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Gender Gap in Agricultural Productivity and Differences in Crop Choice within the farm household in Burkina Faso

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Abstract

The question of whether observed or unobserved factors contribute to gender productivity differences in agriculture remains unresolved. This study uses individually managed plots of data collected in Burkina to decompose the gender productivity gap. As opposed to the existing literature, we find that female-managed plots are on average 9.4% more productive than male-managed plots. Next, the results reveal that differences in observable factors account for about 123% of this productivity gap. Consistent with the existing literature, smaller plot sizes managed by female farmers contribute to closing a large portion of the productivity gap associated with this endowment effect. Another key finding from this study is that crop choice seems to play a critical role in explaining the gender productivity differential. Staple food crops, in particular, contribute to reducing the productivity differential, while cash and semi-cash crops contribute to widening it. A deeper analysis suggests that men and women do not always cultivate the same type of crops. Male farmers are more likely to plant staple food crops and pure cash crops, while women widely cultivate semi-cash crops. This gender crop preference provides a potential explanation of the narrow gender productivity gap among small-scale farmers in Burkina Faso. Lastly, in line with previous literature, non-labor inputs increase the portion of the gender gap that observable differences explain. On the other hand, we do not find evidence of heterogenous returns in the use of non-labor inputs

Keywords: Agricultural Productivity, Gender Gap, Crop Choice, Burkina Faso.

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1 INTRODUCTION

A large share of people living in sub-Saharan Africa rely on agriculture for their livelihoods. Therefore, enhancing agricultural productivity growth becomes crucial to alleviating poverty and enhancing food security in this region. Furthermore, reducing gender differences in agricultural productivity can lead to sustainable poverty reduction. For instance, it has been documented that higher control of agricultural revenue by women, for example, could not only be the fastest way to achieve food security and improved development outcomes for the next generations but also a means to address gender inequality (Anderson et al., 2021; Balasubramanian et al., 2024; Doepke & Tertilt, 2019; Nikiema & Sakurai, 2021; Santoso et al., 2019). However, there is still a persistent productivity gap between male and female farmers in Sub-Saharan Africa, despite the tremendous efforts by governments and NGOs. For example, a recent review has shown that gender differences in agricultural productivity across the region range from 4% to 40%. Most of these disparities tend to cluster around 20% and 30% (Kilic, Winters, et al., 2015). This indicates that addressing and reducing these gender gaps in agricultural productivity remains a critical challenge in the region's quest for sustainable development.

In recent years, there has been widespread use of the decomposition method to gain a deeper understanding of the disparity in agricultural output across genders. This approach not only enables the estimation of the gender gap, but it also allows to distinguish its component driven by differences in observable factors from the unexplained component. Most of these studies found a productivity gap that is in favor of male farmers. For instance, in Malawi, Kilic, Palacios-López, and Goldstein (2015) found that male-managed plots are 25.5% more productive than female-managed plots and that this difference is mostly driven by the differences in observable factors. In the same vein, Aguilar et al. (2015) suggested a gender productivity differential of 23.4% in favor of men in Ethiopia, of which 57% remains unexplained. However, Oseni et al. (2015) suggested that the gender productivity gap differs across regions of Nigeria. They found that in the North, women produce 28% less than men after controlling for observed production factors, whereas there are no significant gender differences in the South. Moreover, they show that the unexplained part of the productivity differential is larger in the North, while in the Southern regions, productivity differences are mostly explained by the differences in the observable factors. A recent study by Singbo et al. (2021) in Mali showed that the agricultural productivity of female plot managers is 20.18% lower than that of male plot managers, with more than half of the agricultural productivity gap influenced by female-specific structural disadvantages.

On the other hand, only a few studies found a productivity gap in favor of female plot managers or an absence of disparity in the Sub-Saharan Africa context (Slavchevska, 2015; de la O Campos, Covarrubias, and Prieto Patron; 2016). For example, Slavchevska (2015) in Tanzania found that there was no substantial disparity in agricultural productivity between male and female plot managers. However, after controlling for manager characteristics, plot features, inputs, and crop choice, it was observed that plots managed by women were less productive. He also argued that female farmers were able to achieve higher yields on smaller plots by reducing the use of male labor and increasing the use of female labor. Similarly, a study by de la O Campos, Covarrubias, and Prieto Patron (2016) found that regardless of the variable of choice, the gender gap in agricultural productivity decreases or disappears when factors of production and crop choice are controlled for.

The existing literature suggests that the extent of the gender productivity gap among farmers and the relative importance of its components vary across countries. This is because each country has its own unique socio-economic profile. Therefore, we cannot extrapolate analyses from neighboring countries. It is necessary to update the gender differences in agriculture to formulate more tailored interventions that are efficient in resorbing the productivity gap.

Previous studies on the gender productivity gap in agriculture in Burkina Faso primarily aim at documenting the Pareto-inefficiency of the intrahousehold allocation of productive resources (Akresh, 2005; Akresh et al., 2016; Theriault et al., 2017; Udry, 1996). These studies were pioneered by Udry (1996), who found that the value of household output can be increased by 10 to 15% by reallocating inputs from men's plots to women's plots. Akresh (2005) attempts to replicate the results of Udry (1996) using nationally representative data from Burkina Faso collected by the World Bank between 1990 and 1991. However, he finds that the gender gap in productivity is important only in the regions covered by Udry (1996)'s study.

Furthermore, the above-mentioned studies do not focus on explicitly explaining gender differences. Instead, they include gender as an explanatory variable or as an extension to their main analysis. Moreover, except for Akresh (2005), previous studies relied on the best regionally representative data. Therefore, the external validity of their findings is limited. Lastly, the data used in these studies was collected almost three decades ago. However, the importance of the factors explaining the gender gap in agriculture is likely to vary over time. Our research takes advantage of the newly released dataset to re-examine the factors explaining the gender difference in agricultural productivity in Burkina Faso. This research differs from the previous studies in Burkina Faso in several significant ways. Firstly, our primary goal is to explain the reasons why there is a gap in agricultural productivity. To achieve this, we adopt the mean decomposition technique developed in Blinder (1973) and Oaxaca (1973). Secondly, this study uses the recent nationally representative datasets on households in Burkina Faso. This dataset is exceptionally rich in information and includes a large sample of farm households and plots. The datasets' richness allows for control of household, crop, and plot level heterogeneity, while national representativeness improves the findings' external validity. This paper makes a new contribution to the literature by emphasizing the implication of gender crop preferences and selection on the productivity gap. Since women and men do not always cultivate the same crop, they are likely to face different constraints in terms of production(Doss, 2018; Doss et al., 2018; Quisumbing et al., 2015; Reynolds et al., 2020).

2 METHOD

2.1 Empirical model

To test for the presence of gender gap in agricultural productivity, we estimate the Equation (1).

$$ln(Y_{ij}) = \alpha + \gamma g_j + \sum_{k=1}^{K} \beta_k M_{jk} + \sum_{h=1}^{H} \delta_h P_{ih} + \sum_{f=1}^{F} \rho_f L_{if} + \sum_{n=1}^{N} \lambda_n I_{in} + \varepsilon_{ij} \qquad (1)$$

Where Y_{ij} is plot $i's$ harvest value per ha obtained by manager j; g_j is the manager gender, and γ is the parameter of interest in this equation. M, is a vector of manager j characteristics other that the gender; P_{ih} a vector of vectors of plot characteristics; L_{if} different types of labor use on plot i , and I_{in} a set of N inputs used on plot i. Depending on the specification regions, village fixed effects or village's characteristics will be included. Also, additional specifications and robustness checks will be allowed to control for unobserved time-invariant household-crop level heterogeneity. The variable of interest in this model is the gender of the plot's manager. The gender gap in agricultural productivity is explained using a progressive method in the initial multivariate study. This approach operates on the premise that it determines the presence and extent in which each group of variables impacts the conditional productivity gap between male and female plot mangers. This is a multivariate regressions framework will also allow to make the results comparable to the previous evidence in Burkina Faso (Udry, 1996, Akresh, 2005, Akresh et al 2016).

2.2 Mean decomposition

To quantify the importance of each driver of the productivity gap between men and women, we follow Kilic, Palacios-López, and Goldstein (2015) and to decompose the productivity gap using the approach developed by Blinder (1973) and Oaxaca (1973). This approach is based on the estimation strategies used in labor economics and decomposes the average difference in land productivity between man-managed and female-managed plots into one component driven by gender differences in levels of observable attributes and into another component that is underlined by gender differences in returns to the same set of observables (Kilic, Palacios-López, et al., 2015). Let define X_g a vector that encompasses all the explanatory variables contained in Equation (1), except for the manager of plot's gender. The expected production value on a plot for a manager of either gender ($g = m, f$) is:

$$E(Y_g) = \alpha_g + E(X_g)'\beta_g \tag{2}$$

More specifically, the gender gap is expressed as the mean outcome difference:

$$Gap = E(Y_m) - E(Y_f) \tag{3}$$

Where Y_m and Y_f is obtained from running Equation (1) on the subsamples of only men and only women. Equation (2) assumes that $E(\varepsilon_m) = E(\varepsilon_f) = 0$.

Plugging (2) in Equation (3), it follows that:

$$Gap = \alpha_m + E(X_m)'\beta_m - \alpha_f - E(X_f)'\beta_f \tag{4}$$

An important aspect of this technique is to decompose the gender gap by separating the part that is explained by group differences in the explanatory variables (endowment effect) and the unexplained part (structural effect). To achieve this, it is important to include non-discriminatory coefficients β^*defined as the vector of coefficients obtained for equation (1). β^* takes into account the possibility that the mean difference in plot-level productivity is explained by the gender of the plot manager.

Including β^* in Equation (4) and rearranging, it follows that:

$$Gap = Q + U \tag{5}$$

Where $Q = [\, E(X_m)' - E\left(X_f\right)'] \beta^*$ (6)

is the endowment effect, that is the gender gap explained by difference in the levels of observables covariates and:

$$U = (\alpha - \alpha_m) + [E(X_m)'(\beta_m - \beta^*)] + \left(\alpha - \alpha_f\right) + [E\left(X_f\right)'(\beta_f - \beta^*)] \tag{7}$$

is the structural effect, which is composed of male structural advantage (part subscript m) and female structural disadvantage (part with subscript f).

2.3 RIF decomposition

The importance of the factors explaining the productivity difference between men and women may be heterogeneous. Therefore, we will use the recentered influence function (RIF) decomposition to complement our analysis. RIF decomposition consists of performing the decomposition at a particular quantile in the gender gap distribution. More specifically, RIF regression is a regression method that is like ordinary least squares (OLS) regression. The only difference is that instead of using the dependent variable, we use the RIF (Relative Importance Function) of the distributional statistic we are interested in (in this case, the logarithm of the harvest value per hectare)

A limitation of the decomposition technique is that it does not provide causal analysis, but instead focuses on correlation. However, as argued in the previous studies, it can show which factors are the most important in terms of numbers when it comes to explaining the observed productivity gap

(Aguilar et al., 2015; Kilic, Winters, et al., 2015). This in turn can help researchers decide what to look into next and, ultimately, how to change policy (Fortin et al., 2011).

