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Changing Gender Roles in Agriculture?

Evidence from 20 Years of Data in Ghana

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ABSTRACT

At a time when donors and governments are increasing efforts to mainstream gender in agriculture, it is critical to revisit long-standing wisdom about gender inequalities in agriculture to be able to more efficiently design and evaluate policy interventions. Many stylized facts about women in agriculture have been repeated for decades. Did nothing really change? Is some of this conventional wisdom simply maintained over time, or has it always been inaccurate? We use longitudinal data from Ghana to assess some of the facts and to evaluate whether gender patterns have changed over time. We focus on five main themes: land, cropping patterns, market participation, agricultural inputs, and employment. We add to the literature by showing new facts and evidence from more than 20 years. Results are varied and highlight the difficulty of making general statements about gender in agriculture.

Keywords: gender, common wisdoms, longitudinal data, feminization of agriculture, Ghana

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1. INTRODUCTION

Concerns about gender inequality were already voiced in the 1980s. Still today, these same concerns are expressed with respect to gender differences, women's access to and control of resources, and similar issues such as women's empowerment. "In the last 30 years, men had gone to the moon and back, yet women were still at the same place they were, namely, trying to sensitize the world to the unwarranted and unacceptable marginalization of women," says UN Special Adviser on Gender Issues Rachel Mayanja (World Conference on Women,2005). The question arises whether there really hasn't been any progress in closing the gender gap in agriculture or whether common understandings of an (eventually overcome) reality are maintained over time.

Several researchers have voiced concerns about the use of stylized but often inaccurate facts about gender, commonly referred to as "gender myths" (for example, Doss 2014; Doss et al. 2015; Palacios-Lopez, Christiaensen, and Kilic forthcoming). Gender myths are effective in mobilizing for gender action but are less efficient in tackling the real issue as they lead to the inability to accurately design and monitor intervention outcomes. Recently, researchers have tried to bridge the evidence gap by underpinning common claims about gender in agriculture with new data. A 2015 special issue of *Agricultural Economics* explores the drivers of gender differences in land productivity by using new data from the Living Standards Measurement Study – Integrated Surveys on Agriculture (LSMS-ISA). A recent (2016) issue of *Food Policy,* albeit not specifically focusing on gender, regularly integrates a gender dimension in its effort to disentangle myths from facts in African agriculture. The aforementioned issues provide insights into some prevailing beliefs about gender in agriculture, but they are not able to account for time trends. Yet gender roles are dynamic and respond to changing economic circumstances (Doss 2001). Solid studies based on reliable time data are fundamental to indicate whether reality still corresponds to the common wisdom as well as to inform policy makers about drivers of and obstacles to development (Deininger, Savastano, and Xia forthcoming). This is especially important in countries undergoing rapid economic and social change and for traditionally more vulnerable groups that can be highly affected by these changes.

In this paper, we revisit five pieces of conventional wisdom about gender in agriculture and analyze their pattern over time: (1) women have limited access to land and lose out when land becomes more commercialized; (2) crops can be classified as men's crops or women's crops, whereby the former are usually cash crops and the latter subsistence crops; (3) participation in market activities by female farmers is low; (4) men have more access to modern agricultural inputs compared to women; and (5) rural women's occupations are mainly limited to unpaid on-farm labor and household work, while men engage in remunerated on- and off-farm activities. We use four rounds of repeated cross-sectional data collected under the Ghana Living Standards Survey (GLSS). The data cover the period from 1991 to 2013 and contain multitopic information that is disaggregated at the plot and plotholder levels. We add to the literature that disentangles common wisdom from facts with new evidence about multiple gender dimensions in Ghana. We especially offer a quantitative perspective on changes in gender roles in agriculture over time, which has been largely absent in previous studies. The aim of this paper is to uniquely describe within-country gender dynamics for the five key areas rather than to uncover causal pathways that explain the differences between male and female agriculture.

2. COMMON WISDOM ABOUT GENDER

Land

"Women have limited access to land and lose out when land becomes more commercialized."

Commonly, women's access to land in developing countries is portrayed to be extremely low and insecure and their land quality inferior compared to men's land. Doss et al. (2015) find that women in Africa have less land and land of lower value compared to their male counterparts. Yet considerable variation exists across countries, regions, and agroecological zones. Figures for land held by women alone across 10 countries in Africa south of the Sahara range between 5 and 23 percent of total land owned; but this figure can be misleading if not put into the perspective that an average of 39 percent of all plots are managed jointly by the couple. Across the same countries 22 percent of all landholders are women. In Ghana and Mozambique, around 30 percent of all agricultural plots are under women's control (De Brauw 2015; Doss 2002), as are 15 percent in Kenya[1] (Gĩthĩnji, Konstantinidis, and Barenberg 2014). In terms of the quality of land, Goldstein and Udry (2008) show that women farm lower-quality land in Ghana, but this result is not confirmed by evidence from De Brauw (2015) on Mozambique.

Whereas they emphasize the same trend, the estimated access to land for women in empirical studies is not nearly as low as the alarming figures often cited by organizations promoting gender-targeted interventions (Doss et al. 2015). Cultural concepts of property ownership must be clearly understood before one makes claims about access to and disposal of land (Doss et al. 2015; Lambrecht and Asare 2016). Also, land tenure systems are dynamic and change in response to rural transformation (Lambrecht and Asare 2016). They are directly affected by land reforms or land deals and indirectly affected by other transformation processes such as changing rural infrastructure, population increase, and rural-urban migration. Overall, land tenure is increasingly individualized and formalized, land markets are rapidly developing, and in many places land has become scarce (Lastarria-Cornhiel 1997; Quisumbing et al. 2001). Such changes possibly affect men's and women's access to land differently, either exacerbating or reducing gender inequalities in access to land. The most commonly held view is that these processes will deteriorate women's access to land and result in transfers of land rights from women to men (Lastarria-Cornhiel 1997). Yet in a study in Ghana's cocoa-growing region, Quisumbing et al. (2001) find that individualization does not necessarily lead to weaker rights for women. There is a large need for more substantiated evidence at the regional and national levels to see how gender patterns in access to land have changed over time.

Gendered Cropping Patterns

"Crops can be classified as men's crops or women's crops, whereby the former are usually cash crops and the latter subsistence crops."

Terms such as "men's crops" and "women's crops" are frequently used when talking about gender and African agriculture. If there were any distinction, clear patterns of men's and women's crops would considerably facilitate gender-targeted policy making and program interventions. By targeting specific crops, programs could easily reach either men or women. There are many settings where such distinctive gendered cropping patterns do not apply. Historically for Ghana, for example, it has been shown that women are involved in the production of all major crops (Doss 2002). Cropping patterns mainly depend on the socioeconomic situation and livelihood strategy of the household rather than a mere distinction according to the gender of the farmer or household head (Carr 2008). In turn, recent evidence from Mozambique and Kenya shows that women plot managers grow fewer crops and fewer cash crops (De Brauw 2015; Gĩthĩnji, Konstantinidis, and Barenberg 2014).

[1] Women are the primary farmers in 633 out of 4,565 male-headed households.

Some studies suggest that gendered cropping patterns change due to changing economic and social circumstances. Dey (1981) illustrates for Gambia how men take over crop control in response to projects focusing on increasing productivity and commercialization of traditional "women crops" like rice. Sanginga et al. (1999) show for Nigeria how soybean gained importance as a cash and staple crop for both men and women after the introduction of improved varieties and technologies. Other studies perceive increased female participation and decision-making power in agriculture, pointing at population pressure, degraded agricultural land, and increasingly profitable off-farm employment opportunities that lead to intrahousehold changes in gendered crop control (Saito, Mekonnen, and Spurling 1994; Palacios-Lopez, Christiaensen, and Kilic forthcoming).

Crop Commercialization

"Participation in market activities by female farmers is low."

It is widely believed that the commercialization of crops is controlled mainly by men. This view is closely related to the belief that men are more likely to grow "cash crops" intended for sale, and women are more likely to grow "food crops," also called "subsistence crops," for household consumption (Doss 2001). Several studies exist that contradict or nuance these claims. Female farmers in Uganda, Malawi, and Tanzania are shown to participate less in market activities, but they tend to sell larger shares of their production conditional on participation (Carletto, Corral, and Guelfi forthcoming). In Ghana, men are more heavily involved in cash crop production, but women also are active in the production and sale of all major crops (Doss 2002; Carr 2008). Moreover, many crops cannot be categorized as either cash or subsistence crops, with part of the production being consumed in the household and another part being sold for cash income (Carletto, Corral, and Guelfi forthcoming; Doss 2001).

Household composition, household strategies, and socioeconomic opportunities are expected to influence the individual's choices about cultivating for market or subsistence purposes. Moreover, changes in external or socioeconomic factors are expected to change commercialization patterns over time. For example, in response to changes in the local market conditions for bananas and the high unemployment rate of men in Kenya the 1990s, production and sales of banana have shifted from being controlled mainly by women to being managed by men (Wanyama, Thomas-Slayter, and Mbuthi 1995). While several studies control for gendered crop commercialization to explain gender productivity gaps (for example, Gĩthĩnji, Konstantinidis, and Barenberg 2014; Kilic, Palacios-Lopez, and Goldstein 2015), the literature exploring crop commercialization patterns across women and men, especially over time, is limited.

Input Use

"Men have more access to modern agricultural inputs compared to women."

The gender of the plot owner is often believed to limit the uptake of agricultural inputs. Several studies point to men's and women's unequal access to inputs as a cause of lower female productivity (Djurfeldt, Djurfeldt, and Bergman Lodin 2013). Various factors have been put forward for influencing women's access to inputs, such as differences between men and women in education and time constraints (Saito et al. 1994), access to land and family labor (Doss and Morris 2001), and extension services (Doss and Morris 2001). Yet few studies have put solid figures on gender disaggregated input use, and most prevailing beliefs are rooted in studies carried out more than 20 years ago (for example, Udry, Hoddinott, Alderman and Haddad, 1995). To the best of our knowledge, only Sheahan and Barrett (forthcoming) make an effort to disentangle input use in African countries and cast doubt on the role of gender in determining input adoption.

Occupation

> *"Rural women's occupations are limited to unpaid on-farm labor and household work, while men engage in remunerated on- and off-farm activities."*

It is often said that women perform the bulk of African agriculture. However, recent literature finds that average contributions of women lie at around 40 percent of the total agricultural labor supply (Palacios-Lopez et al. forthcoming). Despite their major role in agricultural production, it is also commonly assumed that much of the labor that women provide is unpaid labor on farm (and nonfarm) enterprises in which the income is under the control of their husbands or other male family members. Rural women are therefore considered less economically empowered compared to their male counterparts (for example, Kabeer, Sibeen, and Sakiba 2011).

It is believed that women's role in agricultural production is expanding, which is commonly referred to as the "feminization of agriculture." Several case studies indicate that women have widened their involvement in agricultural production during the past few decades, either through participation in agricultural wage labor, particularly in the nontraditional export sector (Maertens and Swinnen 2012), or through increased responsibilities in agricultural smallholder production, as principal farmers or unremunerated family workers (Katz 2003; Lastarria-Cornhiel 2006). These trends have been related to broader social changes, such as increasing agricultural trade, the "casualization" of agricultural work, unprofitable crop production, and male migration. Most studies rely on cross-sectional or anecdotal evidence for these statements, but ideally such statements are assessed comparing statistics from the same region during different time periods. Davis, Di Giuseppe, and Zezza (forthcoming) make a first effort to disentangle household income strategies in several African countries over time but do not specifically focus on gender differences. In this respect, the contribution of this section on women's agricultural occupation is twofold. First, we provide evidence on occupational choices on Ghana, adding to the existing cross-country evidence. Second, we look at occupational dynamics and assess whether women's participation in both wage and smallholder agriculture has changed during the past two decades.

