.	.	3.8
Cassava	2.2	2.4	0.8	0.9	1.8	1.5	1.7
Yam	4.4	1.7	0.4	0.7	1.5	2.6	2.3
Cocoa	.	.	.	.	.	3.7	3.6
Plantain	0.3	.	.	0.1	0.1	0.4	0.2
Pepper	5.7	2.0	5.8	1.4	0.5	0.3	4.2
Okro	1.2	.	0.9	0.0	0.2	.	0.6
Cocoyam	.	0.8	.	0.3	.	1.8	0.4
Soybeans	13.2	5.8	5.0	.	.	2.0	7.4

Source: Nigeria GHS-Panel data, 2010 and 2015

C: Additional tables – sex and farm classification

Table C1: Average quantity of crop produced (in kg) by sex of household head and farm classification, 2010 and 2015

Panel A: 2010							
	Headship				Farm classification		
Crop	Overall	Male	Female	P-value	Small	Medium	P-value
Maize	1162.0	1222.5	672.8	0.051	906.3	2200.2	0.000
Groundnut	766.5	782.4	259.6	0.187	645.1	998.5	0.013
Sorghum	1620.3	1629.3	1123.2	0.770	1242.8	2504.0	0.024
Millet	1400.8	1410.3	411.5	0.598	825.0	2321.4	0.001
Rice	3673.0	3812.1	1960.5	0.716	1216.8	14975.7	0.001
Bean	469.2	462.8	855.2	0.120	393.8	547.8	0.016
Cassava	1531.6	1667.9	860.6	0.006	1419.0	3030.9	0.000
Yam	2913.8	3258.9	1220.5	0.000	2522.0	6536.2	0.000
Cocoa	408.7	430.7	193.7	0.381	310.8	398.2	0.470
Plantain	299.5	310.2	224.3	0.735	279.8	1882.3	0.004
Pepper	670.0	678.6	484.2	0.748	743.4	679.6	0.845
Okro	358.6	367.3	326.1	0.877	412.2	95.6	0.487
Cocoyam	672.9	718.7	563.4	0.623	566.2	422.1	0.724
Soybeans	478.8	479.3	447.3	0.961	426.5	486.8	0.749
Panel B: 2015							
	Headship				Farm classification		
Crop	Overall	Male	Female	P-value	Small	Medium	P-value
Maize	1187.2	1322.6	443.1	0.001	1174.8	1958.6	0.004
Groundnut	636.7	642.3	530.6	0.535	582.6	770.2	0.027
Sorghum	1107.4	1108.1	1091.7	0.950	981.2	1403.4	0.000
Millet	1223.3	1213.3	1494.9	0.288	1187.3	1338.4	0.152
Rice	1907.0	1924.4	1608.4	0.800	1741.4	2622.8	0.213
Bean	408.8	417.9	249.4	0.222	379.1	496.6	0.096
Cassava	2068.8	2335.8	1195.5	0.134	1568.6	3474.3	0.001
Yam	4144.6	4604.4	2466.8	0.006	3760.0	12126.7	0.000
Cocoa	602.1	627.3	237.9	0.193	486.6	1433.2	0.000
Plantain	413.9	519.1	55.0	0.212	355.3	5861.7	0.000
Pepper	220.5	250.1	14.7	0.102	194.0	389.6	0.130
Okro	110.5	130.5	45.0	0.004	103.4	154.1	0.190
Cocoyam	110.4	126.0	79.2	0.153	113.2	840.8	0.000
Soybeans	737.7	747.8	478.2	0.589	623.1	946.9	0.101

Source: Nigeria GHS-Panel data, 2010 and 2015

Table C2: Average quantity of crop sold (in kg) by sex of household head and farm classification, 2010 and 2015