[Figure 1 about here]

3 CONTEXT AND DATA

3.1 The context of the study

Burkina Faso is a landlocked country located in West Africa with an estimated population of 22.6 million. The World Bank classified Burkina Faso as a low-income country in 2022, with an estimated GDP per capita of USD 833(World Bank, 2022). Moreover, the poverty headcount ratio in Burkina Faso at $2.15 a day was 30.5 percent in 2018. Like most Sub-Saharan African nations, the country is continuously threatened by food insecurity and malnutrition. As shown in Figure 1, though between 2002 and 2015, the average prevalence of undernourishment and children's have decreased significantly, the data shows that the recent trends of these indicators are slightly increasing.

[Figure 2 about here]

Agriculture is the backbone of the national economy in Burkina Faso, accounting for over 30 percent of the GDP and employing approximately 80 percent of the working population (DGESS/MAAH, 2022). Unfortunately, agricultural productivity is very low as compared with that of the other countries. This is explained by several factors, including the low rate of chemical application (Figure 2). Therefore, enhancing productivity in agriculture could be a means of reducing poverty significantly in Burkina Faso. More specifically, targeting the increase in women's productivity could be an efficient way to achieve this. For example, Nikiema and Sakurai (2021) have shown that increasing the share of farm revenue that accrues to wives has a more substantial impact on household nutrition than overall income. Furthermore, it is essential to acknowledge that women play a significant role in the agricultural sector of Burkina Faso. As Figure 3 shows, women contribute on average up to 52% of the agricultural labor. Despite their substantial involvement, women control only 16% of the revenue generated from farm activities (Nikiema and Sakurai, 2021).

In Burkina Faso, rural society is patriarchal and patrilineal, with men inheriting the most valuable productivity assets, such as land. Women usually have access to land through marriage[1]. In rural Burkina Faso, there are two types of plots in farm households: collectively managed plots and individually managed plots. The head of household typically manages the collective plots, ensuring the household's food security and purchasing common goods (Haider et al., 2018; Theriault et al., 2017; West, 2010). Alongside the collective field, the head of the household may also allocate plots among individual members including wives, sons, daughters, and sons ’wives and any other relatives living in the household according to both norms and negotiation. The member in charge controls the product of the individually managed plot, unlike collective plots. The product is either used to supplement the food supply or to obtain cash, which is in turn used to purchase food products not produced by the household or non-food products such as children’s clothing and school fees. Identifying the relative quantitative importance of factors explaining the gender gap in agricultural productivity would help formulate more prioritized policies and interventions to improve women.

3.2 Data and sample description

This study uses the Burkina Faso Enquête Harmonisée sur le Conditions de Vie des Ménages (EHCVM) 2018/2019. The data is from the Institut National de la Statistiques et de la

[1] If the husband's land is insufficient, the wife may borrow land from his relatives.

Démographie (INSD) and made available by the World Bank. The Burkina Faso EHCVM 2018/19 sample covers all regions with urban and rural areas surveyed in all regions and is representative for the strata of Ouagadougou, other urban areas, and rural areas. The total survey sample size is 7,010 households—3,149 from urban areas and 3,861 from rural areas. Furthermore, the agriculture module details information of 12,441 plots. More specially, the survey recorded detailed crop and plot-level information, as well as a rich set of households' socioeconomic characteristics and village level characteristics. More interestingly, these datasets provide information that identifies the gender of the decision maker at the plot level, such as the plot management.

In this study, we focused on all the main crops planted in the plot, including the cereals, legumes and roots, vegetables, and fruits (see the list of all the crops in Table A6). We first excluded 302 plots on which harvest has not started or where crop failure was reported[2]. Next, to eliminate outliers, we excluded any plots with the top or bottom one percent of agricultural productivity (106 plots). The final sample size is 12,033 plots, including 6,561 collectively managed plots and 5,472 individually managed plots. Among the individually managed plots, there are 3,556 male-managed plots and 1,916 female-managed plots. In line with previous literature, we base our estimation primarily on the sample of individually managed plots. Additionally, we used the full sample to check the robustness of the estimates, assuming that the heads of the households manage the collective plots.

Table 1 shows the descriptive statistics of the sample used in the econometric estimation. The last column presents the difference in the outcome variables and covariates. This study measures

[2] We investigated whether there is a correlation between crop failure and the gender of plot manager in the robustness check. The results show that there is no significant association between crop failure and the gender of the plot manager. The results are available upon request from the authors.

productivity as the harvest value per ha. We valued the reported production by the price recorded during the survey[3]. The average productivity is 424,815.04 CFA per hectare. As expected, male-managed plots have a higher total value of production than female farmers. However, surprisingly, female-managed plots have, on average, a higher product per unit of land. The inverse relationship between plot size and yields likely drives the high productivity of female plot managers. Table 1 shows that, on average, male-managed plots (1.246 ha) are approximately 2.5 times larger than female-managed plots (0.50 ha) (0.50 ha)[4]. Furthermore, Table 1 reports significant differences in plot manager characteristics, as well as the use of non-labor and labor inputs.

Lastly, we tested for differences in input use across the eight most cultivated crops (Tables A8 and A9). For labor inputs, we first found that family male labor is significantly higher on male-managed plots across all crops, while the sign and significance of other types of labor (female, children, and hired labor) vary by gender and crop type. Notably, female labor tends to be significantly higher on female-managed plots of cash and semi-cash crops (Table A8). For non-labor inputs (fertilizers and pesticides), all statistically significant differences favor male farmers (Table A9).

[Table 1 about here]

4 RESULTS AND DISCUSSION

4.1 Estimation of the gender agricultural productivity gap

Table 2 presents an estimation of the gender productivity difference. According to naïve OLS regression, plots managed by women are 9.4% (but not significant) more productive than plots

[3] In the absence of sales data, we utilized the household-level median price when it was available. Otherwise, we used the median price of the lower admistrative (village, commune, and province).
[4] Note that more than 80% of plots have GPS measures.

managed by men (Column 1 of Table 1). This finding diverges from the common findings in the literature. For example, recent studies across Sub-Saharan Africa suggest an unconditional gender productivity gap that ranges between 8% and 25.5% in favor of male-managed plots. (Aguilar et al., 2015; Ali et al., 2016; de la O Campos et al., 2016; Kilic, Palacios-López, et al., 2015; Slavchevska, 2015).

Previous studies support the idea that the inverse relationship between agricultural productivity and plot size often masks the gender gap (Slavchevska, 2015). Table 2 shows that the log of the plot size coefficient is negative and statistically significant across all the specifications. This is consistent with recent studies that have investigated and provided support for the inverse yield hypothesis (Larson et al. 2014; Carletto et al., 2013). However, in our sample, including the plot size and village fixed effects in the model is not enough to significantly turn the gender gap in favor of men (Columns 2 and 3 of Table 2). Instead, the gender productivity gap becomes very close to zero but non-statistically significant after controlling for the crop fixed effects (Columns 4 and 5). Contrary to the findings of Slavchevska (2015) in Tanzania, our result suggests that crop choice matters when analyzing the gender productivity differential. For example, column (5) shows that the coefficients of sorghum, maize, peanut, and cowpea are negative and significant, while planting cash crops such as cotton, garden vegetables, and sesame is significantly associated with higher productivity. Additionally, Columns (6) and (7) show that the sign and magnitude of crop fixed effects differ across the gender of the plot manager.

Now let us turn back to the other factors that significantly affect agricultural productivity. None of the manager characteristics is significantly associated with productivity, while farmer perceptions of soil fertility are associated with higher productivity (Column 5 of Table 2). Lastly, consistent with the literature, the application of organic and chemical fertilizers, pesticides, and fungicides is associated with higher productivity.

[Table 2 about here]

4.2 Decomposition of the gender agricultural productivity gap

Table 3 presents the Oaxaca-Blinder mean decomposition results on the differential in log of harvest value (in FCFA) per ha between male and female plot managers. The results are based on the controls included in column (5) of Table 2. The aggregate decomposition reveals that the endowment effect, which refers to the gender gap caused by disparities in observable attributes, acts to decrease the difference in agricultural productivity between solely managed plots by males and solely managed plots by females. This effect amounts to -11.8 percentage points and accounts for 123.30% of the average gender difference in agricultural productivity. The female structural disadvantage is calculated to be 2.4 percentage points, accounting for the remaining -23.30% of the gender difference. This strengthens the idea that substantial and meaningful differences between genders in terms of access to resources are key variables contributing to the gender gap (Kilic, Palacios-López, et al., 2015; Oseni et al., 2015).

The detailed decompositions of the endowment effect are shown in column 1 of Table 3. Unlike previous studies, manager characteristics do not appear to significantly reduce the productivity differential between male and female farmers. As for the plot characteristics, consistent with the previous studies, we find that the smaller plot areas farmed by female managers also appear to be a contributing factor (-53%) in shrinking the gender gap. Plot characteristics such as topography, soil texture, and fertility do not contribute meaningfully to explain the productivity gap between male and female farmers. As for the use of the inputs, the results show that non-labor inputs contribute to the widening gender gap (12%), while the contribution of labor inputs differs across labor types. For example, as expected, family male labor widens the productivity differential (12%), whereas family female labor reduces it (-5.2%). Consistent with the results in Table 2, crop choice contributes meaningfully to explaining the gender gap in agricultural productivity (up to 18% of the net contribution). More specifically, production of cash and semi-cash crops contributes to widening the productivity difference by 21.7% and 32%, respectively, while staple food crop cultivation reduces the gender productivity gap by approximately 36% (column 2 of Table 3).

Columns 2 and 3 of Table 3, Panel C, present the detailed decompositions of the male structural advantage and the female structural disadvantage. The overall results suggest that there is no significant difference in the returns to the use of labor and non-labor inputs across the genders of plot managers. Female family labor, crop choice, and village/enumeration are the key factors that significantly reduce female structural disadvantage. Additionally, family female labor and village fixed effects represent the important factors that contribute to widening the female structural disadvantage for this sample. Interestingly, the returns from planting different types of crops vary across genders[5].

[Table 3 about here]

4.3 Quantile decomposition of the agricultural productivity gap

Table 4 presents the disaggregated RIF decomposition findings. The results are based on the controls listed in column (5) of Table 2. First, the highest percentiles appear to drive the observed gender differential. However, the extent of this disparity varies across productivity percentiles. The extent of the difference resulting from the endowment effect varies dramatically throughout

[5] A positive sign on male structural advantage indicates that male managers obtain a higher return than average, whereas a positive sign on female structural disadvantage indicates lower returns than average (Aguilar et al., 2015).

the distribution of agricultural productivity, but it is still dominant across most percentiles. This result is consistent with the findings in Kilic, Palacios-López, and Goldstein (2015) and Slavchevska (2015), which reveal for Malawi and Tanzania that the endowment effect is dominant. On the other hand, our finding differs from those of Singbo et al. (2015), Aguilar et al. (2015), and De la O CAMPOS et al. (2016), who found that productivity differentials remain unexplained for Mali, Ethiopia, and Uganda, respectively.