3. BACKGROUND

Ghana returned to democratic rule in 1992. Monetary and nonmonetary poverty has consistently declined during the past 25 years. Since 2005, Ghana has experienced a steadily increasing economic growth of more than 7 percent per year. At the same time, inequality between the richer South and the poorer North in the country worsened over time (McKay, Pirttila, and Tarp 2015). The agricultural sector experienced steady growth in the 1990s, albeit at a much slower pace compared to other sectors (McKay, Pirttila, and Tarp 2015). Agriculture is the main income source for most, especially for rural households (Davis, Di Giuseppe, and Zezza forthcoming). The country can be subdivided into three agroecological zones: savannah, forest, and coast. The northern savannah zone is characterized by a unimodal rainfall distribution that results in only one growing season. The forest and coastal zones are characterized by a bimodal rainfall pattern that results in a major and a minor growing season.

The majority of land in Ghana is under customary tenure. Traditionally, no commercial transactions of customary land were allowed. Even though land markets have developed, the constitution prohibits the sale of customary land. Typically, many people have rights to the same plot of land, but at one point in time cultivation rights are held by only one specific person (Lambrecht and Asare 2016). Once farmland is allocated to an individual, that individual has control over what is planted, what is harvested, and the crops and income generated on the land (Carr 2008; Lambrecht and Asare 2016). Joint ownership or joint holdings of land by husband and wife, which has been reported in many other countries, is rare in Ghana (Lambrecht 2016).

Ghana also has a variety of ethnic groups and religions, and there are still clear social norms and perceptions about gender roles in the household and society in rural Ghana (Lambrecht 2016). A man’s primary role is to provide basic necessities for his household, and a woman is expected to manage the household and support her husband. These gender roles provide a rationale to prioritize access to productive resources, including agricultural inputs and land, for men. At the same time, it justifies a disproportionate allocation of unpaid domestic and on-farm chores to women (Lambrecht 2016; Clark 1994). A substantial portion of the population belongs to matrilineal ethnicities. However, even though family membership is defined through maternal bloodlines, the communities are essentially patriarchal and patrilocal. To a lesser extent, similar gender norms hold, and men maintain priority access to land and other property (Lambrecht 2016).

4. METHODOLOGY

Data

We use data collected under GLSS. GLSS data consist of nationally representative, repeated, cross-sectional data for six time periods. In the first two rounds—conducted in 1987/1988 (GLSS1) and 1988/1989 (GLSS2)—agricultural production data are obtained only at the household level, not at the plot level. We do not use these data since they do not allow for analyses at the plotholder level. The subsequent rounds—conducted in 1991/1992 (GLSS3), 1998/1999 (GLSS4), 2005/2006 (GLSS5), and 2012/2013 (GLSS6)—contain data that are disaggregated at the plot and plotholder levels.[2] We use the data of these four survey rounds for our analyses. We limit the sample for the analysis to households that and individuals who live in rural areas. The number of rural households interviewed in each survey round increases over time, with 2,957 rural households in GLSS3, 3,718 in GLSS4, 5,056 in GLSS5, and 9,326 in GLSS6. Throughout our analyses sampling weights are applied to control for stratified sampling.

Our analyses related to landholdings, cropping patterns, and commercialization patterns rely on the distinction between plots held by men and plots held by women. The questionnaire asks about the main landholder rather than the owner of an agricultural plot.[3] There is no explicit definition of "landholder" provided with any of the questionnaires, but the concept is easily understood by both enumerators and respondents. In the Ghanaian context, asking for the landholder is more appropriate than a definition based on landownership (Lambrecht and Asare 2016).

Key Indicators

Land

To estimate gender inequalities in access to land, we rely on the households' indication on the agricultural plot's "landholder" instead of "landowner." This is in line with the challenges identified in Doss et al. (2015), who recognize a mismatch between the often "reported," "documented," and "effective" ownership, referring to the individual who actually makes decisions about a plot. It also reflects definitions of landholdings used in other analyses on gendered cropping patterns in recent literature (Doss 2002; De Brauw 2015; Gĩthĩnji, Konstantinidis, and Barenberg 2014). We calculate three indicators: (1) the incidence of women and men plotholders among all men and women in rural areas in the age range of 16 to 65 years (equation 1), (2) the share of plotholders who are women among all men and women plotholders (equation 2), and (3) the mean size of land held by women and men (equation 3).

Incidence of landholders among women and men in rural areas is determined by the following:

$$\frac{Number\ of\ women\ plotholders}{Total\ number\ of\ women\ in\ rural\ areas};\ \frac{Number\ of\ men\ plotholders}{Total\ number\ of\ men\ in\ rural\ areas}. \tag{1}$$

Share of landholders who are women is determined by the following:

$$\frac{Number\ of\ women\ plotholders}{Total\ number\ of\ men\ and\ women\ plotholders}. \tag{2}$$

The mean size of land held by women and men is determined by the following:

$$\frac{Total\ size\ of\ land\ held\ by\ women}{Number\ of\ women\ plotholders};\ \frac{Total\ size\ of\ land\ held\ by\ men}{Number\ of\ men\ plotholders}. \tag{3}$$

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[2] A major drawback is that data on agricultural inputs are provided only at the household level, which impedes comparisons of input use between plots or plotholders in households as well as productivity estimations at the plot or plotholder level.

[3] Note that we use the terms landholder and plotholder as synonyms throughout the paper.

We use a multivariate regression framework to explore the relationship between landholdings (that is, likelihood of holding land and land size), gender of the plotholder *j,* time period (GLSS round), and agroecological zone (*AEZ*). Additional plotholder covariates (X_{ij}) are held constant (equation 4).

$$Land\ holding_{ijt} = \beta_0 + \beta_1 Female_{ij} + \beta_2 GLSS_t + \beta_3 AEZ + \beta_4 X_{ijt} + \varepsilon_{ijt}. \tag{4}$$

The aim of this analysis is to see whether clear trends are visible for the main variables of interest (gender, time, and agroecological zone) rather than to establish causality.

Gendered Cropping Patterns

We adopt an approach similar to Doss's (2002) to examine whether there are gendered cropping patterns and whether they change over time. A farmer is considered to be growing a crop if he or she has harvested the crop in the 12 months prior to the interview. First, for each crop we calculate which share of female (male) plotholders grow the crop, and we test whether the share of women growing the crop is significantly different from the share of men growing the crop (equation 5):

$$\frac{Number\ of\ female\ plotholders\ growing\ crop_{it}}{Total\ number\ of\ female\ plotholders_t} = \frac{Number\ of\ male\ plotholders\ growing\ crop_{it}}{Total\ number\ of\ male\ plotholders_t}. \tag{5}$$

Second, we calculate the share of farmers who grow a crop *i* who are women and test whether this is significantly different from the total share of plotholders who are female (equation 6). If the null hypothesis of equality in equation 6 is rejected, we say that the crop is disproportionally grown by either men or women:

$$\frac{Number\ of\ female\ plotholders\ growing\ crop_i}{Total\ number\ of\ plotholders\ growing\ crop_i} = \frac{Number\ of\ female\ plotholders}{Total\ number\ of\ male\ and\ female\ plotholders}. \tag{6}$$

Third, we explore the relationship between cropping patterns (number of crops or specific crops *i*), gender of the plotholder *j,* time period (GLSS round), and agroecological zone (*AEZ*) in a multivariate regression framework. Additional plotholder covariates (X_{ij}) are held constant (equation 7):

$$Crop_{ijt} = \beta_0 + \beta_1 Female_{ij} + \beta_2 GLSS_t + \beta_3 AEZ + \beta_4 X_{ijt} + \varepsilon_{ijt}. \tag{7}$$

Crop Commercialization

We follow Carletto, Corral, and Guelfi (forthcoming) and construct a Crop Commercialization Index (CCI). Whereas former authors used the measure at the household or farmer level, we calculate CCI for specific crops and by plotholder (equation 4). The index captures the farmers' marketing behavior: a value equal to 0 indicates pure subsistence farming, whereas a value of 1 occurs when the farmer commercializes the entire production. In addition, we construct a conditional CCI, restricting the sample to plotholders who reported any sales.

$$CCI_{ij} = \frac{Gross\ value\ of\ crop\ i\ sales}{Gross\ value\ of\ crop\ i\ produced}. \tag{8}$$

The data on harvest and sales in GLSSs are recorded for a 12-month period for crops with a single harvest period (that is, beans, cocoa, coconut, coffee, cotton, groundnut, guinea corn, sorghum, millet, kenef, maize, rice, rubber, sugarcane, wood, and other crops) and for a two-week period for crops that are repeatedly harvested (okro, garden egg, pepper, leafy vegetables, other vegetables, oil palm, plantain, banana, orange, other fruit, colanut, pineapple, cassava, yam, cocoyam, potato, tomato, onion, avocado, mango, and pawpaw). Due to difficulties in aggregating data from these different time records, we calculate two separate aggregate measures for CCI.

In a multivariate regression framework, similar to equation 7, we explore the relationship between market participation (captured by a dummy variable on whether the farmer sells any crop), unconditional and conditional CCI, gender, time and agroecological conditions.

Input Use. Due to data limitations, input use can be calculated only at the household level. We look at the gender of the household head to explore gender dynamics. Though not without the renowned shortcomings of this measure (Doss 2002; Doss et al. 2015), the limited evidence from the literature on the evolution of input use makes it worthwhile to explore the topic. We distinguish seven input categories: (1) inorganic fertilizer, (2) organic fertilizer, (3) pesticides (including insecticides, weedicides, and fungicides), (4) purchased seeds, (5) hired labor, (6) transport and fuel, and (7) renting of animals and equipment. Two alternative variables are constructed. The first variable indicates whether the household bought any input or any type of the above inputs. The second variable refers to the monetary value of input spent per acre of land held, conditional on having purchased the inputs. Summary statistics and outcomes from a regression analysis on the likelihood of adopting specific inputs are reported.

Occupation. We include the primary occupation of individual household members in six categories: (1) paid employment, (2) nonagricultural self-employment, (3) nonagricultural contributing family worker, (4) agricultural self-employment, (5) agricultural contributing family worker, and (6) no work. Paid employment includes both agricultural and nonagricultural wage employment. Agriculture refers to crop cultivation and livestock rearing but not to fishery, forestry, or hunting activities. We limited the sample to the economically active population, within the age range of 16 to 65 years.

To establish a measure of occupational segregation by gender, we use the Duncan Index (Duncan 1955; Madrigal and Torero 2016), which is defined as

$$D = \tfrac{1}{2}\sum_{i=1}^{N} \left| m_i - w_i \right| \qquad (9)$$

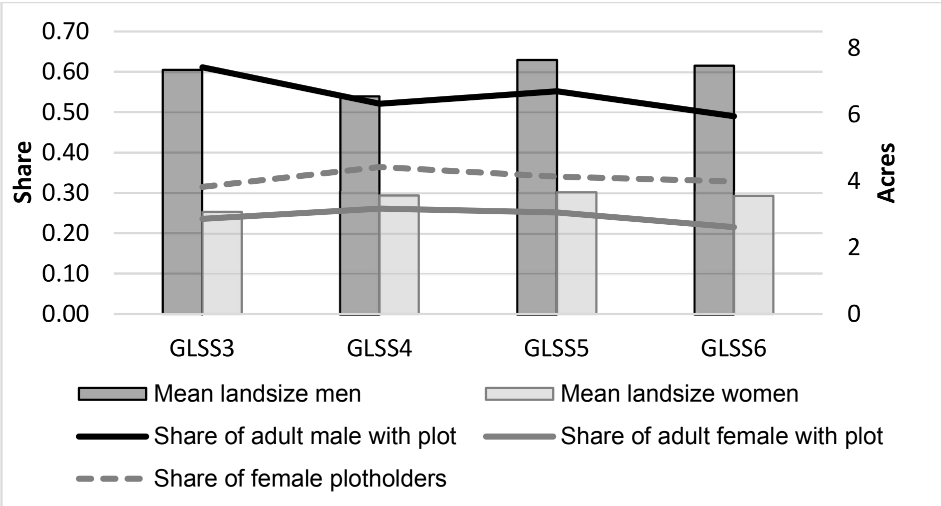
where m_i represents the percentage of rural men in occupation *i* and w_i represents the percentage of rural women in occupation *i.* The values in the Duncan Index can range from 0 to 100 percent and measure the relative separation or integration of gender across occupations. A value equal to 0 signifies an even distribution of occupations between men and women, whereas a value of 100 percent occurs when occupations are completely segregated. We separately estimate the Duncan Index for each of the six types of primary education. We descriptively explore how the index has changed during the 20-year time period and conduct a regression analysis to explore how gender, time, and agroecological zones correlate with the different occupational choices.