Panel A: 2010							
	Headship				Farm classification		
Crop	Overall	Male	Female	P-value	Small	Medium	P-value
Maize	467.2	486.0	329.8	0.320	332.7	805.1	0.000
Groundnut	466.7	484.7	98.0	0.263	259.4	714.6	0.000
Sorghum	216.5	219.3	27.5	0.342	185.3	238.8	0.331
Millet	177.9	179.0	73.7	0.660	120.2	234.9	0.025
Rice	1026.8	988.2	2080.8	0.145	1075.6	923.6	0.671
Bean	202.1	203.5	122.2	0.466	171.2	239.3	0.036
Cassava	1267.6	1413.3	630.7	0.025	913.6	2136.9	0.001
Yam	2217.5	2480.3	430.7	0.165	1177.6	1862.2	0.026
Cocoa	393.2	418.3	171.8	0.299	293.9	340.0	0.735
Plantain	322.7	338.2	206.9	0.708	196.8	1870.1	0.007
Pepper	760.2	779.7	427.2	0.672	937.4	585.7	0.570
Okro	225.0	202.3	305.1	0.550	106.7	74.9	0.595
Cocoyam	360.3	419.7	256.1	0.610	85.6	315.8	0.109
Soybeans	344.4	346.6	238.0	0.843	322.5	428.1	0.587
Panel B: 2015							
	Headship				Farm classification		
Crop	Overall	Male	Female	P-value	Small	Medium	P-value
Maize	806.4	902.0	384.4	0.075	758.3	1525.8	0.023
Groundnut	531.0	541.8	321.1	0.664	586.0	472.4	0.627
Sorghum	688.5	679.5	933.5	0.371	499.5	945.6	0.000
Millet	557.6	557.6	407.7	0.155	431.0	651.0	0.012
Rice	1217.8	1265.7	656.4	0.210	1265.0	1071.9	0.537
Bean	408.0	418.3	221.1	0.641	459.2	347.1	0.573
Cassava	2247.3	2431.8	1603.0	0.302	1856.4	5014.5	0.002
Yam	2174.6	2325.9	1482.6	0.598	2157.6	3826.1	0.404
Cocoa	559.0	577.0	259.7	0.259	467.7	1433.2	0.000
Plantain	559.5	645.0	201.1	0.404	482.0	5557.5	0.000
Pepper	233.5	259.4	9.3	0.197	214.1	425.0	0.217
Okro	104.4	128.8	30.3	0.002	98.1	110.1	0.763
Cocoyam	119.9	143.6	72.5	0.175	109.2	518.5	0.008
Soybeans	542.0	552.2	357.4	0.527	454.3	686.8	0.099

Source: Nigeria GHS-Panel data, 2010 and 2015

Table C3: Average value of crop produced (in Naira) by sex of household head and farm classification, 2010 and 2015

Panel A: 2010							
	Headship				Farm classification		
Crop	Overall	Male	Female	P-value	Small	Medium	P-value
All crops	369,387.60	401,741.30	82408.22	0.310	429,917.50	483,728.10	0.320
Maize	105,146.50	116,509.20	15066.60	0.229	51,056.07	301,248.10	0.136
Groundnut	50,502.56	51,735.12	12923.44	0.141	39,048.12	73,565.53	0.000
Sorghum	115,627.60	117,069.90	26494.89	0.666	109,350.30	100,467.40	0.602
Millet	86,389.61	87,178.06	20214.37	0.627	67,980.44	111,668.10	0.200
Rice	410,866.70	420,782.10	201554.80	0.805	65,175.30	1,739,345.00	0.773
Bean	45,778.22	45,797.52	44856.10	0.984	49,404.63	42,569.50	0.111
Cassava	890,869.70	1,051,507.00	29934.08	0.465	1,377,076.00	65,379.53	0.358
Yam	144,917.50	157,690.40	73714.20	0.001	133,588.40	230,384.20	0.988
Cocoa	126,450.10	131,290.00	79180.80	0.464	90,568.76	151,240.10	0.503
Plantain	16,855.99	15,283.68	28456.43	0.318	21,581.28	23,455.37	0.977
Pepper	57,942.79	54,030.74	140217.40	0.021	51,559.47	87,542.28	0.205
Okro	9,573.41	11,407.32	3629.38	0.139	6,624.90	2,386.10	0.578
Cocoyam	37,091.24	34,218.73	42592.54	0.670	43,380.69	15,337.31	0.002
Soybeans	46,284.16	45,624.25	81630.01	0.607	54,379.62	32,597.94	0.755
Panel B: 2015							
	Headship				Farm classification		
Crop	Overall	Male	Female	P-value	Small	Medium	P-value
All crops	188,432.70	202,923.00	104,561.20	0.000	180,760.10	309,251.00	0.000
Maize	57,721.12	64,615.65	19,803.18	0.000	56,614.76	98,104.08	0.000
Groundnut	55,150.81	55,994.13	39,141.44	0.309	49,140.87	67,715.41	0.017
Sorghum	55,578.79	55,883.27	48,371.09	0.485	48,005.39	73,142.92	0.000
Millet	58,915.06	59,285.62	48,868.46	0.358	52,802.53	72,040.76	0.000
Rice	115,156.70	116,018.30	100,522.20	0.834	100,332.00	172,362.20	0.085
Bean	47,045.09	48,409.94	23,626.89	0.247	45,570.96	53,351.00	0.482
Cassava	51,552.69	53,973.28	43,851.78	0.326	43,699.59	108,094.70	0.000
Yam	176,602.80	191,197.20	122,865.70	0.056	178,994.50	405,299.70	0.000
Cocoa	290,498.00	303,656.00	125,841.40	0.179	255,179.80	929,536.90	0.000
Plantain	32,291.60	38,515.93	11,822.78	0.217	29,061.96	368,601.20	0.000
Pepper	39,398.32	43,403.33	10,561.77	0.221	37,741.46	65,019.04	0.074
Okro	9,901.03	10,852.92	6,778.32	0.057	10,001.82	12,559.15	0.307
Cocoyam	10,034.35	11,164.35	7,760.70	0.091	11,130.78	33,207.66	0.040
Soybeans	63,891.30	64,934.20	37,728.30	0.392	50,656.66	88,188.01	0.003