The detailed RIF decompositions for endowment effect and female structural disadvantage are in Tables A1 and A2 of the appendix. To ensure conciseness, the discussion on the RIF decomposition results focuses on the factors highlighted in the mean decomposition (Figure 4). The results indicate that their contribution varies along the productivity distribution. For example, while the coefficients of plot size increase at the highest percentiles (Fig. 4A), the contribution of family female labor to narrowing the gender productivity gap decreases (Fig. 4B). Furthermore, the coefficients of non-labor inputs increase at the highest percentiles of the agricultural productivity (Fig. 4B). When looking at the structural effect, RIF decomposition shows that crop choice contributes to lessening this effect at the highest percentiles. Overall, the RIF decomposition results show that the sign and statistical significance of the coefficients of the factors highlighted by mean decomposition are consistent along the distribution of agricultural productivity.

[Table 4 about here]

4.4. Robustness checks

This study primarily focused on the individually managed plots, which led to excluding collectively managed plots. However, in reality, the head of the household often manages the collective plots, also known as family plots, which can result in a sample selection. Therefore, our first robustness check involves incorporating the collective model into the analysis. Next, one of the violations of the assumptions of the decomposition method is omitted variable bias. At the household level, there may be some unobservable characteristics that jointly determine agricultural productivity, the gender of the plot manager, and other covariates. To check the impact of the omitted variables, the common approach consists of adding additional controls to the base decomposition model. The expectation is that if the coefficients of the variables in our base model, including the dummy variable for gender, are largely unaffected, then it is unlikely that any unobservable characteristics not accounted for in the model will affect our main results. (Altonji et al., 2005). In addition to this approach, we propose a household fixed effect for the subsample of households where there is more than one plot or where there are both male and female managed plots.

4.4.1. Including the collective plots

For the main sample, 95% of the male managed plots are managed by the head of the household while only 30% of female managed plots are managed by head of the household. This may raise issues to sample selection since most of the female headed household without individual plots are likely to be excluded. Furthermore, as stated in section 1, collective plots are usually managed by the head of household. Therefore, to check the robustness of our results, we assume that the collective plots are managed by the head of the household. While this is a strong assumption, it is still of interest to see how the results are affected. Based on this assumption we re-estimate equation (1) and performed mean decomposition of the productivity differential. The results are shows in Table A3. They are consistent with the results presented in Tables 2 and 3, except that the observed gender gap is lower (9.4%). Also, column (1) of Table A3 shows that crop fixed effects still represent the larger share of the gender gap associated with differences in observable factors (161.70%). Moreover, the magnitude and the sign of the coefficients of the important factors discussed in the mean decompositions remain consistent (Figure 5-d)

4.4.2. Additional controls in the model

The EHCVM records exceptionally detailed plot information. We grouped the additional covariates into the following groups: (i) manager characteristics, and (ii) plot characteristics. We run mean decomposition on models that include these characteristics. Note that, contrary to the previous studies, we do not carry out crop-level mean decomposition since one of our objectives is to check if the contribution of different types of crops would be stable after including the additional controls. The results and the list of the additional variables are shown in Table A4 of the appendix. The sign of the contributors to the endowment effect remains consistent with the results of the base model (Table 3). Moreover, the coefficients of the variables such as plot size, crop fixed effects, and labor usage remain very close to those of the base model. Also, the coefficients of the important factors discussed in the mean decompositions remain consistent (Figure 5-a).

4.4.3. Household fixed model

We implement two household fixed-effect models. The first model considers a sub-sample of households with more than one plot (5,260 plots). For the second model, we take advantage of the presence of both male and female managed plots in the same household to run a model that controls for the household fixed effect. The later approach resulted in restricting our sample to only 1,766 plots. This represents only 32.3% of the sample included in the base model. Therefore, the results may suffer from a lack of external validity. Table A5 of the appendix displays the results. The column (1) shows the results for households with two or more plots, while the column (2) shows the results for households in which both types of managers are present. We found that not only does the unconditional productivity remain higher in plots managed by female farmers (7.8%–

8.9%), but also that the estimates are consistent in significance and sign across all models, suggesting the robustness of our main results. Moreover, the coefficients of the important factors discussed in the mean decompositions remain consistent (Figure 5-a). Finally, the results show that within-household variations do not appear to affect the gender gap.

[Figure 5]

4.5. Gender crop preference and agricultural productivity

A legitimate question from the above results is whether the gender of the plot manager affects the choice of the planted crops. What are the factors that affect the gender crop choice? The literature listed several reasons for which men and women may prefer different crops. These factors include differences in the levels of access to resources needed for market-oriented agriculture and the values placed on crops for home consumption versus market sale (Quisumbing et al., 2015; Reynolds et al., 2020; Zimmerer et al., 2015). For example, limited land access or market constraints constrain women to focus on staple food crop production (Jones et al., 2014; Tavenner et al., 2019). Moreover, it has been argued women place a higher value on crops for food security, while men more frequently emphasize income potential (Reynolds et al., 2020).

Unfortunately, our data does not allow us to analyze the effect of the sub-mentioned factors on gender crop choice. Instead, in this study, we classified cultivated crops into three categories based on their levels of commercialization and examined the correlates for each type of crop[6]. These correlates include factors such as the gender of the plot manager, the characteristics of the plot, and the household. Staple food crops like millet, sorghum, and maize, primarily grown for domestic consumption with minimal commercialization, comprise the first category of crops. The

[6] Table A6 of the appendix displays the complete list of crops by category. We referred to the level of commercialization reported by the Ministry of Agriculture of Burkina Faso, DGESS/MAAH (2022). The "Enquête Permanente Agricole" of Burkina Faso provided the data presented in the DGESS/MAAH (2022) report.

second category is semi-cash crops (rice, peanut, cowpea, traditional vegetables, and other legumes). For these crops, while a larger share remains home consumption, farmers usually aim to obtain cash from selling part of the harvest. The commercialization shares are between 30% and 50%(DGESS/MAAH, 2022). The last category encompasses pure cash crops, high-value cash crops like sesame seed and cotton, and high-value cash vegetables and fruits like onions, tomatoes, and cabbage.

Figure 6 shows land allocation across different types of crops based on management type. Figure 6a suggests that women allocate more land to semi-cash crops, while a larger share of collective plots and male-managed plots go towards producing staple food crops and pure cash crops. However, as expected, the average land size managed by women is smaller compared with that managed by men. Moreover, we conduct a multinomial logistic regression, beginning with a basic model that solely incorporates plot manager and household characteristics, which are not directly associated with resource constraints. Next, in accordance with Reynolds et al. (2020), we incorporate plot characteristics, land, and market access variables sequentially to examine the persistence of gender crop preferences. Table 5 shows the marginal effect of the plot manager's gender on the probability of planting each type of crop. The results align with Figure 6, indicating that women are more likely than men to plant semi-cash crops. The marginal effect of gender remains robust even after controlling for the plot's characteristics and land and market access constraints. To check the robustness of our results, we also estimate the effect of the management type on the probability of planting a given type of crop. The results shown in Table A7 of the appendix align with those in Table 5. First, our results provide a potential explanation of why the unconditional productivity is higher in female-manger plots for this sample. Multinomial logistic analysis suggests that female farmers in our sample are relatively more market-oriented than their male counterparts. This market orientation, consistent with the literature, makes them more productive due to their profit maximization behavior[7] (Kahan, 2013; Rodgers & Akram-Lodhi, 2019; C. Zhang & Zhu, 2023; J. Zhang et al., 2021). The high productivity of pure cash crops planted by male farmers was insufficient to compensate for the negative effect of staple crop production. Secondly, our findings challenge the prevalent belief that excludes women from cash crop production (de Brauw, 2015; Weltzien et al., 2019). Though in absolute terms, women's semi-cash crop production remains low, the share of land that they allocate is larger compared with men[8]. Recent market expansion of the aforementioned semi-cash crop farming in Burkina Faso provides female farmers with the chance to integrate into food value chains. Most vegetables and semi-cash crops[9] can be grown without intensive usage of modern inputs, which are often easily sold in the local market.

[Figure 6]

5 CONCLUSION

Researchers have long been interested in gender inequalities in agricultural productivity. Despite the extensive body of studies, there remains a lack of agreement over whether the gender difference can be attributed to seen or unobserved factors. In this study, we take advantage of the newly released harmonized living standard measurement survey data to estimate the gender gap in agricultural productivity in Burkina Faso. The richness of the data allows us to control for several attributes of plot managers, plots, and community fixed effects.

[7] It is worth noting that from a causal standpoint, the relationship between productivity and commercialization is endogenous due to the potential reverse causality.

[8] Similar results have been found in Papua New Guinea: crop choice by most women is motivated by commercialization, while male farmers choice is mostly motivated by tradition or status concerns (Nordhagen et al., 2021).

[9] In our study, we found that female farmers favored crops like peanut and cowpea, as they required fewer chemical fertilizers for cultivation. In Burkina Faso, farmers primarily cultivate rice in lowland areas, often without the use of chemical fertilizers, making it an affordable crop for female farmers.

First, we find that the unconditional agricultural productivity differential is in favor of female plot managers. More specifically, female-managed plots are estimated to be 9.44% more productive than male-managed plots at the mean. This gender differential is mainly driven by the highest percentiles of the productivity distribution. Our finding differs from recent studies across Sub-Saharan Africa in the sense that these studies support that male farmers are more productive than female farmers (Aguilar et al., 2015; de la O Campos et al., 2016; Kilic, Palacios-López, et al., 2015; Singbo et al., 2021; Slavchevska, 2015). Furthermore, our findings indicate that controlling for crop choice reduces and nearly eliminates the gender gap in agricultural productivity. This confirms the belief that men and women developed specific skills on some specific crops (Doss, 2018; Quisumbing et al., 2014; Reynolds et al., 2020). Further analysis shows that female farmers have a higher likelihood of planting semi-cash crops, while male farmers focus more on staple food and cash crop production. This preference towards market-oriented crops could potentially explain the higher productivity observed in female-managed plots.

Second, the results indicate that, on average, the differences in observable attributes contribute to a large portion of the observed gender gap. This finding supports the view that large gender disparities in the endowment of productive resources are the primary contributors to the productivity gap between male-managed and managed plots (Doss, 2018; Kilic, Palacios-López, et al., 2015; Oseni et al., 2015). Plot size accounts for nearly half of the endowment effect, according to the detail decomposition. Next, crop choice plays a significant role in explaining the productivity differential between female-managed and male-managed plots. More specifically, male-managed plots tend to grow staple food crops, which contribute to reducing the productivity differential, while cash and semi-cash crops widen it. In line with previous research, non-labor inputs widen the portion of the gender gap that the observable differences account for. Lastly, we found that the returns of planting different types of crops differ across genders, while there is no evidence of heterogenous returns in the use of non-labor inputs.