Findings

Land

Figure 5.1 shows that men are more likely to be plotholders than are women and that they hold larger acreages of land compared to women. During the past 20 years, women have represented between 32 and 36 percent of all adults holding land in rural areas of Ghana. Female plotholders hold an average of 3.47 acres of land, which is on average 3.78 acres less than that held by male plotholders. The incidence of male adults with plots decreases over time, from 61 percent of all rural men in 1991/1992 to 49 percent of all rural men in 2012/2013. The incidence of women plotholders remains constant at around 22–26 percent of all rural women. In the same reference period the mean plot size slightly increases for all plotholders, where the increase for women is larger than that for men. So while the size of land held by female plotholders is slightly affected, no major changes are detected at the level of their likelihood of holding land. These figures are comparable to other African countries, in which a minimum share of 10 percent (Niger) and a maximum of 38 percent (Uganda) of all plots are managed by women (Deininger, Savastano, and Xia forthcoming).

Figure 5.1 Landholders by gender, 1991–2013



Source: Author's estimations using GLSS data (GSS various years).
Note: GLSS = Ghana Living Standards Survey.

Regression results (Table 5.1) confirm that women are less likely to hold land and that they hold smaller plots of land than do men. The gap is larger in the forest and savannah than in the coast. The decrease in the likelihood of holding land over time is remarkable. The significant and positive effects from the interaction terms between gender and time indicate that this trend is driven mainly by male plotholders. The magnitudes of the coefficients show that the share of women who are plotholders remains constant over time, except in the savannah, where we find a net increase of female landholdings (the positive magnitude of the interaction term "Female*GLSS" reverses the negative effect from the time dummies only). In line with women's lower likelihood of holding land, the land size difference between men and women is larger in the forest and savannah as compared to the coast. Over time on average, land sizes of both women and men are not considerably changing. Small differences exist at the level of the agroecological zones, as the gender gap in land size seems to widen in the savannah but reduces in the forest. Household heads are more likely to hold land and cultivate larger plots than female spouses in male-headed households. Women in matrilineal ethnic groups are more likely to hold land in the coast and savannah and hold larger plots of land in the forest.

Table 5.1 Logit and ordinary least squares (OLS) regression specification on "landholding" and "land size"

	Dependent variable = Plot holding dummy (Logit model)				Dependent variable = Land size in acres (OLS model)			
Variable name	Ghana	Coast	Forest	Savannah	Ghana	Coast	Forest	Savannah
Female	-2.627***	-2.403***	-2.979***	-4.351***	-3.670***	-2.888***	-5.884***	-4.793***
	(0.090)	(0.142)	(0.105)	(0.133)	(0.443)	(0.595)	(0.777)	(0.542)
4.GLSS	-0.368***	-0.684***	-0.245**	-0.280**	-0.569	0.138	-1.321*	-0.242
	(0.072)	(0.143)	(0.106)	(0.132)	(0.404)	(0.694)	(0.675)	(0.544)
5.GLSS	-0.290***	-0.130	-0.225**	-0.313***	0.068	0.820	-0.869	0.939**
	(0.066)	(0.145)	(0.100)	(0.113)	(0.405)	(0.660)	(0.751)	(0.432)
6.GLSS	-0.581***	-1.157***	-0.539***	-0.304***	-0.470	-0.088	-2.115***	0.669
	(0.063)	(0.143)	(0.094)	(0.108)	(0.352)	(0.746)	(0.643)	(0.435)
Female#4.GLSS	0.761***	0.771***	0.483***	1.213***	0.858*	0.301	1.678**	-0.057
	(0.090)	(0.181)	(0.129)	(0.172)	(0.473)	(0.720)	(0.834)	(0.672)
Female#5.GLSS	0.600***	0.516***	0.423***	1.007***	0.415	0.093	0.400	0.570
	(0.084)	(0.185)	(0.124)	(0.150)	(0.508)	(0.767)	(0.910)	(0.767)
Female#6.GLSS	0.764***	0.845***	0.362***	1.267***	0.075	-0.270	1.501*	-1.192**
	(0.078)	(0.179)	(0.116)	(0.138)	(0.435)	(0.699)	(0.803)	(0.564)
Forest	0.695***				2.496***			
	(0.062)				(0.373)			
Savannah	0.938***				2.274***			
	(0.081)				(0.394)			
Female#Forest	-0.578***				-1.559***			
	(0.076)				(0.328)			
Female#Savannah	-1.199***				-1.706***			
	(0.078)				(0.331)			
Female HH head	1.087***	0.685***	1.097***	1.228***	1.312***	0.594*	0.947***	2.178***
	(0.039)	(0.087)	(0.058)	(0.069)	(0.186)	(0.338)	(0.252)	(0.362)
Matrilineal ethnic group	0.029	0.319**	-0.041	0.398***	0.392	-0.581	0.844***	-0.290
	(0.043)	(0.146)	(0.053)	(0.104)	(0.240)	(1.154)	(0.262)	(0.678)
Constant	1.533***	0.863***	2.378***	3.184***	4.363***	5.238***	7.705***	5.852***
	(0.092)	(0.198)	(0.119)	(0.148)	(0.509)	(1.375)	(0.702)	(0.586)
HH controls	yes	yes	yes	yes	yes	yes	yes	yes
Region FE	yes	yes	yes	yes	yes	yes	yes	yes
No. of Obs.	48,821	7,008	19,897	21,916	20,696	2,717	9,005	8,974
R-squared					.07	.08	.08	.07

Source: Author's estimations using GLSS data (GSS various years).

Note: FE = fixed effects; GLSS = Ghana Living Standards Survey; HH = household; No. of Obs. = number of observations. Robust standard errors are in parentheses. Household controls include ethnicity, religion, marital status, and household size.

*p < .1. **p < .05. ***p < .01.

Gendered Cropping Patterns

Across all time dimensions, men cultivate on average around one more crop than do women (Table 5.2). There are no crops that are exclusively grown on men's or women's plots. Most crops are significantly more likely to occur on men's than on women's plots throughout the years (equation 5), with the exception of only some—typically horticultural—crops in 1991/1992 (cocoyam, eggplant, and onion) and 2005 (garden eggs, pepper, and onion). The average number of crops per plotholder decreases over time for both men and women, but the gender gap in number of crops remains. The frequency of occurrence of all crops diminishes over time for both men and women, with the exception of cocoa, rice, and the category regrouping sorghum, millet, and guinea corn. For cocoa, the trend is reversed for both genders, while for rice and sorghum, millet, and guinea corn we see a slight increase in their occurrence on women's plots only (Table 5.2).

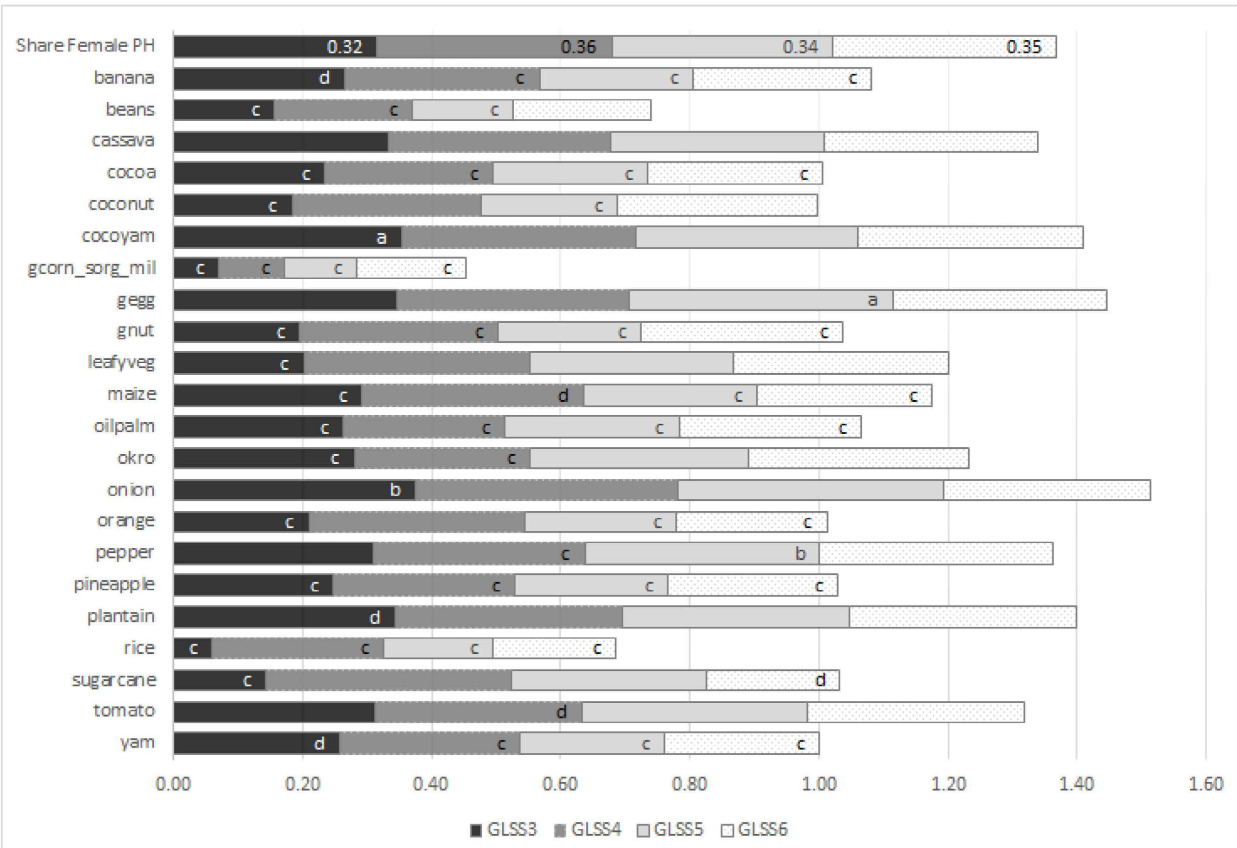
Table 5.2 Female versus male plotholders growing a crop, 1991–2013