Source: Nigeria GHS-Panel data, 2010 and 2015

Table C4: Average value of crop sold (in Naira) by sex of household head and farm classification, 2010 and 2015

Panel A: 2010							
	Headship				Farm classification		
Crop	Overall	Male	Female	P-value	Small	Medium	P-value
All crops	157,118.70	175,998.10	15,940.79	0.474	278,937.80	46,539.78	0.330
Maize	21,038.84	23,206.36	5,022.40	0.038	17,638.37	24,456.54	0.254
Groundnut	28,745.44	29,695.52	5,076.12	0.358	16,377.13	42,786.74	0.000
Sorghum	12,321.11	12,412.06	5,326.49	0.514	10,361.98	14,163.13	0.174
Millet	11,180.67	11,175.26	11,703.83	0.968	13,766.67	8,712.39	0.083
Rice	50,324.18	48,716.39	95,525.97	0.172	52,855.51	42,803.17	0.527
Bean	18,608.34	18,770.79	10,991.79	0.672	19,745.44	15,636.65	0.511
Cassava	1,083,328.00	1,284,853.00	18,758.73	0.480	1,591,819.00	40,293.07	0.384
Yam	88,558.95	98,520.94	23,088.96	0.347	105,677.20	80,251.94	0.772
Cocoa	123,902.80	126,755.00	91,740.98	0.613	89,571.16	151,240.10	0.129
Plantain	14,797.98	14,527.85	16,693.15	0.822	17,002.80	22,106.90	0.750
Pepper	41,104.15	36,627.15	116,599.40	0.007	33,766.84	65,779.79	0.055
Okro	4,336.88	4,738.50	3,017.75	0.246	4,962.47	2,119.02	0.272
Cocoyam	7,163.88	8,864.44	4,094.61	0.102	3,254.63	24,066.31	0.000
Soybeans	28,365.90	28,123.02	39,770.01	0.833	32,224.22	21,335.53	0.607
Panel B: 2015							
	Headship				Farm classification		
Crop	Overall	Male	Female	P-value	Small	Medium	P-value
All crops	60,778.09	64,354.72	40,415.33	0.043	59,884.00	100,827.80	0.595
Maize	21,742.68	23,458.97	11,574.77	0.000	20,610.65	30,987.93	0.007
Groundnut	39,189.58	40,005.62	24,900.67	0.927	35,758.34	45,435.64	0.710
Sorghum	39,455.09	40,730.84	14,724.49	0.567	42,093.79	36,632.74	0.000
Millet	28,675.82	28,373.04	29,626.05	0.077	23,658.66	68,849.68	0.001
Rice	14,809.22	14,526.41	22,080.98	0.941	9,266.31	25,080.76	0.703
Bean	8,458.30	8,733.63	1,827.90	0.223	3,980.02	15,831.26	0.728
Cassava	58,968.06	60,396.63	40,594.03	0.067	55,117.33	65,738.47	0.019
Yam	314,231.40	330,131.20	118,000.80	0.029	277,329.90	1,001,073.00	0.487
Cocoa	33,781.26	38,451.75	14,472.84	0.179	27,445.44	348,950.20	0.345
Plantain	67,111.97	65,896.14	72,052.03	0.460	59,950.92	148,933.30	0.128
Pepper	31,928.32	34,642.45	7,443.71	0.149	33,226.47	47,183.84	0.806
Okro	356.80	364.14	314.88	0.807	341.57	283.94	0.548
Cocoyam	6,094.09	6,377.41	5,519.53	0.754	6,252.57	16,454.12	0.927
Soybeans	42,713.69	44,025.05	19,266.67	0.658	36,751.38	51,720.35	0.212