This research shows that a large portion of the gender gap is explained by observable factors; this implies that there is room to close the agricultural productivity gender gap through more targeted interventions. Moreover, a new finding of our research that crop choice plays significant role in narrowing gender productivity. Therefore, agricultural programs should be tailored to fit gender crop preferences. Women and men do not always cultivate the same crop; therefore, they do not face the same constraints in terms of production technology and commercialization. Therefore, they may not respond similarly to policies and development interventions(Doss, 2018; Quisumbing et al., 2014). To design agricultural interventions that are inclusive, policymakers should thoroughly examine the local context to identify the crops cultivated by each gender. We recommend conducting further research to understand the causal factors that guide gender crop choice. Collecting gender-disaggregated data is essential for capturing differences in preferences and constraints between women and men within households and across different households.

Data Availability Statement

The Burkina Faso Enquête Harmonisée sur le Conditions de Vie des Ménages (EHCVM) 2018/2019) data is accessible free of charge on the World Bank Microdata Library website. (https://microdata.worldbank.org/index.php/catalog/4290). Stata program for the main analysis will be available upon request

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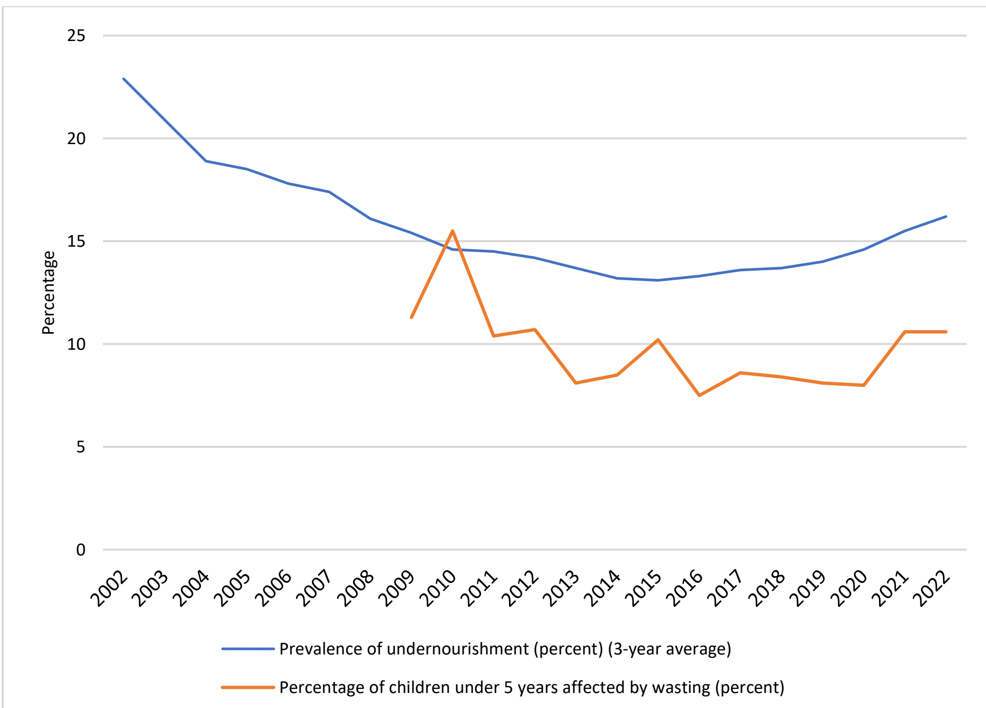
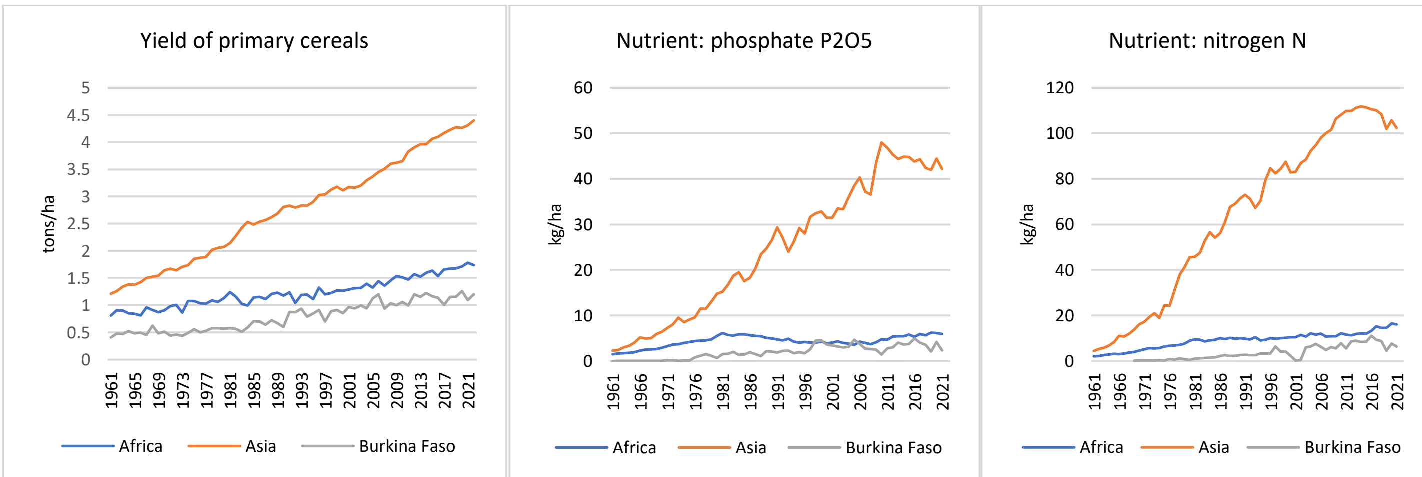
Tables and Figures

Figure 1: Trends of undernourishment and children wasting in Burkina Faso



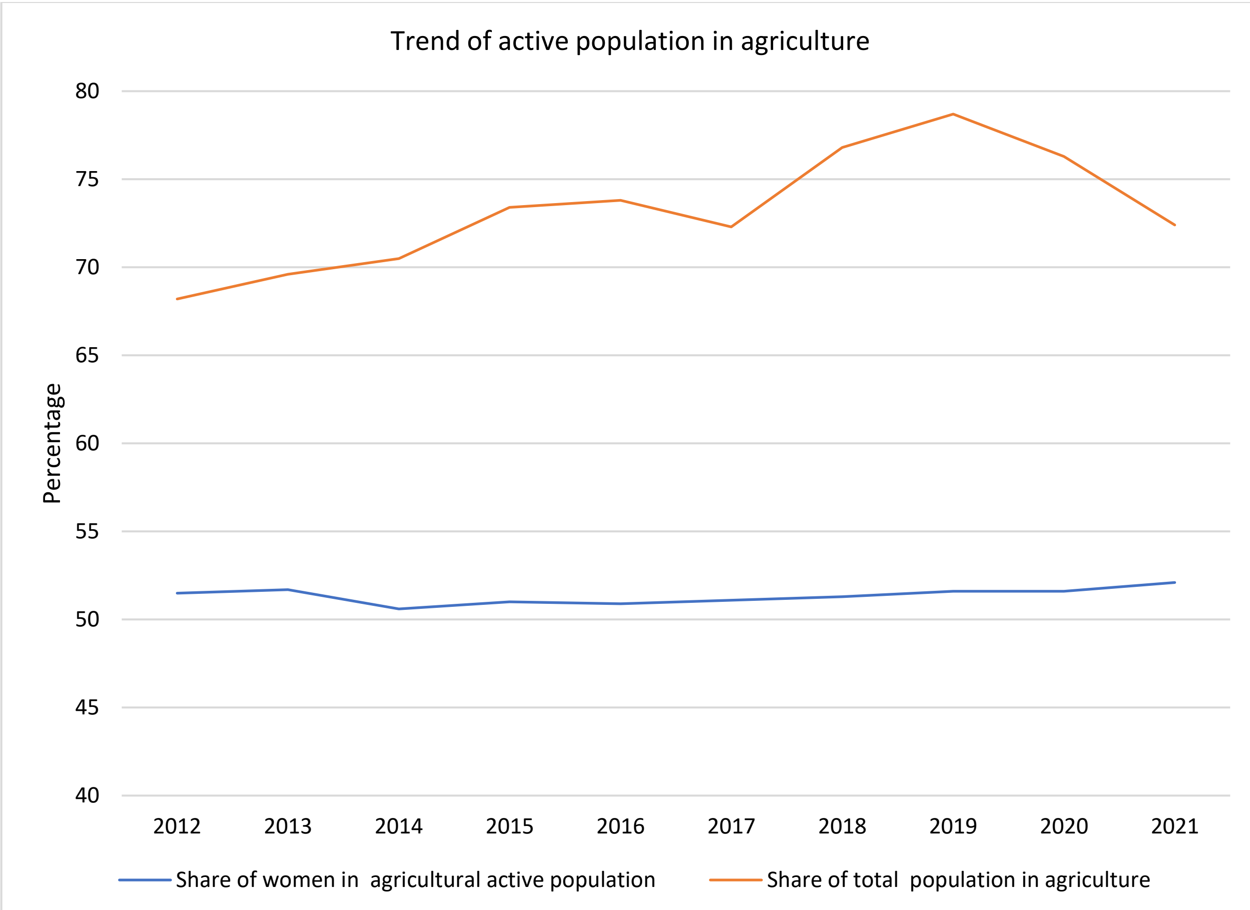
Source: Based on the FAO (2024) food security indicators

Figure 2: Trend in crop yield and use of chemical fertilizers



Source: Based on FAO (2024)

Figure 3: Trend of active population in agriculture in Burkina Faso



Source: Based on DGESS/MAAH (2022)

Table 1: Summary statistics and results from tests and mean differences by gender of the plot manager