	GLSS3			GLSS4			GLSS5			GLSS6		
Crop name	Male	Female		Male	Female		Male	Female		Male	Female	
# crops cultivated	7.38	6.29	***	6.63	5.53	***	5.89	4.67	***	4.58	3.65	***
banana	0.14	0.11	**	0.11	0.09	***	0.14	0.09	***	0.11	0.08	***
beans	0.23	0.09	***	0.20	0.09	***	0.17	0.06	***	0.13	0.07	***
cassava	0.71	0.77	***	0.48	0.44	*	0.67	0.63	***	0.54	0.51	**
cocoa	0.18	0.12	***	0.20	0.12	***	0.22	0.14	***	0.26	0.18	***
coconut	0.05	0.02	***	0.04	0.03	*	0.03	0.02	***	0.01	0.01	
cocoyam	**0.39**	**0.46**	*******	0.26	0.26		0.32	0.32		0.20	0.20	
gcorn_sorg_mil	0.22	0.04	***	0.23	0.05	***	0.22	0.05	***	0.15	0.06	***
gegg	**0.19**	**0.22**	*****	0.12	0.12		**0.12**	**0.15**	*******	0.09	0.08	
gnut	0.23	0.12	***	0.25	0.19	***	0.22	0.12	***	0.17	0.15	***
leafyveg	0.19	0.10	***	0.21	0.20		0.19	0.17	*	0.10	0.09	
maize	0.75	0.67	***	0.84	0.77	***	0.75	0.53	***	0.68	0.48	***
oilpalm	0.27	0.21	***	0.23	0.13	***	0.25	0.18	***	0.16	0.12	***
okro	0.43	0.36	***	0.31	0.21	***	0.28	0.28		0.20	0.19	
onion	**0.07**	**0.10**	******	0.04	0.05		**0.03**	**0.04**	*****	0.02	0.02	
orange	0.11	0.06	***	0.11	0.10		0.12	0.07	***	0.07	0.04	***
pepper	0.54	0.52		0.42	0.36	***	**0.41**	**0.45**	*******	0.27	0.28	
pineapple	0.10	0.07	***	0.11	0.07	***	0.11	0.06	***	0.06	0.04	***
plantain	0.42	0.48	***	0.30	0.28		0.42	0.44		0.34	0.34	
rice	0.13	0.02	***	0.15	0.09	***	0.10	0.04	***	0.12	0.05	***
sugarcane	0.02	0.01	***	0.01	0.01		0.01	0.01		0.00	0.00	**
tomato	0.35	0.34		0.24	0.20	***	0.27	0.28		0.14	0.14	
yam	0.41	0.31	***	0.35	0.24	***	0.40	0.22	***	0.34	0.20	***

Source: Author's estimations using GLSS data (GSS various years).
Note: GLSS = Ghana Living Standards Survey; gcorn_sorg_mil = guinea corn, sorghum and millet; gegg = garden egg; gnut =groundnut; leafyveg = leafy vegetables; oilpalm = oil palm. Boldface indicates significant difference to be larger for female than for male*p < .1. **p < .05. ***p < .01.

In Figure 5.2 we show the share of plotholders who grow a crop who are women and compare this with the share of plotholders who are women (equation 6). No crop is primarily grown by women. Crops in which women are most involved throughout the years are cocoyam, garden egg, pepper, plantain, and onion. A few crops could be considered men's crops in GLSS1 (1991/1992), such as rice and sorghum, millet, and guinea corn, but the share of women plotholders cultivating these crops significantly increases from then onward. By GLSS6 (2012/2013) no crop is primarily grown by men. When we compare the share of women growing a specific crop with the overall share of women plotholders (first bar of Figure 5.2) we see that most crops are disproportionally grown by men in GLSS3 (16 out of 22 crops under analysis), while only 2 are disproportionally grown by women. Cocoa is Ghana's main agricultural export and the country's main cash crop. Although men are slightly more likely to be involved in cocoa production, female plotholders play an important role. Gender differences seem to decrease over time; by GLSS6 only 12 out of the 22 crops are disproportionally grown by men, while none is disproportionally grown by women.

Figure 5.2 Proportion of farmers who are growing a specific crop who are women, 1991–2013



Source: Author's estimations using GLSS data (GSS various years).
Note: GLSS = Ghana Living Standards Survey; gcorn_sorg_mil = guinea corn, sorghum, millet; gegg = garden egg gnut = groundnut; leafyveg = leafy vegetables; oilpalm = oil palm; PH = plotholder. The proportion of farmers who are growing the crop who are women is greater than the share of female plotholders in the population in the reference year, (a) at the 1 percent significance level and (b) at the 5 percent significance level. The proportion of farmers who are growing the crop who are women is smaller than the share of female plotholders in the population the reference year (c) at the 1 percent significance level and (d) at the 5 percent significance level.

Similar to the summary statistics, the regression results (equation 7, Table 5.3) show that the number of crops grown by plotholders significantly decreases over time and that women grow a significantly lower number of crops compared to men. This is true for Ghana as a whole and for each of the agroecological zones. Gendered patterns are more outspoken in the northern savannah and forest compared to the coast. When looking at the interaction between gender and time, we see that the number of crops grown by women plotholders decreases less rapidly than for men. This is mainly driven by the forest and savannah zones. This points to a reduction in the gender gap of number of crops cultivated over time, especially in regions with higher gender discrepancies. The positive and significant coefficient on female household head indicates that cropping patterns of female heads are more similar to male cropping patterns than that of female spouses. Table A.1 in the Appendix reports the same analysis for the likelihood of growing specific crops.

Table 5.3 Ordinary least squares regression specification on "number of crops harvested"

	Number of crops			
Variable name	**Ghana**	**Coast**	**Forest**	**Savannah**
Female	-1.424***	-0.827***	-2.138***	-2.980***
	(0.178)	(0.288)	(0.235)	(0.231)
4.GLSS	-0.563***	-0.032	-0.389*	-1.077***
	(0.119)	(0.291)	(0.203)	(0.147)
5.GLSS	-1.449***	-1.331***	-1.455***	-1.360***
	(0.097)	(0.220)	(0.178)	(0.124)
6.GLSS	-2.837***	-2.644***	-3.509***	-2.029***
	(0.093)	(0.237)	(0.162)	(0.124)
Female#4.GLSS	-0.102	0.057	-0.430	0.253
	(0.197)	(0.427)	(0.301)	(0.289)
Female#5.GLSS	0.029	-0.141	-0.079	0.597**
	(0.164)	(0.322)	(0.267)	(0.248)
Female#6.GLSS	0.446***	0.176	0.741***	0.699***
	(0.152)	(0.307)	(0.241)	(0.236)
Forest	1.382***			
	(0.109)			
Savannah	0.701***			
	(0.133)			
Female#Forest	-0.720***			
	(0.149)			
Female#Savannah	-0.996***			
	(0.139)			
Female HH head	0.939***	-0.007	0.895***	1.425***
	(0.085)	(0.200)	(0.133)	(0.121)
Matrilineal ethnic group	0.289***	0.592	0.291**	0.955***
	(0.087)	(0.362)	(0.115)	(0.173)
Constant	7.064***	6.194***	8.672***	7.490***
	(0.149)	(0.427)	(0.203)	(0.138)
HH controls	yes	yes	yes	yes
Region FE	yes	yes	yes	yes
No. of Obs.	24,319	3,092	10,877	10,350
R-Squared	.19	.23	.18	.20

Source: Author's estimations using GLSS data (GSS various years).
Note: FE = fixed effects; GLSS = Ghana Living Standards Survey; HH = household; No. of Obs. = number of observations. Robust standard errors are in parentheses. Household controls include ethnicity, religion, marital status, and household size.
**p* < .1. ***p* < .05. ****p* < .01.

Crop Commercialization

Table 5.4 gives an overview of market participation and the degree of commercialization of crops. We find that both male and female farmers regularly sell some of their produce to the market, for both crops with a single harvest (12-month period) and repeatedly harvested crops (two-week period). Even if we consider only the 12-month subsample of crops, we find that at least 64–71 percent of all male plotholders and 51–64 percent of all women sell crops. Overall, male plotholders are more likely than female plotholders to sell some of their produce. This is not entirely unexpected, as men cultivate a larger number of crop varieties. For most individual crops, however, the proportion of male farmers who sell part of their harvest is not significantly different from women farmers who grow the crop. Moreover, in many cases the proportion of the harvest sold is similar for male and female farmers who sell a specific crop. When significant differences appear, they tend to be relatively small. The plotholder CCI provides insights into the value of crop sales compared to the value of total crop production. CCI across the crops with records of 12 months is between 0.41 and 0.49 for men and 0.39 and 0.46 for women. At first sight, women plotholders appear to commercialize less than men. Yet when conditioning on any sales, the trend is reduced if not reversed: CCI across crops tends to be larger for women than for men, taking on values between 0.57 and 0.66 for male and 0.61 and 0.73 for female plotholders. Among sellers, female farmers seem to be more commercially oriented both for crops that are popularly considered to be food crops, such as maize and rice, and for crops considered cash crops, such as cocoa.

Regression results suggest that crop commercialization increases over time in terms of both the share of plotholders who sell a certain crop and the proportion of the crop that is sold (Table 5.5).[4] On average for Ghana, the likelihood of selling a crop is slightly lower for female plotholders. Effects vary by agroecological zone: while no differences exist in the coast, women plotholders are less likely to sell and commercialize crops in the forest but more likely to sell crops in the savannah. The increase in crop commercialization over time is less pronounced for women than for men. When conditioning on sales, results are negative and significant only for the coast but not significant or even positive in the savannah and forest. While the likelihood of selling a crop does not differ by the women's role within the household, the proportion of crops sold is larger for female spouses than for female heads. This contrasts the results on crop cultivation choices. Interesting to note, women from matrilineal ethnic groups are more market oriented than their counterparts from patrilineal ethnic groups.

[4] We report regression results only on crops that were produced and sold in the past 12 months. Results on crops produced and sold in the past two weeks are similar but not reported in the interest of space.

Table 5.4 Degree of plotholder agricultural commercialization by gender and type of crop over time, 1991–2013

Crop name		GLSS3			GLSS4			GLSS5			GLSS6		
		% selling	CCI	Cond CCI	% selling	CCI	Cond CCI	% selling	CCI	Cond CCI	% selling	CCI	Cond CCI
All crops - 12 month period	Male	**0.64**	**0.43**	**0.61**	**0.73**	0.41	**0.57**	**0.69**	0.48	**0.63**	**0.71**	**0.49**	**0.66**
	Female	**0.53**	**0.46**	**0.68**	**0.64**	0.39	**0.61**	**0.51**	0.46	**0.67**	**0.52**	**0.46**	**0.73**
All crops - 2 week period	Male	0.27	**0.16**	0.48	0.19	0.13	0.47	**0.30**	**0.22**	0.55	**0.20**	**0.18**	0.59
	Female	0.29	**0.21**	0.53	0.17	0.11	0.48	**0.23**	**0.17**	0.52	**0.15**	**0.14**	0.57
maize [a]	Male	0.53	**0.33**	**0.63**	0.52	0.30	0.58	0.58	**0.34**	**0.59**	**0.53**	0.32	**0.61**
	Female	0.57	**0.38**	**0.66**	0.53	0.32	0.61	0.56	**0.35**	**0.63**	**0.45**	0.30	**0.67**
rice [a]	Male	0.51	0.31	0.61	**0.60**	**0.34**	**0.56**	0.56	0.33	0.59	**0.58**	**0.34**	0.59
	Female	0.33	0.23	0.70	**0.71**	**0.45**	**0.63**	0.53	0.29	0.55	**0.45**	**0.28**	0.62
cassava [b]	Male	**0.19**	0.12	0.63	0.18	0.10	0.55	0.24	0.16	0.69	0.18	0.12	0.67
	Female	**0.24**	0.14	0.61	0.20	0.10	0.51	0.23	0.15	0.66	0.19	0.13	0.66
guinea corn, sorghum, millet [a]	Male	0.15	0.07	0.45	0.24	0.10	0.42	0.39	0.21	0.55	**0.30**	0.17	0.57
	Female	0.11	0.06	0.58	0.29	0.13	0.44	0.34	0.20	0.60	**0.16**	0.08	0.50
yam [b]	Male	**0.16**	0.09	0.58	0.11	0.06	**0.52**	**0.16**	**0.10**	0.62	**0.17**	**0.10**	0.63
	Female	**0.08**	0.05	0.63	0.08	0.05	**0.70**	**0.08**	**0.06**	0.71	**0.05**	**0.03**	0.56
groundnut [a]	Male	**0.62**	**0.36**	**0.57**	**0.67**	0.35	**0.53**	0.74	0.46	0.62	0.66	0.39	**0.59**
	Female	**0.74**	**0.55**	**0.74**	**0.54**	0.32	**0.60**	0.77	0.48	0.63	0.62	0.40	**0.64**
plantain [b]	Male	0.28	0.18	0.64	0.31	0.19	0.60	**0.32**	**0.22**	**0.68**	0.32	**0.24**	**0.74**
	Female	0.30	0.18	0.61	0.33	0.19	0.56	**0.25**	**0.15**	**0.63**	0.27	**0.17**	**0.65**
okro [b]	Male	0.15	0.10	0.72	0.16	0.10	0.65	**0.21**	**0.16**	0.76	0.15	0.12	0.79
	Female	0.21	0.15	0.74	0.17	0.11	0.64	**0.12**	**0.09**	0.68	0.14	0.10	0.73
cocoa [a]	Male	0.94	0.88	0.94	0.98	0.89	0.91	0.94	0.83	**0.88**	0.96	**0.85**	**0.89**
	Female	0.92	0.88	0.96	0.99	0.91	0.92	0.92	0.87	**0.95**	0.97	**0.91**	**0.94**
oilpalm [b]	Male	**0.23**	**0.15**	0.73	0.26	0.16	**0.60**	**0.33**	**0.26**	0.78	**0.31**	**0.24**	0.80
	Female	**0.15**	**0.10**	0.69	0.21	0.16	**0.75**	**0.15**	**0.12**	0.76	**0.20**	**0.16**	0.80
pineapple [b]	Male	**0.15**	0.10	**0.67**	0.12	0.09	0.71	0.14	0.10	0.75	0.27	0.19	0.71
	Female	**0.07**	0.07	**1.00**	0.07	0.05	0.76	0.12	0.09	0.75	0.28	0.17	0.63
tomato [b]	Male	0.26	0.19	0.75	**0.23**	0.17	0.70	**0.35**	**0.29**	0.81	0.25	0.21	0.83
	Female	0.25	0.18	0.74	**0.15**	0.12	0.67	**0.21**	**0.16**	0.77	0.24	0.18	0.74