Source: Nigeria GHS-Panel data, 2010 and 2015

Table C5: Average cultivated plot sizes (in ha) by sex of household head and farm classification, 2010 and 2015

Panel A: 2010							
	Headship				Farm classification		
Crop	Overall	Male	Female	P-value	Small	Medium	P-value
All crops	4.6	4.9	1.8	0.000	1.6	13.0	0.000
Maize	4.3	4.6	2.2	0.043	1.6	11.6	0.000
Groundnut	3.2	3.3	1.5	0.296	1.8	9.3	0.000
Sorghum	5.9	6.0	2.8	0.424	2.1	13.4	0.000
Millet	7.2	7.2	4.3	0.625	1.8	12.8	0.000
Rice	5.9	5.9	5.7	0.981	1.6	19.2	0.000
Bean	5.8	5.8	8.6	0.638	1.8	13.5	0.000
Cassava	2.3	2.7	1.1	0.003	1.4	10.5	0.000
Yam	3.7	4.1	1.3	0.034	1.3	13.9	0.000
Cocoa	1.7	1.6	3.0	0.200	1.2	7.5	0.000
Plantain	0.2	0.2	0.0	0.199	0.2	.	.
Pepper	5.0	4.5	10.8	0.374	1.6	17.2	0.000
Okro	2.6	3.1	0.8	0.495	1.1	26.0	0.000
Cocoyam	1.3	1.3	1.3	0.994	0.8	6.7	0.000
Soybeans	2.8	2.8	2.0	0.167	1.1	5.8	0.000
Panel B: 2015							
	Headship				Farm classification		
Crop	Overall	Male	Female	P-value	Small	Medium	P-value
All crops	3.6	3.8	2.4	0.001	1.6	11.0	0.000
Maize	4.0	4.2	1.3	0.018	1.7	11.0	0.000
Groundnut	6.0	4.4	17.0	0.081	2.3	17.9	0.003
Sorghum	4.5	4.5	3.4	0.427	2.1	9.6	0.000
Millet	5.5	5.5	5.6	0.965	2.4	12.4	0.000
Rice	2.8	2.8	3.2	0.740	1.5	9.5	0.000
Bean	3.8	3.9	0.8	0.497	1.8	9.7	0.000
Cassava	1.7	1.8	1.3	0.091	1.0	7.9	0.000
Yam	2.3	2.4	1.7	0.039	1.4	8.4	0.000
Cocoa	3.6	2.2	18.6	0.002	1.7	31.3	0.000
Plantain	0.2	0.2	0.1	0.722	0.2	.	.
Pepper	4.2	4.2	3.8	0.335	2.5	11.9	0.806
Okro	0.6	0.9	0.3	0.250	0.6	.	.
Cocoyam	0.4	0.4	0.4	0.893	0.4	.	.
Soybeans	7.4	7.9	2.9	0.519	1.8	18.9	0.000