	(1)	(2)	(3)	(3)-(2)
	Pooled	Male	Female	Pairwise t-test
Variables	Mean/(SE)	Mean/(SE)	Mean/(SE)	Mean difference
Proxy of productivity				
Total value of harvest (CFA)	224,718.90	315486.70	56,258.41	-259,200
Productivity: Value of harvest (CFA/ha)	424,815.04	270,172.65	711,823.56	441,650.87*
Manager characteristics				
Age in years	43.924	45.907	40.244	-5.663***
No basic education (1 if yes)	0.996	0.995	0.998	0.003**
Basic education (1 if yes)	0.149	0.178	0.096	-0.083***
Number of plots managed (1 if yes)	3.142	3.485	2.505	-0.980***
Manager has off-farm activity (1 if yes)	0.504	0.598	0.330	-0.269***
Manager has mobile phone (1 if yes)	0.769	0.844	0.630	-0.215***
Manager is the head of HH (1 if yes)	0.724	0.945	0.314	-0.631***
Manager living in polygamous HH (1 if yes)	0.554	0.614	0.442	-0.173***
Plots characteristics				
Plot size(ha)	0.985	1.246	0.500	-0.746***
Variety	0.068	0.092	0.024	-0.068***
Land acquisition: owned	1.389	0.774	0.491	-0.283***
Land acquisition: borrowed	0.675	0.193	0.494	0.301***
Land acquisition: other	0.298	0.033	0.015	-0.018***
Plot topography: slope	0.027	0.226	0.194	-0.033***
Plot topography: highland	0.215	0.038	0.016	-0.022***
Plot topography: flat top	0.030	0.690	0.734	0.044***
Plot topography: lowland	0.705	0.046	0.056	0.011*
Soil texture: sandy (=1 if yes)	0.050	0.506	0.522	0.017
Soil texture: loamy (=1 if yes)	0.512	0.181	0.198	0.018
Soil texture: clay (=1 if yes)	0.187	0.241	0.223	-0.018
Soil texture: other (=1 if yes)	0.235	0.073	0.056	-0.017**
Soil fertility: bad (=1 if yes)	0.067	0.166	0.209	0.043***
Soil fertility: average (=1 if yes)	0.181	0.628	0.620	-0.008
Soil fertility: good (=1 if yes)	0.625	0.206	0.171	-0.035***
Time to the plot (minutes)	14.227	14.492	13.522	-0.970**
Respondent is different from the owner (=1 if yes)	0.163	0.090	0.298	0.208***
Commercialization (1 if yes)	0.378	0.370	0.391	0.020
Share of the output sold	0.243	0.230	0.264	0.033***
Usage of non-labor inputs				
Use organic fertilizers (1 if yes)	0.299	0.379	0.151	-0.228***
Organic fertilizers (kg/ha)	69.278	91.924	27.246	-64.678***
Use chemical fertilizers (1 if yes)	0.351	0.422	0.218	-0.204***

Chemical fertilizers (kg/ha)	212.387	284.482	78.583	-205.900
Use pesticides/fungicides (1 if yes)	0.307	0.364	0.200	-0.164***
Chemical pesticides(liter/ha)	0.448	0.507	0.336	-0.171**
Usage of family labor				
Use family male labor (1 if yes)	0.783	0.939	0.494	-0.444***
Family male labor (man/day/ha)	87.043	106.219	55.179	-51.040***
Use family female labor (1 if yes)	0.877	0.832	0.959	0.127***
Family female labor (man/day/ha)	128.038	100.631	178.594	77.963***
Use under 15 labor (1 if yes)	0.552	0.551	0.555	0.004
Family under 15 labor (man/day/ha)	99.723	84.496	105.335	20.839**
Usage of hired labor				
Use hired male labor (1 if yes)	0.305	0.359	0.205	-0.153***
Hired male labor (man/day/ha)	9.290	10.414	7.204	-3.210**
Use hired female labor (1 if yes)	0.231	0.254	0.188	-0.066***
Hired female labor (man/day/ha)	6.685	5.545	8.801	3.256***
Use hired under 15 labor (1 if yes)	0.072	0.078	0.061	-0.018**
Hired under 15 labor (man/day/ha)	1.710	1.618	1.881	0.263
Crops (1 if yes)				
Millet	0.108	0.133	0.063	-0.070***
Sorghum	0.184	0.226	0.105	-0.121***
Rice	0.069	0.045	0.113	0.068***
Maize	0.162	0.211	0.070	-0.141***
Cowpea	0.166	0.157	0.183	0.026**
Peanut	0.125	0.064	0.240	0.176***
Sesame	0.035	0.039	0.028	-0.011**
Cotton	0.035	0.051	0.007	-0.044***
Vegetables (traditional)	0.052	0.014	0.122	0.108***
Vegetables (garden)	0.039	0.044	0.031	-0.012**
Legumes (excluding cowpea and peanut)	0.020	0.011	0.038	0.027***
Household and community characteristics				
Household size	7.349	7.635	6.818	-0.817***
Dependency ratio	0.461	0.459	0.466	0.007
Household plant cotton (1 if yes)	0.149	0.167	0.116	-0.051***
Household Tropical Livestock Unit (TLU)	4.888	5.189	4.329	-0.861***
Log Productive Asset per ha	10.373	10.514	10.113	-0.401***
Log Home Asset	10.802	11.006	10.425	-0.580***
Log Home Asset per capita	11.326	11.460	11.078	-0.383***
Observations	5,472	3,556	1,916	5,472

[a)] Soil fertility is subjective measure of soil quality by the farmer. *** p<0.01, ** p<0.05, * p<0.1. Errors are clustered at village level.

Table 2: Gender differences in agricultural productivity in Burkina Faso Dependent variable: Log value of harvest (CFA/ha)

	Pooled					Female	Male
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Female	0.094	-0.070	-0.075	-0.028	-0.024		
	(0.070)	(0.050)	(0.057)	(0.048)	(0.054)		
Age in years		-0.015	-0.015	-0.014	-0.015	0.101	-0.065
		(0.064)	(0.061)	(0.059)	(0.058)	(0.126)	(0.091)
Squared of age in years		-0.001	0.001	-0.000	0.000	-0.011	0.007
		(0.007)	(0.006)	(0.006)	(0.006)	(0.013)	(0.009)
Primary education (1 if yes)		0.026	-0.019	0.018	-0.019	-0.184	-0.001
		(0.065)	(0.074)	(0.060)	(0.072)	(0.234)	(0.090)
Manager has off-farm activity (1 if yes)		-0.026	-0.013	0.014	0.001	-0.030	0.038
		(0.041)	(0.046)	(0.040)	(0.046)	(0.090)	(0.072)
Manager has mobile phone (1 if yes)		-0.007	0.039	0.008	0.043	-0.068	0.111
		(0.061)	(0.060)	(0.058)	(0.059)	(0.075)	(0.099)
Log plot size (ha)		-0.515***	-0.493***	-0.533***	-0.549***	-0.555***	-0.498***
		(0.035)	(0.037)	(0.029)	(0.035)	(0.062)	(0.035)
Soil texture: sandy (=1 if yes)		0.286***	0.210**	0.288***	0.246***	0.240	0.273**
		(0.092)	(0.098)	(0.087)	(0.087)	(0.268)	(0.121)
Soil texture: loamy (=1 if yes)		0.080	-0.018	0.088	0.029	0.126	0.051
		(0.093)	(0.097)	(0.090)	(0.090)	(0.278)	(0.128)
Soil texture: clay (=1 if yes)		0.150*	0.080	0.146*	0.108	0.250	0.133
		(0.088)	(0.093)	(0.085)	(0.085)	(0.265)	(0.122)
Plot topography: highland		0.108	0.175*	0.133*	0.171**	0.466**	0.109
		(0.094)	(0.098)	(0.079)	(0.085)	(0.209)	(0.104)
Plot topography: flat top		-0.098**	-0.051	-0.078	-0.048	0.017	-0.079
		(0.047)	(0.051)	(0.049)	(0.056)	(0.139)	(0.068)
Plot topography: lowland		-0.007	-0.075	-0.101	-0.135*	-0.262*	-0.111
		(0.080)	(0.083)	(0.075)	(0.080)	(0.158)	(0.115)
Soil fertility: good (=1 if yes) [a)]		0.341***	0.355***	0.331***	0.360***	0.393**	0.350***
		(0.076)	(0.085)	(0.076)	(0.085)	(0.158)	(0.106)
Soil fertility: average (=1 if yes)		0.145**	0.206***	0.137**	0.189***	0.075	0.219**
		(0.061)	(0.074)	(0.059)	(0.071)	(0.141)	(0.090)
Use organic fertilizers (1 if yes)		0.144**	0.138**	0.157***	0.145**	0.384***	0.102*
		(0.056)	(0.057)	(0.053)	(0.058)	(0.136)	(0.059)
Use chemical fertilizers (1 if yes)		0.521***	0.482***	0.300***	0.326***	0.371***	0.276***
		(0.058)	(0.063)	(0.047)	(0.051)	(0.108)	(0.062)
Use pesticides/fungicides (1 if yes)		0.345***	0.266***	0.255***	0.163***	0.251*	0.119
		(0.065)	(0.077)	(0.059)	(0.059)	(0.143)	(0.074)
Log family male labor (man/day/ha)		0.084***	0.066***	0.064***	0.052***	0.028	0.071***
		(0.018)	(0.015)	(0.015)	(0.013)	(0.020)	(0.025)
Log family female labor (man/day/ha)		0.037**	0.055***	0.042***	0.051***	0.077***	0.042*
		(0.016)	(0.016)	(0.014)	(0.016)	(0.024)	(0.022)
Log family under 15 labor (man/day/ha)		0.015	0.012	0.022*	0.017	-0.010	0.020
		(0.013)	(0.013)	(0.013)	(0.013)	(0.023)	(0.017)

Use hired male labor (1 if yes)		0.143***	0.120**	0.137***	0.101**	0.024	0.112
		(0.045)	(0.048)	(0.046)	(0.050)	(0.102)	(0.068)
Use hired female labor (1 if yes)		-0.088	0.095**	-0.068	0.082*	0.004	0.124*
		(0.058)	(0.046)	(0.057)	(0.048)	(0.073)	(0.073)
Dependency ratio		0.418***	0.450***	0.350***	0.379***	0.507**	0.569***
		(0.145)	(0.134)	(0.127)	(0.121)	(0.224)	(0.206)
Household Tropical Livestock Unit (TLU)		0.009**	0.008**	0.007**	0.008***	0.008	0.009**
		(0.004)	(0.003)	(0.003)	(0.003)	(0.010)	(0.004)
Log of farm capital (CFA/ha)		0.028*	0.022	0.031**	0.027*	0.035	0.029**
		(0.015)	(0.016)	(0.013)	(0.014)	(0.027)	(0.014)
Sorghum				-0.147***	-0.159**	-0.217	-0.161**
				(0.054)	(0.064)	(0.162)	(0.068)
Rice				-0.044	-0.181	-0.212	-0.243
				(0.100)	(0.120)	(0.218)	(0.151)
Maize				-0.135**	-0.217***	-0.247	-0.231***
				(0.064)	(0.068)	(0.203)	(0.073)
Cowpea				-0.745***	-0.745***	-0.683***	-0.748***
				(0.069)	(0.076)	(0.180)	(0.092)
Peanut				-0.469***	-0.530***	-0.482***	-0.633***
				(0.081)	(0.082)	(0.165)	(0.170)
Sesame				-0.137	-0.244*	-0.073	-0.439**
				(0.113)	(0.141)	(0.295)	(0.172)
Cotton				0.790***	0.671***	1.005	0.748***
				(0.181)	(0.186)	(0.614)	(0.273)
Vegetables (traditional)				-0.009	-0.294**	-0.284	-0.487
				(0.159)	(0.134)	(0.215)	(0.311)
Vegetables (garden)				0.622***	0.310*	-0.481*	0.373
				(0.158)	(0.167)	(0.278)	(0.256)
Legumes (excluding cowpea and peanut)				-0.538***	-0.469***	-0.559**	-0.293**
				(0.144)	(0.143)	(0.216)	(0.120)
Village/Enumeration area fixed effects	No	No	Yes	No	Yes	Yes	Yes
Crop fixed effects	No	No	No	Yes	Yes	Yes	Yes
Observations	5,472	5,472	5,472	5,472	5,472	1,563	2,846
R-squared	0.001	0.338	0.468	0.388	0.501	0.569	0.481

Notes: [a)] Soil fertility is subjective measure of soil quality by the farmer. [b)] Base category is millet. The full composition of each type of crop is attached in the appendix. *** p<0.01, ** p<0.05, * p<0.1. Errors are clustered at village level.