Source: Author's estimations using GLSS data (GSS various years).
Note: CCI = Crop Commercialization Index for producers; Cond CCI = Crop Commercialization Index conditional on selling; GLSS = Ghana Living Standards Survey; oilpalm = oil palm. Boldface indicates significant differences at the 1 percent or 5 percent level between male and female plotholders. [a.] Indicators based on a 12-month period record. [b.] Indicators based on a two-week period record.

Table 5.5 Logit and GLM regression specification on "crop commercialization," crops grown and sold in the past 12 months

	Dependent variable = Sell any crop (Logit model)				Dependent variable = CCI (GLM model)				Dependent variable = Conditional CCI (GLM model)			
Variable name	Ghana	Coast	Forest	Savannah	Ghana	Coast	Forest	Savannah	Ghana	Coast	Forest	Savannah
Female	-0.197*	0.061	-0.933***	-0.278	0.146	0.184	-0.246**	0.743***	0.115	0.225	-0.067	0.662***
	(0.109)	(0.187)	(0.124)	(0.179)	(0.093)	(0.157)	(0.111)	(0.141)	(0.084)	(0.143)	(0.104)	(0.137)
4.GLSS	0.422***	0.272*	0.476***	0.493***	-0.103**	-0.313***	-0.222***	0.188***	-0.188***	-0.273**	-0.394***	0.077
	(0.065)	(0.142)	(0.102)	(0.109)	(0.046)	(0.115)	(0.071)	(0.070)	(0.041)	(0.109)	(0.067)	(0.062)
5.GLSS	0.115*	0.157	0.176*	0.163*	0.254***	0.164	0.118*	0.450***	0.120***	0.190*	-0.103	0.356***
	(0.059)	(0.137)	(0.094)	(0.092)	(0.043)	(0.115)	(0.072)	(0.063)	(0.039)	(0.109)	(0.067)	(0.057)
6.GLSS	0.386***	0.269*	0.143*	0.763***	0.283***	0.315**	0.274***	0.290***	0.265***	0.105	0.098	0.438***
	(0.058)	(0.158)	(0.087)	(0.095)	(0.042)	(0.133)	(0.067)	(0.063)	(0.039)	(0.120)	(0.064)	(0.057)
Female#4.GLSS	-0.090	-0.216	0.054	-0.209	-0.356***	-0.396**	-0.159	-0.523***	-0.193**	-0.368**	0.009	-0.090
	(0.105)	(0.219)	(0.148)	(0.220)	(0.083)	(0.178)	(0.119)	(0.164)	(0.076)	(0.159)	(0.111)	(0.156)
Female#5.GLSS	-0.303***	-0.538**	-0.098	-0.486**	-0.224***	-0.487***	-0.019	-0.292*	-0.118	-0.351**	0.099	-0.108
	(0.099)	(0.216)	(0.143)	(0.197)	(0.084)	(0.186)	(0.125)	(0.153)	(0.077)	(0.169)	(0.117)	(0.145)
Female#6.GLSS	-0.397***	-0.469**	-0.035	-0.709***	-0.255***	-0.293	-0.053	-0.494***	-0.032	-0.126	0.216*	-0.096
	(0.094)	(0.228)	(0.132)	(0.186)	(0.079)	(0.198)	(0.116)	(0.145)	(0.074)	(0.179)	(0.112)	(0.140)
Forest	0.789***				0.656***				0.322***			
	(0.063)				(0.051)				(0.048)			
Savannah	0.708***				0.343***				0.094			
	(0.082)				(0.064)				(0.058)			
Female#Forest	-0.458***				-0.077				0.176**			
	(0.089)				(0.076)				(0.071)			
Female#Savannah	-0.292***				0.277***				0.424***			
	(0.094)				(0.080)				(0.074)			
Female HH head	0.030	-0.246*	0.072	0.074	-0.318***	-0.318***	-0.149**	-0.572***	-0.237***	-0.171	-0.036	-0.508***
	(0.053)	(0.135)	(0.075)	(0.095)	(0.046)	(0.121)	(0.067)	(0.078)	(0.043)	(0.113)	(0.062)	(0.071)
Matrilineal ethnic group	0.107**	0.642***	0.019	0.181*	0.429***	0.694***	0.350***	0.344***	0.474***	0.203	0.409***	0.423***
	(0.051)	(0.194)	(0.065)	(0.109)	(0.038)	(0.180)	(0.049)	(0.078)	(0.036)	(0.172)	(0.047)	(0.074)
Constant	0.279***	-0.309	1.372***	0.428***	-0.025	0.010	0.752***	-0.976***	0.873***	1.257***	1.384***	-0.401***
	(0.099)	(0.240)	(0.124)	(0.142)	(0.080)	(0.224)	(0.097)	(0.098)	(0.076)	(0.202)	(0.095)	(0.085)
HH controls	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Region FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
No. of obs.	24,526	3,092	10,877	10,350	21,405	2,576	9,288	9,541	14,757	1,581	7,119	6,057

Source: Author's estimations using GLSS data (GSS various years).
Note: CCI = Crop Commercialization Index for producers; Conditional CCI = Crop Commercialization Index conditional on selling; FE = fixed effects; GLM = General linear model; GLSS = Ghana Living Standards Survey; HH = household; No. of Obs. = number of observations. Robust standard errors are in parentheses. Household controls include ethnicity, religion, marital status, and household size. *$p < .1$. **$p < .05$. ***$p < .01$.

Input Use

Data on input use are provided at only the household level; hence Figure 5.3 shows data disaggregated by the gender of the household head rather than gender of the plotholder. Female-headed households are less likely to buy inputs compared to male-headed households, with the exception of hired labor. Differences are largest in the use of fertilizers, pesticides, and fuel for transport. Conditional on having bought the input, we find that the amount spent per acre does not significantly differ among male- and female-headed households for most inputs. The largest gender differences are detected in the larger amounts women spend on the hiring of labor and renting of equipment. This is likely related to physical and social constraints for women farmers to perform agricultural duties that require a high amount of strength, such as land clearing and preparation or pesticide application.

The use of inputs has rapidly increased in the past 20 years (Figure 5.3). The steepest increase is found in the use of inorganic fertilizers and pesticides. In 1991/1992 around 10 percent of all plotholders applied inorganic fertilizers or pesticides. By 2012/2013, 29 percent and 65 percent of the households used inorganic fertilizer and pesticides, respectively. The reported use of inorganic fertilizers in 2012/2013 is in line with the findings from Sheahan and Barrett (forthcoming), who use the LSMS-ISA data from 2010 to 2012 from six African countries and find that 35 percent use inorganic fertilizers, but they are higher than what is commonly found in the literature (for example, Minot and Benson 2009, using FAOSTAT data from 2009). Pesticide use is considerably higher in Ghana than cited in Sheahan and Barrett (forthcoming), who find that only 3–33 percent of all cultivating households in other African countries use pesticides.

Figure 5.3 Input use, 1991–2013

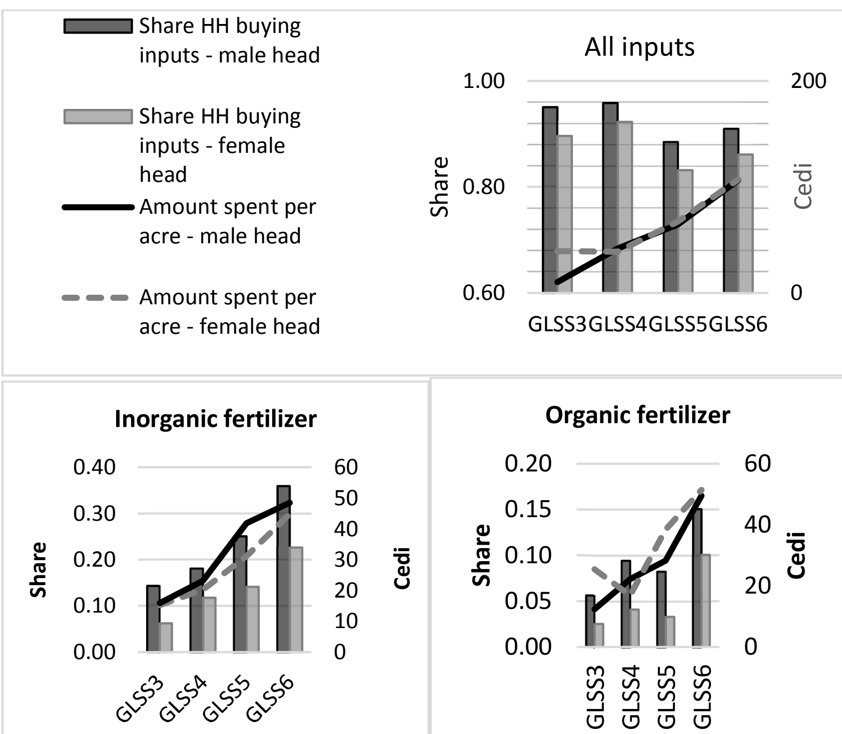
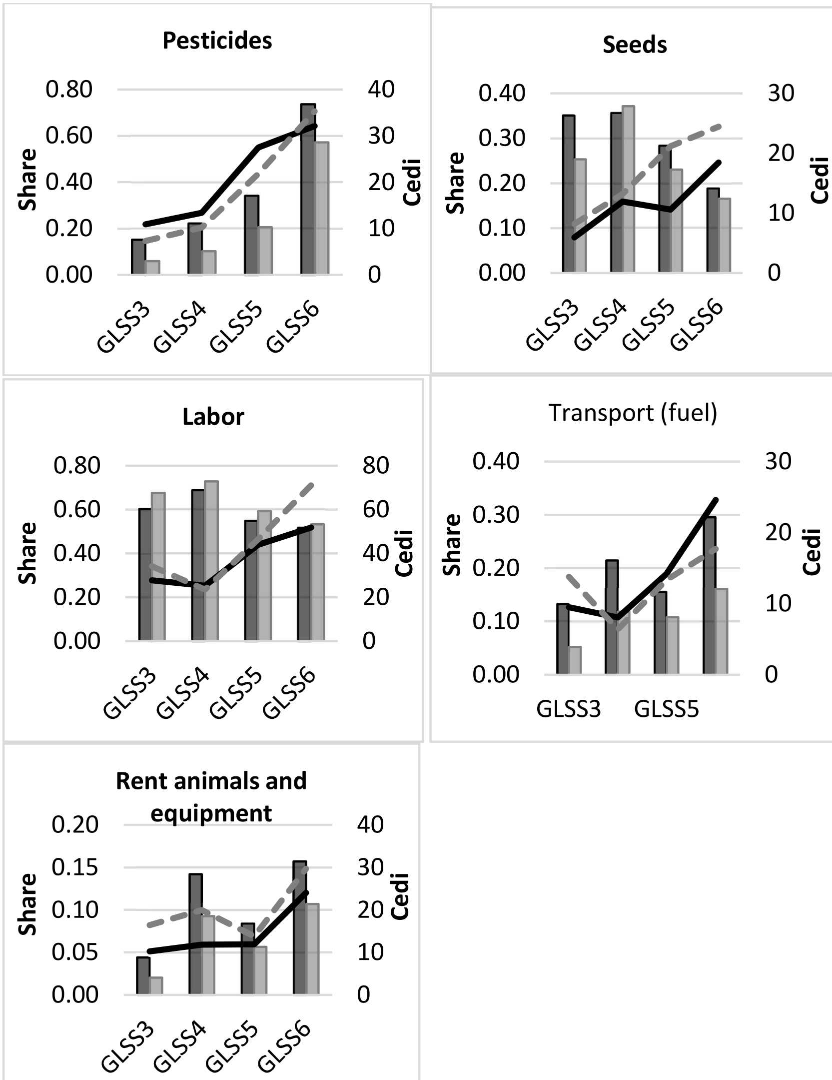