Source: Nigeria GHS-Panel data, 2010 and 2015

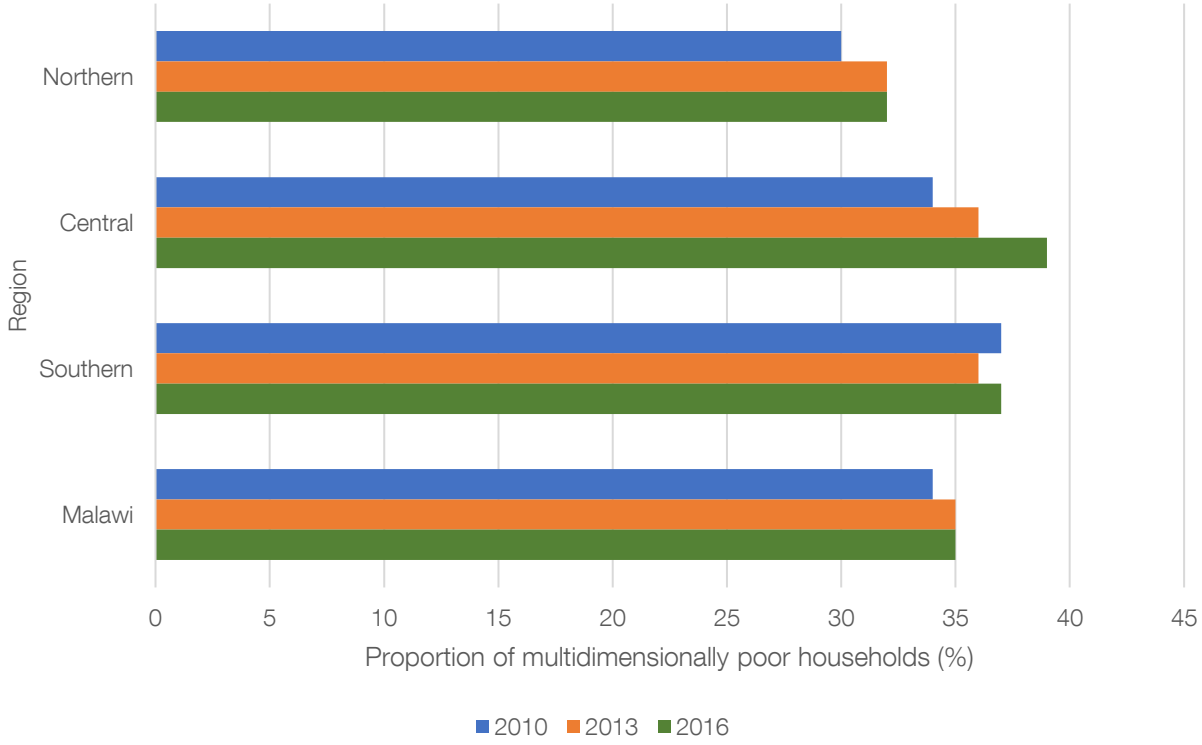
III. Malawi

Table A1: Incidence and intensity of poverty of households by groups for 2010, 2013 and 2016

	2010	2013	2016	Overall change between 2013 and 2016
Incident of poverty (Head count)	43%	42%	44%	+2%
Intensity of poverty (Poverty gap Index)	996.99	571.35	404.30	-167.05
Gini Coefficient	0.797	0.798	0.864	+0.066

Source: Authors' own

Figure A1: Trends in multidimensional poverty



Source: Authors' own

Table A2: Incidence of multidimensional poverty (%) and commercialisation level by groups

	MPI (%)	HCI (mean)	HCI SD
Ultra-poor/poorest (2010)	13.13	10.63	24.61
Moderately poor (2010)	53.81	19.07	32.27
Non-poor (2010)	33.06	13.83	27.34
Ultra-poor/poorest (2013)	11.52	15.04	27.81
Moderately poor (2013)	61.29	19.56	32.61
Non-poor (2013)	27.19	16.04	31.32
Ultra-poor/poorest (2016)	10.02	18.23	27.38
Moderately poor (2016)	56.56	17.94	30.62
Non-poor (2016)	33.42	17.21	29.84