Table 3: Decomposition of the gender differential in agricultural productivity

Panel A: Mean of agricultural productivity			
Male-managed plots		11.4594***	
		(0.0465)	
Female-managed plots		11.5539***	
		(0.0879)	
Mean gender differential		-0.0944	
		(0.0700)	
Panel B: Aggregate decomposition	**Endowment effect**	**Male structural advantage**	**Female structural disadvantage**
Total	-0.118*	-0.000	0.024
	(0.071)	(0.016)	(0.050)
Share of the gender differential	123.30%	0.00%	-23.30%
Panel C: Detailed decomposition			
Age in years	-0.000	-0.268	-0.493
	(0.038)	(0.296)	(0.342)
Squared of age in years	-0.005	0.145	0.227
	(0.033)	(0.142)	(0.170)
Primary education (1 if yes)	-0.001	0.001	0.014
	(0.005)	(0.009)	(0.015)
Manager has off-farm activity (1 if yes)	-0.000	0.031	0.001
	(0.011)	(0.026)	(0.018)
Manager has mobile phone (1 if yes)	0.011	0.065	0.039
	(0.015)	(0.056)	(0.034)
Log plot size(ha)	-0.527***	-0.038**	-0.099*
	(0.051)	(0.018)	(0.056)
Soil texture	0.001	-0.001	0.002
	(0.006)	(0.017)	(0.036)
Plot topography	0.007*	0.002	0.014
	(0.004)	(0.019)	(0.043)
Plot fertility	0.013*	0.019	0.016
	(0.008)	(0.012)	(0.017)
Use organic fertilizers (1 if yes)	0.021*	-0.012	-0.014
	(0.014)	(0.014)	(0.014)
Use chemical fertilizers (1 if yes)	0.067***	-0.015	-0.025
	(0.014)	(0.014)	(0.016)
Use pesticides/fungicides (1 if yes)	0.032***	-0.013	-0.016
	(0.011)	(0.018)	(0.021)
Log family male labor (man/day/ha)	0.120***	0.137**	0.042
	(0.022)	(0.060)	(0.026)
Log family female labor (man/day/ha)	-0.052***	-0.065*	-0.169**

	(0.016)	(0.033)	(0.074)
Log family under 15 labor (man/day/ha)	-0.003	0.010	0.041
	(0.003)	(0.023)	(0.029)
Use hired male labor (1 if yes)	0.016**	-0.001	0.009
	(0.008)	(0.012)	(0.016)
Use hired female labor (1 if yes)	0.003	0.017**	0.022
	(0.003)	(0.008)	(0.014)
Dependency ratio	-0.003	0.044	-0.051
	(0.004)	(0.061)	(0.066)
Household Tropical Livestock Unit (TLU)	0.008	-0.008	0.017
	(0.005)	(0.012)	(0.036)
Log of farm capital (CFA/ha)	0.012*	0.021	-0.069
	(0.007)	(0.139)	(0.171)
Staple food crops	-0.360***	-0.242*	-0.753***
	(0.096)	(0.138)	(0.153)
Semi-cash crops	0.317***	-0.100*	-1.536***
	(0.069)	(0.056)	(0.295)
Cash crops	0.218***	-0.050	-1.015***
	(0.053)	(0.033)	(0.198)
Village/EA Fixed Effects	0.003	0.067***	-0.144**
	(0.043)	(0.019)	(0.059)

Note: *** p<0.01, ** p<0.05, * p<0.1. Controls are the same as in column (4) of Table 3. The number of observations is 5,472.

Table 4: Aggregate Decomposition of the Gender Differential in Agricultural Productivity at Selected Points of the Agricultural Productivity Distribution.

	Mean	10th percentile	20th percentile	30th percentile	40th percentile	50th percentile	60th percentile	70th percentile	80th percentile	90th percentile
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
A. Gender differential										
Mean male-managed plot	11.459***	10.133***	10.584***	10.930***	11.239***	11.489***	11.737***	11.983***	12.291***	12.719***
	(0.046)	(0.053)	(0.054)	(0.054)	(0.051)	(0.045)	(0.047)	(0.046)	(0.049)	(0.060)
Mean female-managed plot	11.554***	10.123***	10.579***	10.938***	11.232***	11.452***	11.779***	12.062***	12.394***	12.985***
	(0.088)	(0.086)	(0.097)	(0.073)	(0.073)	(0.083)	(0.078)	(0.075)	(0.075)	(0.137)
Difference	-0.094	0.010	0.006	-0.008	0.007	0.037	-0.042	-0.078	-0.102	-0.266*
	(0.070)	(0.076)	(0.071)	(0.055)	(0.052)	(0.063)	(0.058)	(0.058)	(0.068)	(0.142)
B. Aggregate decomposition										
Endowment Effect	-0.116*	0.005	-0.060	-0.071	-0.037	-0.026	-0.121*	-0.107	-0.101	-0.376***
	(0.071)	(0.075)	(0.081)	(0.067)	(0.066)	(0.067)	(0.069)	(0.077)	(0.083)	(0.124)
Male structural advantage	-0.000	-0.000	-0.000	-0.000	-0.000	0.000	-0.000	0.000	-0.000	-0.000
	(0.015)	(0.025)	(0.021)	(0.019)	(0.017)	(0.021)	(0.019)	(0.018)	(0.025)	(0.043)
Female structural disadvantage	0.022	0.004	0.066	0.063	0.043	0.064	0.079	0.029	-0.002	0.110
	(0.050)	(0.070)	(0.068)	(0.055)	(0.055)	(0.057)	(0.056)	(0.066)	(0.076)	(0.114)

Notes: Controls are the same as in column (5) of Table 3. The number of observations is 5,472. Standard errors clustered at the village/Enumeration Area in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Figure 4: Details of RIF decomposition