Figure 5.3 Continued



Source: Author's estimations using GLSS data (GSS various years).
Note: GLSS = Ghana Living Standards Survey; HH = household. GLSS3, GLSS4, and GLSS5 values are adjusted to Ghana cedi equivalents in GLSS6 (base year 2013).

Table 5.6 shows the multivariate regression results on the likelihood of buying specific inputs and the amount spent on the input conditional on purchase. Except for labor, female-headed households are significantly less likely to buy inputs. The average likelihood of buying fertilizers, pesticides, fuel, and equipment tends to increase over time. In turn, it decreases for seed and labor, the latter indicating a higher mechanization of agriculture but a lack of successful dispersion of new varieties and certified planting material in the past 20 years (Tripp 1993; Tripp and Ragasa 2015). The decrease in the use of seeds over time is smaller for female-headed households, but these households seem to catch up in the use of inorganic fertilizers. Conditional on buying an input, households increase their spending on agricultural inputs over time. The gender of the household head does not appear to be a major determinant of the amount of input use. This only partly echoes the findings by Sheahan and Barrett (forthcoming): for some African countries (Malawi, Niger, and Nigeria) they find that plots managed by men are more likely to receive inorganic fertilizers and agrochemicals and in higher amounts, but results do not hold for other countries (Ethiopia, Tanzania, and Uganda). With time, we find that households with female headship spend higher amounts on seed, labor, animals, and equipment. Belonging to a matrilineal or patrilineal ethnic group does not affect the outcome variable.

Table 5.6 Regression specification on "input purchase"

	Dependent variable = Buy any input (Logit model)						
Variable name	**Inorganic fertilizers**	**Organic fertilizer**	**Agro-chemicals**	**Seeds**	**Labor**	**Transport fuel**	**Animal or equipment**
Female HH head	-0.624***	-0.451	-0.871***	-0.316**	0.378***	-0.835***	0.094
	(0.218)	(0.367)	(0.211)	(0.142)	(0.125)	(0.265)	(0.365)
4.GLSS	0.123	0.612***	0.370***	-0.081	0.477***	0.629***	1.441***
	(0.093)	(0.135)	(0.084)	(0.068)	(0.066)	(0.092)	(0.136)
5.GLSS	0.612***	0.570***	0.993***	-0.412***	-0.166***	0.136	0.804***
	(0.082)	(0.126)	(0.078)	(0.065)	(0.060)	(0.092)	(0.135)
6.GLSS	1.233***	1.238***	2.847***	-0.826***	-0.270***	0.987***	1.612***
	(0.079)	(0.123)	(0.078)	(0.066)	(0.059)	(0.083)	(0.130)
FemaleHead#4.GLSS	0.435*	-0.441	0.147	0.559***	-0.168	0.195	0.269
	(0.235)	(0.328)	(0.216)	(0.134)	(0.132)	(0.233)	(0.346)
FemaleHead#5.GLSS	0.389*	-0.307	0.407**	0.318**	-0.243*	0.449*	0.565
	(0.223)	(0.314)	(0.202)	(0.137)	(0.126)	(0.240)	(0.352)
FemaleHead#6.GLSS	0.362*	0.005	0.269	0.363***	-0.314***	0.216	0.420
	(0.211)	(0.278)	(0.193)	(0.135)	(0.118)	(0.219)	(0.337)
Forest	-0.274***	0.073	0.998***	-0.150**	0.348***	0.998***	0.297**
	(0.087)	(0.133)	(0.089)	(0.074)	(0.065)	(0.096)	(0.128)
Savannah	0.183	-0.129	0.461***	-0.144	0.580***	0.826***	-0.012
	(0.113)	(0.184)	(0.109)	(0.099)	(0.091)	(0.127)	(0.172)
FemaleHead#Forest	-0.150	0.149	-0.232	-0.185	0.089	-0.014	-0.674***
	(0.153)	(0.255)	(0.148)	(0.120)	(0.106)	(0.199)	(0.202)
FemaleHead#Savannah	0.030	0.652**	0.345**	0.082	-0.057	0.019	-0.570***
	(0.155)	(0.257)	(0.156)	(0.136)	(0.120)	(0.228)	(0.200)
Matrilineal ethnic group	-0.066	0.387***	0.046	0.036	0.211***	0.097	0.095
	(0.068)	(0.112)	(0.067)	(0.062)	(0.057)	(0.068)	(0.108)
Constant	-1.849***	-3.324***	-2.264***	-0.888***	-0.150	-2.266***	-3.900***
	(0.128)	(0.205)	(0.133)	(0.116)	(0.105)	(0.143)	(0.201)
HH controls	yes	yes	yes	yes	yes	yes	yes
Region FE	yes	yes	yes	yes	yes	yes	yes
No. of Obs.	17,687	17,687	17,687	17,687	17,687	17,687	17,687
R-Squared							

Table 5.6 Continued

	Dependent variable = Amount spent per acre (OLS model)						
Variable name	**Inorganic Fertilizers**	**Organic Fertilizer**	**Agro-chemicals**	**Seeds**	**Labor**	**Transport Fuel**	**Animal or equipment**
Female HH head	-13.581	34.586	0.295	1.321	6.551	-4.630	-3.938
	(10.104)	(23.280)	(8.361)	(3.824)	(8.310)	(5.074)	(7.403)
4.GLSS	-2.141	24.203**	-0.227	4.919***	-1.888	-1.148	-0.879
	(2.462)	(10.076)	(2.042)	(1.739)	(2.097)	(2.302)	(2.074)
5.GLSS	15.006***	24.007***	15.294***	3.299***	17.781***	3.257	3.448
	(2.798)	(5.570)	(2.260)	(0.896)	(4.517)	(2.229)	(2.564)
6.GLSS	27.772***	38.053***	26.152***	8.508***	22.424***	10.790***	15.850***
	(2.308)	(6.747)	(2.401)	(1.465)	(3.398)	(2.686)	(2.450)
FemaleHead#4.GLSS	-0.566	-15.394	-0.136	-2.140	-2.839	-1.325	5.004
	(8.342)	(23.589)	(3.263)	(2.869)	(4.833)	(3.566)	(4.713)
FemaleHead#5.GLSS	1.285	4.401	-2.843	6.296*	7.428	1.754	4.530
	(10.382)	(24.233)	(3.945)	(3.487)	(7.478)	(4.254)	(5.252)
FemaleHead#6.GLSS	6.487	13.981	5.894	7.888**	24.410***	0.697	8.360*
	(9.624)	(28.341)	(4.876)	(3.566)	(8.712)	(4.888)	(4.858)
Forest	0.874	-4.609	-0.730	-8.741**	-1.224	-5.816**	-17.838***
	(4.615)	(10.408)	(4.747)	(3.573)	(4.347)	(2.624)	(4.895)
Savannah	-7.759	11.524	4.557	-4.215	8.888**	-6.288*	-20.224***
	(5.730)	(26.266)	(7.502)	(4.071)	(4.356)	(3.662)	(4.702)
FemaleHead#Forest	24.892**	-39.800	-2.204	2.555	-3.786	5.390	-3.147
	(10.299)	(40.896)	(8.276)	(4.712)	(6.188)	(4.683)	(7.791)
FemaleHead#Savannah	18.068**	-34.302	-8.590	-3.433	-8.276	8.234	-0.217
	(7.606)	(45.220)	(7.853)	(4.465)	(7.588)	(8.962)	(7.336)
Matrilineal ethnic group	5.316	0.152	2.482	1.273	1.863	-1.222	0.625
	(4.158)	(12.442)	(5.074)	(1.712)	(3.045)	(1.837)	(2.517)
Constant	0.652	3.669	-3.872	9.285**	23.739***	18.553***	28.405***
	(7.480)	(21.973)	(5.788)	(3.763)	(5.004)	(7.050)	(4.807)
HH controls	yes	yes	yes	yes	yes	yes	yes
Region FE	yes	yes	yes	yes	yes	yes	yes
No. of Obs.	4,541	1,805	7,293	4,349	9,794	3,041	2,231
R-Squared	.05	.04	.04	.04	.03	.03	.07

Source: Author's estimations using GLSS data (GSS various years).

Note: CCI = Crop Commercialization Index for producers; Conditional CCI = Crop Commercialization Index conditional on selling; Dep Var = dependent variable; Equip = equipment; FE = fixed effects; GLSS = Ghana Living Standards Survey; HH = household; No. of Obs. = number of observations; OLS = ordinary least squares. Coefficients of logit models are reported. Robust standard errors are in parentheses. Household controls include ethnicity, religion, marital status, and household size. *$p < .1$. **$p < .05$. ***$p < .01$.

Occupation

In Table 5.7 we report the share of men and women and the Duncan Index for different types of primary occupations over time. The index is highest for agricultural self-employment and agricultural contributing family worker, which indicates that these occupations have the highest level of gender segregation. Women and men are equally likely to have a primary occupation in agriculture, but men are more likely than women to be self-employed farmers, and women are more likely than men to be contributing family farm workers. This is consistent with patterns of land control we reported above. The gap is somewhat decreasing over time, and while the self-employment Duncan value was 12.1 percent in 1991/1992 (GLSS3) it decreased to 9.6 percent in 2012/2013 (GLSS6). The same is true for the Duncan value on contributing family worker, indicating that fewer women are primarily involved in family labor. Out of all women, 41.5 percent in GLSS3 and 34.2 percent in GLSS6 were primarily agricultural family workers; during the same time period primary employment of men in agricultural family work increased from 18–20 percent. Albeit the frequency of occurrence is lower, inequalities in terms of paid and nonagricultural self-employment increase over time. While in 1991/1992 (GLSS3), paid employment was rarely observed as primary employment, we see that by 2012/2013 (GLSS6), 12 percent of all men and 4 percent of all women consider wage employment their primary employment. At the same time, an equal share of women and men were self-employed in nonagricultural activities as their primary job in 1991/1992 (around 20 percent), but men exit the sector over time, and by 2012/2013, only 8 percent of all men consider nonfarm self-employment their main occupation. A similar trend is visible if we consider both primary and secondary employment (results not shown).