Notes: SD =Standard Deviation

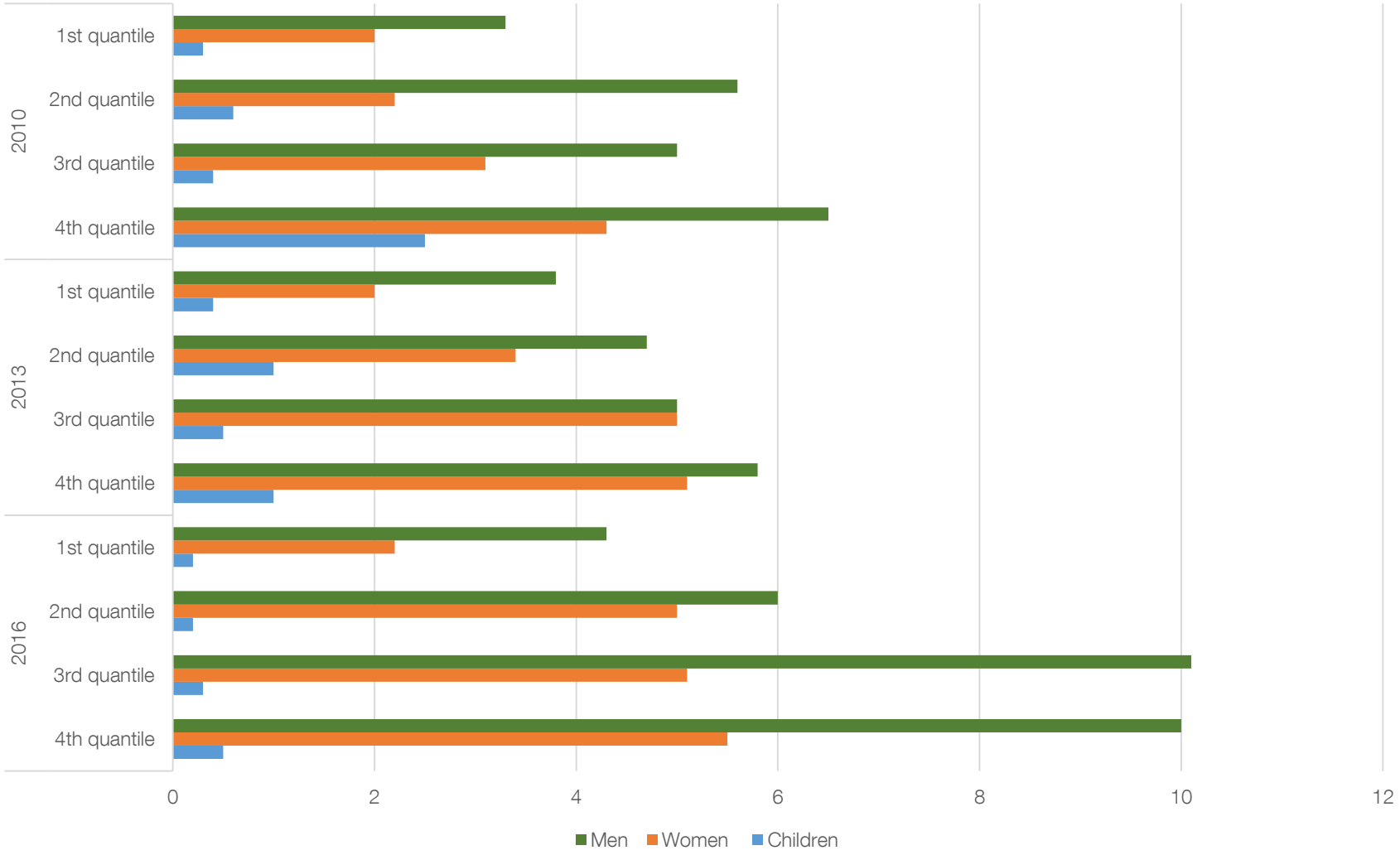
Source: Authors' own

Table A3: Food Consumption Score and dietary diversity by HCI quantiles

	2010	2013	2016
Quantile of HCI		**FCS**	
1st quantile (<=25%)	47	51	42
2nd quantile (>25% <=50%)	46	52	43
3rd quantile (>50% <=75%)	49	53	45
4th quantile (>75% <=100%)	51	48	45
Quantile of HCI		**Household dietary diversity**	
1st quantile (<=25%)	8	9	7
2nd quantile (>25% <=50%)	8	9	8
3rd quantile (>50% <=75%)	9	9	8
4th quantile (>75% <=100%)	8	9	8