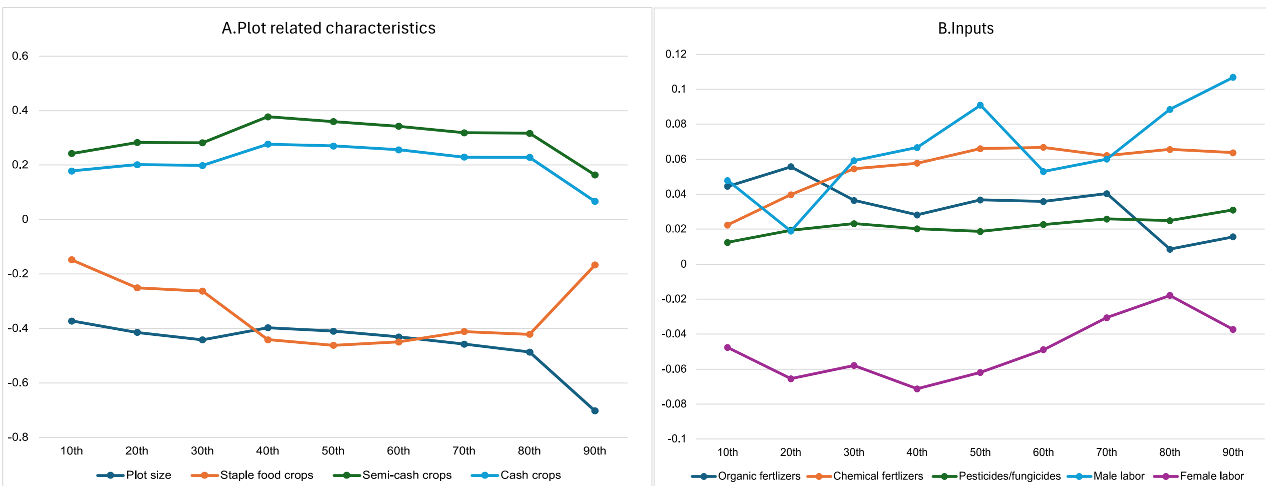


Figure 5: Details decomposition using robustness check models

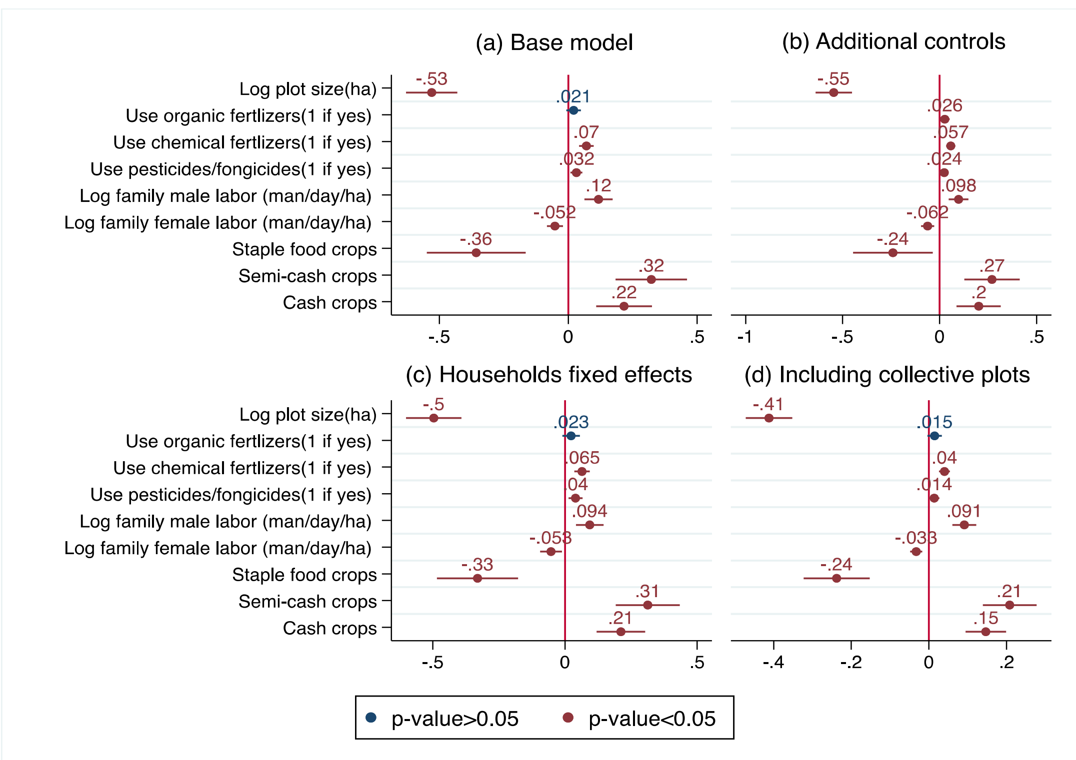


Figure 6: Land allocation across crop by management types

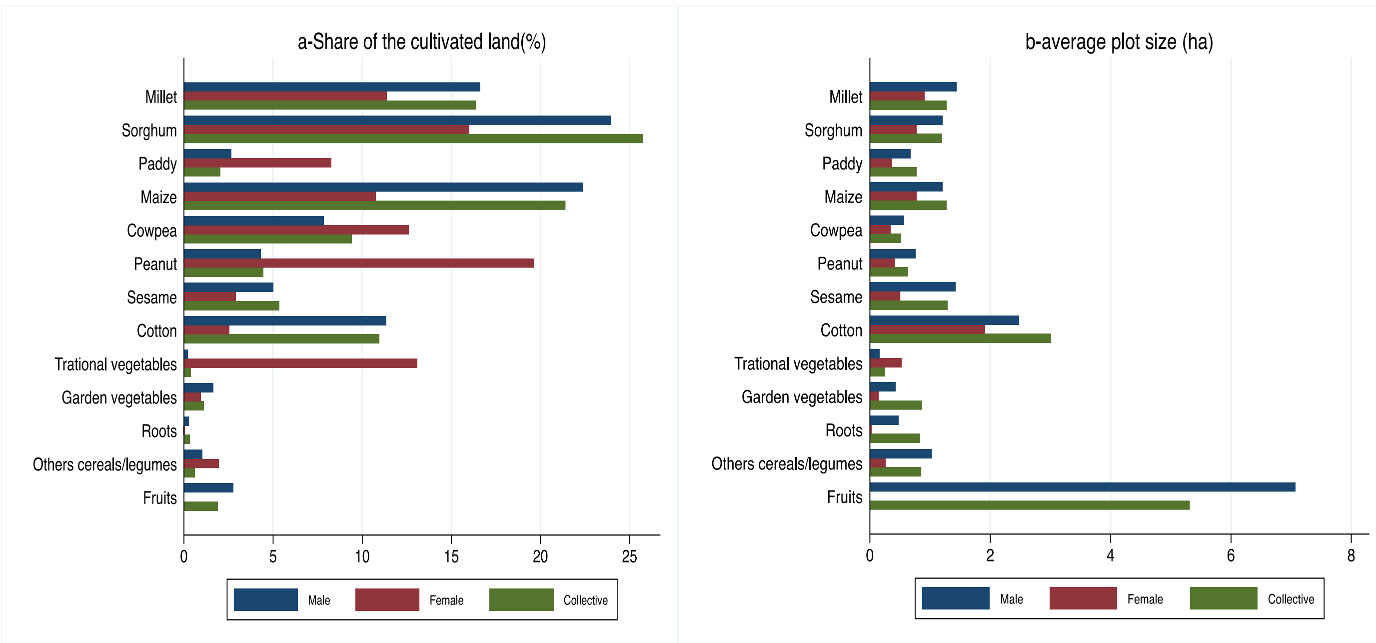


Table 5: Effect of management type on the probability of planting crop type $\boldsymbol{i}$

	Staples food crops			Semi-cash crops			Cash crops		
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Male	0.746***	0.728***	0.734***	0.160***	0.166***	0.162***	0.211***	0.231***	0.250***
	(0.006)	(0.009)	(0.006)	(0.008)	(0.008)	(0.009)	(0.012)	(0.015)	(0.016)
Female	0.400***	0.507***	0.454***	0.388***	0.260***	0.295***	0.092***	0.105***	0.103***
	(0.019)	(0.022)	(0.022)	(0.017)	(0.017)	(0.020)	(0.004)	(0.005)	(0.004)
Manager characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Households and village characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Plots characteristics	No	Yes	Yes	No	Yes	Yes/	No	Yes	Yes
Land and market access variables	No	No	Yes	No	No	Yes	No	No	Yes

Notes: This table shows the margins calculated at the sample mean from multinomial logistic regression. Number of observations is 5,472 (including all crops and surveyed plots without restrictions). **Village characteristics:** Matrilocality, women cooperative, existence of extension service, cereals are the main crops in the village. **Land and markets access** controls: total land owned plots manager, plot manager has a telephone, number of motorbike/bicycles owned by household distance of the village to the nearest town and paved road (1/0).

Appendix

Table A 1: Details Recentered Influence Function Estimates for the endowment effect

	Percentiles								
Variables	10th	20th	30th	40th	50th	60th	70th	80th	90th
Age in years	(0.076)	-0.091	-0.058	-0.046	-0.004	0.016	0.047	0.059	0.157**
	(0.063)	(0.066)	(0.055)	(0.054)	(0.046)	(0.045)	(0.048)	(0.050)	(0.069)
Squared of age in years	0.060	0.088	0.043	0.030	-0.001	-0.029	-0.057	-0.059	-0.147**
	(0.054)	(0.058)	(0.049)	(0.048)	(0.040)	(0.039)	(0.042)	(0.045)	(0.058)
Primary education (1 if yes)	0.010	0.006	0.005	0.000	0.000	0.002	-0.005	-0.004	-0.010
	(0.007)	(0.006)	(0.006)	(0.006)	(0.005)	(0.005)	(0.005)	(0.007)	(0.010)
Manager has off-farm activity (1 if yes)	-0.000	0.016	0.032**	0.031**	0.020*	0.005	0.011	-0.009	-0.058***
	(0.020)	(0.020)	(0.016)	(0.015)	(0.012)	(0.014)	(0.013)	(0.014)	(0.022)
Manager has mobile phone (1 if yes)	0.005	-0.013	-0.024	-0.007	0.003	-0.012	-0.001	0.003	0.057*
	(0.017)	(0.016)	(0.015)	(0.016)	(0.015)	(0.018)	(0.015)	(0.018)	(0.029)
Log plot size (ha)	-0.373***	-0.414***	-0.442***	-0.397***	-0.410***	-0.431***	-0.457***	-0.486***	-0.702***
	(0.055)	(0.055)	(0.052)	(0.043)	(0.043)	(0.042)	(0.048)	(0.054)	(0.099)
Soil texture	-0.001	0.000	0.003	0.003	0.001	0.004	0.004	0.002	0.001
	(0.006)	(0.006)	(0.007)	(0.006)	(0.006)	(0.007)	(0.007)	(0.004)	(0.006)
Plot topography	0.002	0.000	0.002	0.005	0.004	0.009	0.010*	0.009	0.011
	(0.007)	(0.006)	(0.005)	(0.005)	(0.006)	(0.006)	(0.005)	(0.006)	(0.007)
Plot fertility	0.007	0.009	0.008	0.008	0.013*	0.013*	0.013*	0.017*	0.018
	(0.007)	(0.007)	(0.006)	(0.006)	(0.007)	(0.007)	(0.007)	(0.009)	(0.011)
Use organic fertilizers (1 if yes)	0.045**	0.056**	0.036*	0.028*	0.037**	0.036**	0.040**	0.009	0.016
	(0.022)	(0.026)	(0.019)	(0.017)	(0.017)	(0.017)	(0.016)	(0.016)	(0.023)
Use chemical fertilizers (1 if yes)	0.022	0.040***	0.055***	0.058***	0.066***	0.067***	0.062***	0.066***	0.064***
	(0.014)	(0.014)	(0.015)	(0.015)	(0.014)	(0.013)	(0.014)	(0.015)	(0.021)

Use pesticides/fungicides (1 if yes)	0.012	0.019	0.023*	0.020*	0.019	0.023**	0.026**	0.025*	0.031*
	(0.011)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.011)	(0.013)	(0.019)
Log family male labor (man/day/ha)	0.048*	0.019	0.059**	0.067***	0.091***	0.053**	0.060**	0.088***	0.107**
	(0.027)	(0.029)	(0.024)	(0.024)	(0.025)	(0.025)	(0.026)	(0.027)	(0.044)
Log family female labor (man/day/ha)	-0.048**	-0.065***	-0.058***	-0.071***	-0.062***	-0.049***	-0.031*	-0.018	-0.037
	(0.023)	(0.019)	(0.017)	(0.016)	(0.015)	(0.015)	(0.017)	(0.017)	(0.029)
Log family under 15 labor (man/day/ha)	-0.004	-0.002	-0.003	-0.000	0.001	-0.001	-0.004	-0.005	-0.004
	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.005)	(0.005)
Use hired male labor (1 if yes)	0.013	0.012	-0.001	0.007	0.014	0.027**	0.019**	0.025**	0.028*
	(0.012)	(0.012)	(0.011)	(0.011)	(0.010)	(0.012)	(0.009)	(0.012)	(0.016)
Use hired female labor (1 if yes)	0.012*	0.005	0.006	0.005	0.005	-0.001	0.003	0.003	-0.003
	(0.007)	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.004)	(0.005)
Dependency ratio	-0.003	-0.003	-0.003	-0.002	-0.003	-0.002	-0.001	-0.002	-0.004
	(0.004)	(0.005)	(0.003)	(0.003)	(0.004)	(0.002)	(0.002)	(0.003)	(0.006)
Household Tropical Livestock Unit (TLU)	0.008	0.006	0.006	0.008	0.007	0.007	0.005	0.005	0.009
	(0.006)	(0.005)	(0.004)	(0.005)	(0.005)	(0.005)	(0.004)	(0.004)	(0.007)
Log of farm capital (CFA/ha)	0.012	0.013	0.023**	0.025***	0.025***	0.020**	0.021***	0.032***	0.019
	(0.009)	(0.009)	(0.010)	(0.009)	(0.009)	(0.009)	(0.008)	(0.011)	(0.015)
Staple food crops	-0.147*	-0.251***	-0.263***	-0.441***	-0.462***	-0.449***	-0.411***	-0.421*	-0.167
	(0.078)	(0.060)	(0.085)	(0.101)	(0.090)	(0.082)	(0.116)	(0.250)	(0.171)
Semi-cash crops	0.243***	0.283***	0.282***	0.378***	0.360***	0.343***	0.319***	0.317**	0.164
	(0.060)	(0.051)	(0.064)	(0.077)	(0.069)	(0.064)	(0.080)	(0.160)	(0.112)
Cash crops	0.178***	0.201***	0.199***	0.277***	0.270***	0.256***	0.230***	0.229*	0.067
	(0.047)	(0.039)	(0.050)	(0.060)	(0.054)	(0.049)	(0.063)	(0.128)	(0.088)
Village/EA fixed effects	-0.014	0.010	-0.001	0.001	0.003	-0.004	0.003	0.032	-0.004
	(0.052)	(0.056)	(0.045)	(0.044)	(0.044)	(0.042)	(0.042)	(0.047)	(0.084)

Table A 2: Details Recentered Influence Function Estimates for the female structural disadvantage