Table 5.7 Primary occupation and Duncan Index (D), 1991–2013

	GLSS3				GLSS4			
Employment category	**Men**	**Women**		**D**	**Men**	**Women**		**D**
Agric self-employed	0.514	0.272	***	12.1	0.589	0.373	***	10.8
Agric family worker	0.179	0.415	***	11.8	0.116	0.296	***	9.0
Non-agric self employed	0.195	0.198		0.2	0.127	0.279	***	7.6
Non-agric family worker	0.011	0.017	**	0.3	0.009	0.013		0.2
Paid employment	0.000	0.001		0.0	0.156	0.039	***	5.8
No work	0.091	0.087		0.2	0.003	0.000	**	0.2
No. of Obs.	2,820	3,362			3,004	3,714		

	GLSS5				GLSS6			
Employment category	**Men**	**Women**		**D**	**Men**	**Women**		**D**
Agric self-employed	0.519	0.266	***	12.7	0.454	0.263	***	9.6
Agric family worker	0.142	0.346	***	10.2	0.195	0.342	***	7.3
Non-agric self employed	0.059	0.200	***	7.0	0.084	0.176	***	4.6
Non-agric family worker	0.002	0.009	***	0.3	0.009	0.023	***	0.7
Paid employment	0.119	0.025	***	4.7	0.123	0.042	***	4.0
No work	0.143	0.140		0.1	0.098	0.126	***	1.4
No. of Obs.	5,342	6,090			10,420	11,569		

Source: Author's estimations using GLSS data (GSS various years).
Note: Agric = agriculture; GLSS = Ghana Living Standards Survey; No. of Obs. = number of observations. Share of men and women in primary occupation are significantly different at ***p* < .05; ****p* < .01.

Table 5.8 reports logit regression results.[5] While the overall trend for agricultural self-employment is ambiguous and first increases but decreases in GLSS6, we observe a net over-time decrease in nonagricultural self-employment and nonagricultural family employment. The decline is more than compensated for by a large increase in paid employment. This message is consistent with findings on rural Ghana from Davis, Di Giuseppe, and Zezza (forthcoming), who find that household-level participation rates in farm and nonfarm self-employment fell during the period from 1992 to 2005. At the same time, however, they find that the share of household income from self-employment doubled and from nonagricultural wages increased by 50 percent during the period from 1992 to 2005. Although the share of adults with self-employment as their primary occupation is decreasing, it is possible that those who continue to engage in self-employment were able to turn this into a more profitable venture.

Table 5.8 Logit regression specification on primary employment category

	Dependent variable = Primary Employment					
Variable name	**Agric self**	**Agric fam**	**NonAgr self**	**NonAgr fam**	**Paid empl**	**No Work**
Female	-1.433***	1.657***	-0.073	0.944***	-1.806***	0.413***
	(0.083)	(0.106)	(0.087)	(0.285)	(0.133)	(0.122)
4.GLSS	0.327***	-0.255***	-0.942***	-0.332	5.593***	-3.629***
	(0.068)	(0.077)	(0.081)	(0.298)	(0.710)	(0.387)
5.GLSS	0.139**	-0.291***	-1.485***	-1.729***	5.378***	0.599***
	(0.058)	(0.064)	(0.082)	(0.370)	(0.707)	(0.085)
6.GLSS	-0.121**	0.060	-1.147***	-0.256	5.474***	0.012
	(0.055)	(0.060)	(0.066)	(0.226)	(0.706)	(0.083)
Female#4.GLSS	0.282***	-0.109	1.102***	0.011	0.000	0.000
	(0.087)	(0.096)	(0.100)	(0.362)	.	.
Female#5.GLSS	-0.052	-0.115	1.475***	0.760*	-0.031	-0.107
	(0.077)	(0.082)	(0.100)	(0.425)	(0.149)	(0.118)
Female#6.GLSS	0.423***	-0.683***	0.980***	0.298	0.452***	0.148
	(0.071)	(0.075)	(0.084)	(0.266)	(0.125)	(0.114)
Forest	0.715***	0.342***	-0.358***	-0.373	-0.653***	-0.324***
	(0.057)	(0.079)	(0.070)	0.242	(0.072)	(0.077)
Savannah	1.134***	0.487***	-0.449***	-0.442	-1.186***	-0.615***
	(0.071)	(0.088)	(0.089)	0.304	(0.125)	(0.104)
Female#Forest	-0.378***	0.332***	-0.290***	0.037	0.090	0.116
	(0.072)	(0.095)	(0.079)	0.27	(0.115)	(0.098)
Female#Savannah	-1.178***	0.531***	-0.146*	0.001	0.251*	0.333***
	(0.072)	(0.092)	0.089	0.287	(0.135)	(0.103)
Female HH head	0.666***	-0.963***	0.394***	0.171	0.215***	0.096**
	(0.036)	(0.042)	(0.041)	(0.118)	(0.064)	(0.049)
Matrilineal ethnic group	0.004	-0.439***	0.133***	-0.048	0.226***	0.372***
	(0.034)	(0.037)	(0.040)	(0.132)	(0.063)	(0.052)
Constant	0.050	-2.634***	-0.421***	-5.097***	-5.856***	-3.948***
	(0.081)	(0.100)	(0.094)	(0.292)	(0.712)	(0.125)
HH controls	yes	yes	yes	yes	yes	yes
Region FE	yes	yes	yes	yes	yes	yes
No. of Obs.	46,171	46,171	46,171	46,171	46,171	42,457

Source: Author's estimations using GLSS data (GSS various years).
Note: AgricSelf = Agricultural self-employment; AgricFam = Agricultural family worker; NonAgric Self = Non-agricultural self-employment; NonAgr Fam = Non-agricultural family worker; Paid Empl = Paid Employment; No Work = Not working; FE = fixed effects; GLSS = Ghana Living Standards Survey; HH = household; No. of Obs. = number of observations. Robust standard errors are in parentheses. Household controls include ethnicity, religion, marital status, and household size. **p* < .1. ***p* < .05. ****p* < .01.

[5] A multinomial logit model would lead to more efficient parameter estimates but would make the interpretation more cumbersome as results are compared to one occupation that is used as a reference category. Given that our objective is to describe trends, we stick to more straightforward binary logistic regression models.

In line with the descriptive statistics, the regressions confirm that women are more likely to be unemployed or to consider their primary employment contributing family work either in farm or nonfarm businesses. Yet this gap is closing, and over time women become more likely to be involved in farm and nonfarm self-employment and less in agricultural family work compared to their female counterparts in 1991/1992. This hints at an increase in economic empowerment of women. Also, for paid employment the initial gap between men and women was lower in 2012/2013, but a longer time period is necessary to detect an overall trend. Similar to previous gender patterns, differences exist at the level of the agroecological zones: primary occupations in agriculture, either self-employed or as a contributing member, are more prevalent in the forest and savannah than in the coast. This is likely related to the broader set of economic opportunities in the relatively more developed coastal zone of Ghana. Occupational choices of female household heads and women of matrilineal ethnic groups are more similar to those of men than to those of female spouses.

6. DISCUSSION

Results show that some stylized facts about gender differences in agriculture have never existed; some say the gender gap is closing, while other long-standing beliefs remain largely true. An overview of the results in section 5 is shown in box 6.1. At the level of access to land and land size held, not much has happened in Ghana at both the overall and the gender gap level during the past 20 years. The incidence of male landholders in the rural population has slightly decreased, while the average land size has increased, but changes are far from sizeable. The share of acreage held by women is constant at around 20 percent of all available land held by rural plotholders. Women hold the largest portion of land in the matrilineal ethnic groups, but their share does not surpass even one-third of the total land held. Regardless of how ownership is defined, these figures are remarkably consistent with recent figures from other African countries (Doss et al. 2015; Deininger, Savastano, and Xia forthcoming). This confirms worries in the literature about women's access to land, although the figures are not nearly as low as advocacy groups tend to mention.

Box 6.1 Summary of results

Land

- Women are less likely to hold land and hold smaller plots of land than men.
- The incidence of women plotholders remain constant over time, whereas the share of men plotholders decreases over time.
- The gender gap in land size increases in the Savannah, but reduces in the Forest zone.

Gendered cropping patterns

- Men cultivate more crops than women, but there are no clear patterns of distinctive men's or women's crops.
- There is a reduction in the gender gap in number of crops grown by men and women over time.
- Gendered cropping patterns are more outspoken in the Savannah and Forest zones compared to the coastal zone.

Crop commercialization

- Female plotholders sell less produce than male plotholders, but conditional on growing a crop, men and women sell similar proportions of their harvest. Conditional on selling a crop, there is evidence of a higher market orientation of women compared to men.
- Crop commercialization increases over time for both men and women.
- Compared to the coastal zone women plotholders are less likely to commercialize crops in the forest, but are more likely to sell crops in the savannah zone.

Input use

- Input use is lower among female-headed households compared to male-headed households, but conditional on buying the input the use rates per acre are not different for female- and male-headed households. An exception is higher use of hired labor by female-headed households.
- Input use increases over time, and the gender gap for inorganic fertilizer use reduces over time.
- Trends in input use differ across different agroecological zones.

Occupation

- The share of men and women with a primary employment in agriculture is similar, but women are more often contributing family workers rather than self-employed in farm enterprises compared to men. Women are more likely to indicate that they are unemployed.
- Over time we see an increase in women's economic empowerment, with lower female unemployment rates and a lower share of women being contributing family workers.
- A larger share of the rural population is primarily employed in agriculture in the forest and savannah zones compared to the coastal zone.

Source: Authors' summary of results.

We find that gendered cropping patterns are not strong in Ghana, similar to results from Doss (2002) and Carr (2008). In particular, there are no crops grown exclusively by men or by women, but men are disproportionally involved in the harvesting of some types of crops and grow a larger number of crops. Given that men are more likely to cultivate land and cultivate larger portions of land, it is not surprising that most crops are more frequently grown by men compared to women and are grown more frequently on the land of male plotholders compared to the land of female plotholders. Moreover, we find evidence that gendered cropping differences decrease over time.

In line with the smaller number of crops grown, women are less likely than men to sell crops. Conditional on selling, we find evidence of an equal if not higher market orientation of women compared to men. The data do not provide evidence for the idea that as crops become more profitable more men move into their production while women are left with crops for home consumption. Rather, even if gender differences are still significant, we see that the gender gap in cropping patterns is closing; this is driven mainly by the more traditionalist forest and savannah zones. The often-cited dichotomy between "men's cash crops" and "women subsistence crops" likely has been overcome in Ghana or never existed (see Von Braun, Kennedy, and Bouis 1990 for an early discussion about this).

When looking at input use by male and female-headed households, we find significant differences in their likelihood of applying inputs but not in the amounts used per acre. It seems that once an initial hurdle in accessing inputs is overcome, the input use is similar. This only partly confirms the myth that female-headed households use considerably fewer inputs than male-headed households. Moreover, both male- and female-headed households increase input use and usage rates over time.

Finally, the share of people in rural areas who depend primarily on agriculture for their livelihoods is decreasing. There are indications of increased economic empowerment of women. Women still provide more unpaid farm labor than men, but the share of women who do so as their primary employment is decreasing. Women's participation in agricultural and nonagricultural self-employment, as well as paid employment, rises over time. Nevertheless, our results do not strongly support the conventional wisdom of an ongoing "feminization of agriculture"—not based on access to land, not based on a disproportional involvement in the production of some crops, and not based on information about women's primary occupations.

Considerable differences exist across agroecological zones, and there does seem to be evidence for gender gaps in some, but not all, aspects. In the savannah and forest agroecological zones, the gap in terms of crop production closes, but it is exacerbated in terms of land size in the savannah zone. Belonging to a matrilineal ethnic group attenuates gender differences for all aspects under analysis except input use. Finally, our results show that gender patterns in agriculture are different according to a woman's position within the household. Except for crop commercialization, patterns of female household heads are more similar to those of men than to those of female spouses. This indicates that a farmer's status within the household may be a more important determinant of cropping patterns than the gender of the farmer per se. Female household heads often face the burden of being both the main provider of cash or in-kind income for the household and the main caretaker of the household (Lambrecht 2016). Hence, our results are supportive of the hypothesis that gender-related patterns observed may be explained by social norms and expectations regarding the role of the household head rather than the gender, although household heads are more likely to be men (Kazianga and Wahhaj 2013).