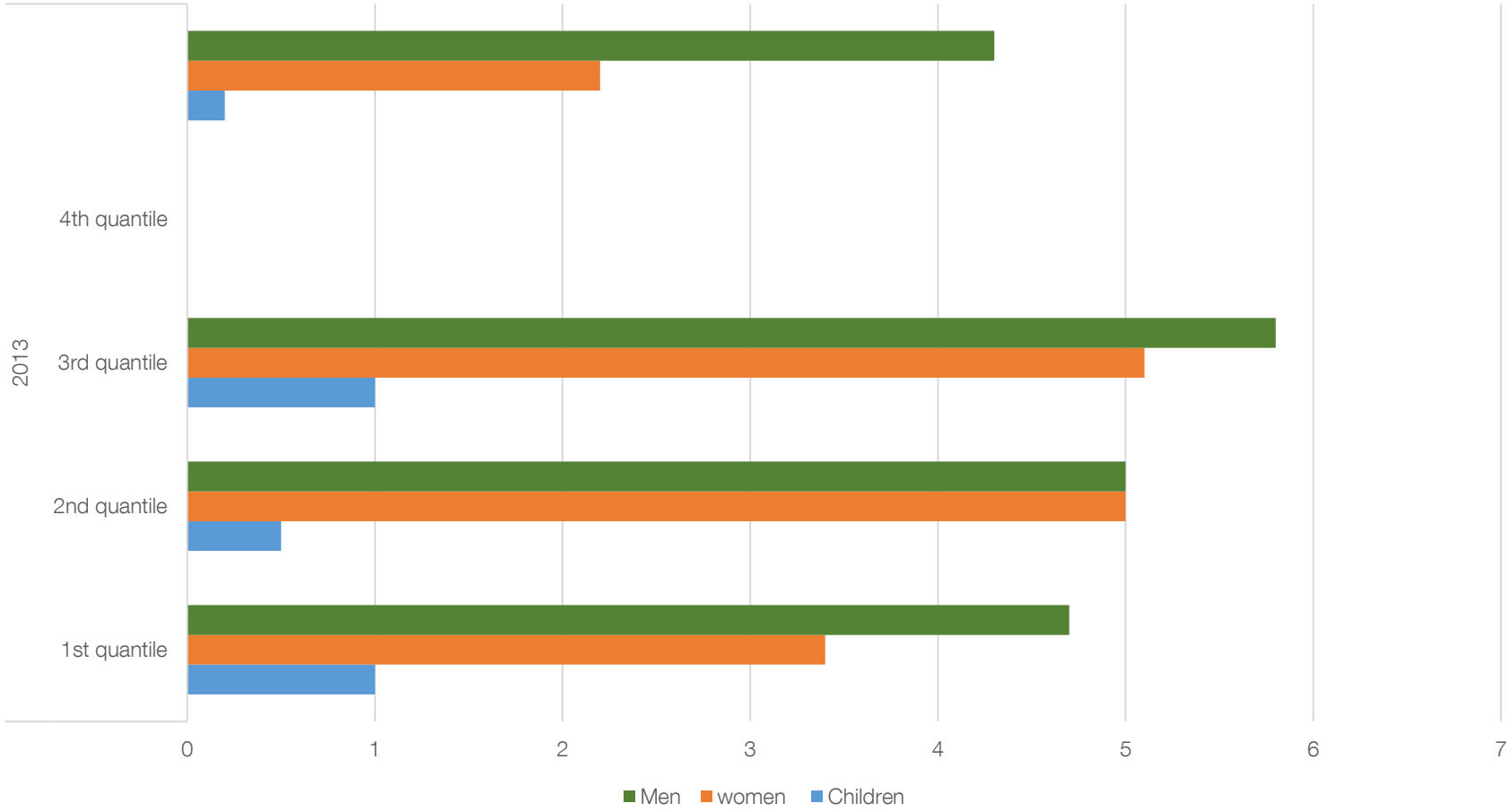
Source: Authors' own

Figure A2: Hired labour (days)



Source: Authors' own

Figure A3: Average daily wage for hired labour (Malawi Kwacha)



Source: Authors' own

Table A4: Households' economic activity by HCI quantiles (2010)

Economic activity/HCI quantile	% of households in unpaid agricultural work	% of households in *ganyu*	% of households in business (non-agricultural)	% of households in wage employment
1st quantile	54.03	14.52	12.79	14.17
2nd quantile	75.82	13.19	7.69	8.79
3rd quantile	68.63	11.76	9.80	9.80
4th quantile	71.43	9.18	9.18	7.14

Source: Authors' own

Table A5: Households' economic activity by HCI quantiles (2013)

Economic activity/ HCI quantile	% of households in unpaid agricultural work	% of households in *ganyu*	% of households in business (non-agricultural)	% of households in wage employment
1st quantile	66.17	4.10	11.46	18.17
2nd quantile	77.67	1.94	12.62	7.77
3rd quantile	77.14	1.43	14.29	5.71
4th quantile	82.46	2.34	7.60	7.02

Source: Authors' own

Table A6: Households' economic activity by HCI quantiles (2016)

Economic activity/ HCI quantile	% of households in unpaid agricultural work	% of households in *ganyu*	% of households in business (non-agricultural)	% of households in wage employment
1st quantile	66.83	11.67	11.06	10.20
2nd quantile	68.97	13.79	10.34	6.90
3rd quantile	80	7.69	4.62	7.69
4th quantile	70	11.82	11.82	6.36

Source: Authors' own

Table A7: Average HCI by region and headship in 2010

		Region				Headship			
	N	Malawi	North	Central	Southern	N	Male	N	Female	P-value
All crops	1,224	15.33	17.5	25.9	6.7	851	18.30	255	7.94	0.000
Maize	1161	6.14	9.5	10.7	1.8	797	6.71	246	4.56	0.140
Beans	74	9.71	9	16.7	0	56	9.05	13	14.36	0.448
Tobacco	192	96.88	87.5	97.5	100	173	97.11	13	92.31	0.347
Groundnuts	396	33.08	18.9	40.3	20.8	285	35.09	84	23.81	0.053
Irish potato	10	48.19	0	37.5	73.1	8	50.87	2	37.5	0.719
Rice	44	11.19	6.3	23.3	0	28	11.75	12	13.61	0.861
Soybeans	82	47.56	16.7	54.2	50	71	49.30	7	28.57	0.301
Pigeon peas	260	14.47	100	0	14.4	168	14.75	78	14.83	0.984
Sweet potatoes	59	32.20	7.1	42.9	37.5	47	27.66	11	54.54	0.090