7. CONCLUSION

At a time when donors and governments are increasing efforts to mainstream gender in agriculture, it is critical to revisit long-standing wisdom about rural women and men farmers to be able to more efficiently design and evaluate policy interventions. With this paper, we provide a unique overview of changes in gender patterns in agriculture during more than 20 years in Ghana. Our contribution is threefold. First, we provide new evidence of gender patterns in agriculture. The national representativeness of the data and level of disaggregation at the plot and plotholder level for many of the indicators allow us to overcome shortcomings of previous studies. Second, we provide insights into changes in gender patterns in agriculture over time, which is largely absent in the existing literature so far. Third, we look at several gender dimensions in one and the same country, which facilitates grasping the bigger picture of gender dynamics in agriculture.

Our results are varied and highlight the difficulty of making general statements about gender in agriculture. Major gender issues persevere in women's access to land as well as access to input and output markets. Yet once the entry barrier is overcome, women and men seem to follow similar agricultural patterns. Important variations exist at the level of the agroecological zone and women's positions within households. The evidence we provide calls for more nuanced statements about gender trends in agriculture. A larger openness by researchers and governmental and nongovernmental agencies is needed toward what can be detected from solid data rather than what is expected based on commonly voiced gender myths or what would be beneficial to successful fundraising campaigns. More up-to-date gender-disaggregated data that facilitate a more precise analysis and interpretation of gender gaps are imperative.

This article provides a modest attempt to contribute to the overall movement to present more objective and substantiated facts about women and men in agriculture. Clearly, it does not come without shortcomings. The repeated cross-sectional dimension, instead of pure panel data, renders the data less comparable over time due to both slight differences in survey questions and sampling strategies. The data thus do not come without noise, which we have tried to limit through a thorough data-cleaning process. Also, some of the issues may need more detailed data and extra questions about intrahousehold differences, while many more aspects of gender patterns in agriculture remain to be addressed. Microdata of specific case studies often provide clear results on impacts and have the possibility to dig further into the mechanisms of some of the effects, while these are more difficult to detect in a nationally representative sample. Finally, it goes beyond the scope of this paper to detect causal mechanisms explaining gender differences. More solid studies explaining these differences, and exploring the impact of the agricultural gender gap on welfare, empowerment, or profitability, would be of high value to the existing literature.

APPENDIX: SUPPLEMENTARY TABLE

Table A.1 Logit regression specification on "specific crop harvested"

Variable name	Banana	Beans	Cassava	Cocoa	Coconut	Gcorn_sorg_mil	Geeg	Gnut	Maize	Oilpalm
Female	-0.746***	-0.199	-0.674***	-1.252***	-1.414***	-3.049***	-0.075	0.684***	-0.882***	-1.231***
	(0.186)	(0.204)	(0.129)	(0.205)	(0.293)	(0.273)	(0.140)	(0.210)	(0.124)	(0.136)
4.GLSS	-0.236***	-0.258***	-1.255***	0.279***	0.010	-0.138	-0.475***	-0.033	0.423***	-0.193***
	(0.089)	(0.084)	(0.073)	(0.089)	(0.151)	(0.129)	(0.084)	(0.093)	(0.077)	(0.074)
5.GLSS	0.033	-0.452***	-0.141*	0.317***	-0.220	-0.376***	-0.549***	-0.159**	-0.153**	-0.069
	(0.083)	(0.074)	(0.073)	(0.085)	(0.149)	(0.115)	(0.081)	(0.080)	(0.067)	(0.072)
6.GLSS	-0.628***	-0.762***	-0.898***	0.483***	-1.565***	-1.194***	-0.956***	-0.541***	-0.463***	-0.925***
	(0.083)	(0.072)	(0.067)	(0.081)	(0.195)	(0.115)	(0.078)	(0.078)	(0.066)	(0.071)
Female#4.GLSS	-0.009	0.298	-0.191	-0.130	0.163	-0.195	-0.162	0.381**	0.308**	-0.223*
	(0.158)	(0.183)	(0.121)	(0.162)	(0.295)	(0.315)	(0.136)	(0.176)	(0.122)	(0.130)
Female#5.GLSS	-0.205	-0.083	-0.175	-0.153	0.158	-0.193	0.215*	-0.518***	-0.266**	0.084
	(0.153)	(0.166)	(0.121)	(0.161)	(0.303)	(0.287)	(0.130)	(0.168)	(0.112)	(0.125)
Female#6.GLSS	0.101	0.240	0.111	0.025	0.388	0.631**	0.021	0.207	-0.138	0.347***
	(0.151)	(0.155)	(0.113)	(0.149)	(0.384)	(0.274)	(0.130)	(0.156)	(0.106)	(0.125)
Forest	0.693***	-0.140	0.386***	2.428***	-1.429***	-0.641	0.039	0.018	-0.096	0.430***
	(0.092)	(0.133)	(0.069)	(0.092)	(0.137)	(1.333)	(0.081)	(0.143)	(0.071)	(0.069)
Savannah	-0.141	1.093***	0.444***	0.542***	-2.599***	2.410*	0.065	2.099***	-0.089	-0.806***
	(0.134)	(0.143)	(0.091)	(0.148)	(0.541)	(1.382)	(0.114)	(0.145)	(0.097)	(0.113)
Female#Forest	0.100	-0.688***	-0.259***	0.021	0.483**	0.774	-0.330***	-0.750***	-0.177*	0.026
	(0.160)	(0.190)	(0.096)	(0.166)	(0.225)	(0.572)	(0.116)	(0.195)	(0.101)	(0.107)
Female#Savannah	0.058	-0.963***	-0.943***	0.103	-0.092	0.000	-0.233	-1.032***	-1.265***	-0.022
	(0.229)	(0.168)	(0.111)	(0.277)	(1.146)	.	(0.148)	(0.175)	(0.106)	(0.200)
Female HH head	0.064	0.515***	0.715***	0.327***	0.187	1.420***	0.331***	0.193**	0.998***	0.424***
	(0.088)	(0.086)	(0.066)	(0.081)	(0.195)	(0.133)	(0.080)	(0.080)	(0.062)	(0.075)
Matrilineal ethnic group	-0.014	-1.092***	0.276***	0.581***	0.413**	-1.857***	0.355***	-0.740***	-0.349***	0.461***
	(0.069)	(0.084)	(0.054)	(0.064)	(0.189)	(0.204)	(0.068)	(0.079)	(0.056)	(0.062)
Constant	-1.515***	-1.623***	1.588***	-2.220***	-1.147***	-3.924***	-0.850***	-3.112***	0.787***	-0.908***
	(0.144)	(0.169)	(0.111)	(0.133)	(0.263)	(1.445)	(0.130)	(0.219)	(0.109)	(0.119)
HH controls	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Region FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
No. of Obs.	24,319	24,319	24,319	24,319	19,710	22,395	24,319	24,319	24,319	24,319

Table A.1 Continued

Variable name	Okro	Onion	Orange	Pepper	Pineapple	Plantain	Rice	Sugarcane	Tomato	Yam
Female	0.001	-0.139	-0.983***	-0.078	-0.517***	-0.797***	-1.613***	-1.208**	0.114	-0.673***
	(0.127)	(0.242)	(0.192)	(0.109)	(0.194)	(0.128)	(0.539)	(0.481)	(0.117)	(0.142)
4.GLSS	-0.506***	-0.488***	0.162*	-0.421***	0.165*	-0.873***	0.307***	-0.030	-0.404***	-0.342***
	(0.067)	(0.129)	(0.095)	(0.060)	(0.098)	(0.079)	(0.102)	(0.237)	(0.065)	(0.068)
5.GLSS	-0.616***	-1.086***	0.174*	-0.481***	0.102	0.007	-0.215**	-0.343	-0.340***	-0.037
	(0.060)	(0.126)	(0.093)	(0.056)	(0.096)	(0.076)	(0.091)	(0.249)	(0.060)	(0.062)
6.GLSS	-1.179***	-1.448***	-0.575***	-1.125***	-0.770***	-0.757***	-0.237***	-0.737***	-1.063***	-0.462***
	(0.059)	(0.123)	(0.095)	(0.054)	(0.101)	(0.071)	(0.091)	(0.261)	(0.059)	(0.060)
Female#4.GLSS	-0.491***	-0.226	0.420**	-0.256**	-0.145	-0.191	1.326***	0.753	-0.346***	-0.038
	(0.120)	(0.198)	(0.181)	(0.102)	(0.181)	(0.125)	(0.285)	(0.498)	(0.113)	(0.116)
Female#5.GLSS	0.083	-0.107	0.124	0.168*	-0.088	0.007	0.833***	1.006**	-0.020	-0.414***
	(0.106)	(0.208)	(0.187)	(0.096)	(0.181)	(0.121)	(0.278)	(0.508)	(0.105)	(0.110)
Female#6.GLSS	0.075	-0.489**	0.305	0.171*	0.310*	0.047	0.924***	0.783	-0.100	-0.287***
	(0.103)	(0.211)	(0.193)	(0.092)	(0.184)	(0.113)	(0.270)	(0.549)	(0.104)	(0.104)
Forest	0.291***	-0.471***	0.582***	0.089	0.161*	1.182***	1.607***	-0.973***	-0.032	0.959***
	(0.080)	(0.168)	(0.092)	(0.064)	(0.095)	(0.069)	(0.267)	(0.194)	(0.070)	(0.078)
Savannah	0.433***	-0.512**	-0.914***	0.124	-0.619***	-0.726***	2.506***	-1.834***	0.272***	2.189***
	(0.099)	(0.213)	(0.171)	(0.084)	(0.163)	(0.104)	(0.281)	(0.447)	(0.092)	(0.097)
Female#Forest	-0.281**	0.302	-0.083	-0.186**	-0.145	0.043	-0.144	-0.284	-0.248**	0.039
	(0.115)	(0.230)	(0.153)	(0.091)	(0.147)	(0.102)	(0.476)	(0.346)	(0.100)	(0.125)
Female#Savannah	-0.002	0.398	-0.083	-0.109	-0.470*	0.054	0.109	0.856	-0.148	-1.205***
	(0.117)	(0.250)	(0.307)	(0.096)	(0.283)	(0.148)	(0.458)	(0.627)	(0.105)	(0.135)
Female HH head	0.209***	0.197	-0.003	0.132**	-0.144	0.476***	0.340***	0.036	0.043	0.521***
	(0.061)	(0.124)	(0.100)	(0.053)	(0.103)	(0.067)	(0.094)	(0.305)	(0.062)	(0.064)
Matrilineal ethnic group	-0.433***	0.859***	0.371***	-0.039	0.323***	0.648***	-1.208***	1.164***	0.091	-0.094*
	(0.054)	(0.138)	(0.084)	(0.049)	(0.087)	(0.053)	(0.118)	(0.320)	(0.055)	(0.051)
Constant	-0.236**	-3.003***	-2.545***	0.549***	-1.537***	-0.110	-3.535***	-3.707***	-0.056	-1.035***
	(0.111)	(0.232)	(0.160)	(0.095)	(0.160)	(0.111)	(0.303)	(0.463)	(0.105)	(0.108)
HH controls	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Region FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
No. of Obs.	24,319	24,319	24,319	24,319	24,319	22,003	24,319	22,003	24,319	24,319

Source: Author's estimations using GLSS data (GSS various years).

Note: FE = fixed effects; GLSS = Ghana Living Standards Survey; gcorn_sorg_mil = guinea corn, sorghum and millet; gegg = garden egg; gnut = groundnut; HH = household; No. of Obs. = number of observations; oilpalm = oil palm. Coefficients of logit models are reported. Robust standard errors are in parentheses. Household controls include ethnicity, religion, marital status, and household size. *$p < .1$. **$p < .05$. ***$p < .01$.

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