Source: Authors' own

Table A8: Average HCI by region and headship in 2013

		Region				Headship				
	N	Malawi	North	Central	Southern	N	Male	N	Female	P-value
All crops	1476	18.5	14	31.6	8.3	1117	20.90	359	11.56	0.0000
Maize	1401	6.74	3.4	11.7	3.1	1051	7.17	350	5.45	0.182
Beans	153	18.42	10	26.6	7.6	135	20.13	37	25.62	0.416
Tobacco	163	95.71	94.1	96.2	95	151	96.03	12	91.67	0.476
Groundnuts	548	41.79	21.2	54.6	21.3	421	42.28	127	40.16	0.671
Rice	159	69.81	3.6	8.3	12.2	40	7.84	17	11.76	0.605
Soybeans	414	14.18	57.1	71.8	64.3	133	72.18	26	57.69	0.143
Pigeon peas	64	40.63	0	0	14.3	300	16.10	114	9.10	0.023
Sweet potatoes	1476	18.5	0	57.7	32.4	53	39.62	11	45.45	0.725

Source: Authors' own

Table A9: Average HCI by region and headship in 2016

		Region				Headship				
	N	Malawi	North	Central	Southern	N	Male	N	Female	P-value
All crops	1766	18.39	19.5	28.4	10.5	808	21.08	342	13.64	0.000
Maize	1594	7.91	8.3	14.8	2	723	8.76	310	6.49	0.147
Beans	164	12.17	14.5	15.3	7.2	73	11.53	32	18.23	0.321
Tobacco	184	82.61	75	81.1	79.2	127	82.69	19	63.16	0.047
Groundnuts	381	51.44	54.5	58.7	27.8	200	54	78	41.03	0.053
Rice	36	11.04	0	0	9.5	102	67.65	39	69.23	0.858
Soybeans	390	20.84	40	76.9	39.1	187	21.06	93	23.08	0.654
Pigeon peas	92	53.26	0	12.5	22.2	49	57.14	12	66.67	0.555
Sweet potatoes	1766	18.39	50	57.1	65	808	21.08	342	13.64	0.000

Source: Authors' own

Table A10: Average HCI by farm size classification

	N	Overall	N	Small	N	Medium	P-value
HCI by farm size classification in 2010							
All crops	1,224	15.33	861	10.50	363	26.79	0.000
Maize	1161	6.14	823	5.03	338	8.84	0.003
Beans	74	9.71	36	9.06	38	10.32	0.808
Tobacco	192	96.88	68	100	124	95.16	0.066
Groundnuts	396	33.08	221	31.22	175	35.43	0.378
Irish potato	10	48.19	4	61.11	6	39.58	0.473
Rice	44	11.19	24	15.80	20	5.67	0.252
Soybeans	82	47.56	44	38.64	38	57.89	0.083
Pigeon peas	260	14.47	203	13.27	57	18.72	0.219
Sweet potatoes	64	40.63	37	40.54	27	40.74	0.987
HCI by farm size classification in 2013							
All crops	1476	18.5	1041	13.74	435	30.33	0.000
Maize	1401	6.74	991	5.13	410	10.62	0.000
Beans	153	18.42	99	19.32	54	16.78	0.808
Tobacco	163	95.71	54	98.15	109	94.50	0.282
Groundnuts	548	41.79	321	38.32	227	46.70	0.050
Rice	57	9.01	38	5.70	19	15.63	0.174
Soybeans	159	69.81	83	75.90	76	63.16	0.081
Pigeon peas	414	14.18	315	12.09	99	20.80	0.007
HCI by farm size classification in 2016							
All crops	1766	18.39	247	16.22	1519	18.75	0.238
Maize	1594	7.91	219	8	1375	7.91	0.956
Beans	164	12.17	30	13.71	134	11.83	0.752
Tobacco	184	82.61	20	70	164	84.15	0.116
Groundnuts	381	51.44	47	44.68	334	52.40	0.323
Soybeans	195	68.21	24	66.67	171	68.42	0.864
Rice	36	11.04	9	0	27	14.72	0.187
Pigeon peas	390	20.84	64	28.62	326	19.31	0.050
Sweet potatoes	92	53.26	16	62.5	76	51.32	0.421

Notes: A farm is classified as small if land size is in the range of above 0 and less than 1 acres; and Medium if in the range of greater or equal to 1 and less than 10 acres

Source: Authors' own