	Percentiles								
Variables	10th percentile	20th percentile	30th percentile	40th percentile	50th percentile	60th percentile	70th percentile	80th percentile	90th percentile
Age in years	-0.604	-0.225	-0.078	-0.065	-0.170	-0.423	-0.207	-0.052	-0.686
	(0.565)	(0.507)	(0.414)	(0.422)	(0.438)	(0.378)	(0.321)	(0.422)	(0.561)
Squared of age in years	0.322	0.105	0.025	-0.018	0.016	0.126	0.083	0.032	0.414
	(0.289)	(0.254)	(0.207)	(0.222)	(0.234)	(0.196)	(0.165)	(0.217)	(0.279)
Primary education (1 if yes)	0.001	0.012	0.013	0.012	0.014	0.000	0.020	0.036*	0.077**
	(0.016)	(0.014)	(0.015)	(0.013)	(0.012)	(0.017)	(0.015)	(0.020)	(0.037)
Manager has off-farm activitiy (1 if yes)	-0.043	-0.019	0.027	0.000	-0.006	-0.012	-0.035	-0.061**	0.028
	(0.031)	(0.038)	(0.026)	(0.025)	(0.024)	(0.029)	(0.027)	(0.031)	(0.047)
Manager has mobile phone (1 if yes)	0.116	0.101	0.049	0.038	0.036	0.043	0.001	-0.010	-0.025
	(0.092)	(0.080)	(0.060)	(0.047)	(0.035)	(0.034)	(0.044)	(0.048)	(0.066)
Log plot size(ha)	0.045	-0.007	0.072	0.055	-0.032	-0.073	-0.088	-0.054	-0.323***
	(0.053)	(0.053)	(0.047)	(0.041)	(0.049)	(0.052)	(0.057)	(0.058)	(0.110)
Soil texture	0.023	0.008	-0.003	-0.013	0.013	0.018	0.010	-0.012	0.040
	(0.048)	(0.041)	(0.033)	(0.035)	(0.030)	(0.031)	(0.032)	(0.043)	(0.056)
Plot topography	0.033	0.074	0.004	0.070	0.044	-0.007	0.028	-0.023	-0.036
	(0.075)	(0.085)	(0.070)	(0.064)	(0.056)	(0.066)	(0.060)	(0.087)	(0.124)
Plot fertility	-0.011	0.013	0.015	0.010	0.002	0.043*	0.041*	0.023	0.015
	(0.029)	(0.026)	(0.021)	(0.019)	(0.020)	(0.024)	(0.022)	(0.025)	(0.037)
Use organic fertilizers (1 if yes)	0.000	0.003	-0.010	-0.022	-0.027	-0.047*	-0.042**	0.002	-0.039
	(0.022)	(0.020)	(0.020)	(0.021)	(0.022)	(0.025)	(0.019)	(0.020)	(0.029)
Use chemical fertilizers (1 if yes)	-0.011	-0.047**	-0.014	-0.018	-0.029	-0.033	-0.004	-0.001	-0.005
	(0.025)	(0.023)	(0.019)	(0.019)	(0.020)	(0.022)	(0.020)	(0.022)	(0.037)
Use pesticides/fungicides (1 if yes)	0.011	0.041	0.003	0.019	0.028	0.017	-0.019	-0.049	-0.034
	(0.025)	(0.029)	(0.024)	(0.024)	(0.024)	(0.028)	(0.027)	(0.034)	(0.039)

Log family male labor (man/day/ha)	0.033	0.090**	0.044	0.053*	0.059*	0.045	0.045*	0.066**	0.036
	(0.031)	(0.035)	(0.032)	(0.031)	(0.032)	(0.030)	(0.026)	(0.030)	(0.043)
Log family female labor (man/day/ha)	-0.352*	-0.212*	-0.146	-0.093	-0.126	-0.069	-0.071	-0.223*	-0.373
	(0.187)	(0.126)	(0.114)	(0.101)	(0.091)	(0.105)	(0.104)	(0.133)	(0.243)
Log family under 15 labor (man/day/ha)	0.095**	0.084**	0.091**	0.076**	0.053	0.004	0.003	0.040	0.078
	(0.042)	(0.042)	(0.039)	(0.037)	(0.036)	(0.038)	(0.037)	(0.039)	(0.065)
Use hired male labor (1 if yes)	0.001	0.027	0.041	0.027	0.032	0.015	0.014	-0.001	-0.038
	(0.023)	(0.030)	(0.027)	(0.023)	(0.022)	(0.021)	(0.019)	(0.026)	(0.036)
Use hired female labor (1 if yes)	0.021	0.021	0.063***	0.060***	0.033	0.036	-0.019	-0.010	0.004
	(0.032)	(0.029)	(0.023)	(0.020)	(0.020)	(0.023)	(0.020)	(0.026)	(0.030)
Dependency ratio	0.100	0.051	-0.011	-0.045	-0.077	-0.129	-0.020	-0.142	-0.341**
	(0.127)	(0.108)	(0.098)	(0.082)	(0.079)	(0.081)	(0.077)	(0.089)	(0.166)
Household Tropical Livestock Unit (TLU)	0.046	0.006	0.000	-0.028	-0.037	-0.034	-0.025	-0.004	0.022
	(0.041)	(0.040)	(0.038)	(0.035)	(0.033)	(0.043)	(0.036)	(0.050)	(0.083)
Log of farm capital (CFA/ha)	-0.060	-0.146	0.007	-0.040	-0.190	-0.194	-0.338	-0.349	-0.198
	(0.225)	(0.214)	(0.189)	(0.187)	(0.205)	(0.222)	(0.211)	(0.292)	(0.292)
Staple food crops	-0.048	-0.124	-0.041	-0.210	-0.226*	-0.390**	-0.525***	-0.936***	-1.467***
	(0.160)	(0.132)	(0.123)	(0.133)	(0.122)	(0.181)	(0.189)	(0.268)	(0.257)
Semi-cash crops	-0.144	-0.294	-0.170	-0.500*	-0.472*	-0.788**	-1.063***	-1.923***	-2.939***
	(0.340)	(0.275)	(0.259)	(0.273)	(0.246)	(0.366)	(0.375)	(0.521)	(0.480)
Cash crops	-0.093	-0.199	-0.088	-0.308*	-0.299*	-0.503**	-0.696***	-1.254***	-1.920***
	(0.226)	(0.180)	(0.169)	(0.180)	(0.161)	(0.243)	(0.249)	(0.350)	(0.318)
Village/EA fixed effects	-0.389***	-0.185**	-0.030	0.022	0.084	-0.035	0.017	0.300***	-0.099
	(0.080)	(0.074)	(0.074)	(0.063)	(0.069)	(0.084)	(0.083)	(0.107)	(0.142)

Table A 3: Mean decomposition of gender agricultural productivity gap including collective plots

Panel A: Mean of agricultural productivity			
Male-managed plots		11.466***	
		(0.036)	
Female-managed plots		11.560***	
		(0.074)	
Mean gender differential		-0.094	
		(0.068)	
Panel B: Aggregate decomposition	**Endowment effect**	**Male structural advantage**	**Female structural disadvantage**
Total	-0.152**	-0.000	0.058
	(0.063)	(0.008)	(0.041)
Share of the gender differential	161.70%	0.00%	-61.70%
Panel C: Detailed decomposition			
Age in years	-0.017	-0.286*	-0.557
	(0.026)	(0.147)	(0.415)
Squared of age in years	0.007	0.135*	0.305
	(0.021)	(0.070)	(0.209)
Primary education (1 if yes)	0.000	-0.001	0.011
	(0.000)	(0.003)	(0.013)
Manager has off-farm activity (1 if yes)	0.001	0.010	0.028
	(0.006)	(0.009)	(0.026)
Manager has mobile phone (1 if yes)	0.009	0.031	0.070*
	(0.010)	(0.027)	(0.041)
Log plot size(ha)	-0.542***	-0.021***	-0.152***
	(0.041)	(0.008)	(0.043)
Soil texture	0.007**	-0.001	-0.036
	(0.003)	(0.007)	(0.035)
Plot topography	0.004	0.005	0.063
	(0.003)	(0.009)	(0.040)
Plot fertility	0.012**	0.004	0.040**
	(0.006)	(0.003)	(0.016)

Use organic fertilizers (1 if yes)	0.012	-0.014*	-0.033**
	(0.010)	(0.007)	(0.017)
Use chemical fertilizers (1 if yes)	0.043***	-0.011**	-0.027*
	(0.007)	(0.005)	(0.014)
Use pesticides/fungicides (1 if yes)	0.015**	-0.006	-0.029
	(0.007)	(0.007)	(0.019)
Log family male labor (man/day/ha)	0.114***	0.101***	0.087***
	(0.019)	(0.028)	(0.030)
Log family female labor (man/day/ha)	-0.056***	-0.095***	-0.281***
	(0.010)	(0.023)	(0.076)
Log family under 15 labor(man/day/ha)	-0.004	0.010	0.043
	(0.003)	(0.012)	(0.035)
Use hired male labor (1 if yes)	0.008**	-0.003	-0.011
	(0.004)	(0.004)	(0.019)
Use hired female labor (1 if yes)	-0.001	0.010**	0.043**
	(0.002)	(0.004)	(0.021)
Dependency ratio	0.000	0.020	-0.002
	(0.004)	(0.026)	(0.066)
Household Tropical Livestock Unit (TLU)	0.012***	-0.003	0.001
	(0.004)	(0.004)	(0.029)
Log of farm capital (CFA/ha)	0.029***	0.042	0.058
	(0.008)	(0.074)	(0.172)
Staple food crops	-0.358***	-0.029	-1.049***
	(0.062)	(0.051)	(0.142)
Semi-cash crops	0.304***	-0.007	-1.398***
	(0.049)	(0.023)	(0.188)
Cash crops	0.216***	0.001	-0.878***
	(0.038)	(0.013)	(0.122)
Village/EA Fixed Effects	0.060**	0.009	-0.072
	(0.029)	(0.007)	(0.055)

Note: *** p<0.01, ** p<0.05, * p<0.1. Controls are the same as in column (4) of Table 3. The number of observations is 12,033.

Table A 4: Mean decomposition: Additional controls

	(1)			(2)		
Male-managed plots		11.471***			11.469***	
		(0.040)			(0.040)	
Female-managed plots		11.559***			11.555***	
		(0.075)			(0.076)	
Mean gender differential		-0.088			-0.086	
		(0.063)			(0.065)	
Aggregate decomposition	EF	MSA	FSD	EF	MSA	FSD
	-0.104	-0.001	0.017	-0.128	-0.001	0.043
	(0.107)	(0.017)	(0.092)	(0.109)	(0.017)	(0.095)
Detail decomposition						
Manager characteristics						
Age in years	-0.013	-0.053	-0.170	-0.014	0.037	-0.088
	(0.042)	(0.299)	(0.338)	(0.043)	(0.298)	(0.343)
Squared of age in years	0.015	0.040	0.076	0.017	-0.004	0.033
	(0.035)	(0.142)	(0.172)	(0.036)	(0.142)	(0.172)
Primary education (1 if yes)	0.002	-0.003	0.006	0.001	-0.002	0.003
	(0.005)	(0.009)	(0.017)	(0.005)	(0.009)	(0.017)
Manager has off-farm activity (1 if yes)	0.004	0.001	-0.020	0.004	0.003	-0.019
	(0.011)	(0.024)	(0.019)	(0.011)	(0.025)	(0.020)
Manager has mobile phone (1 if yes)	0.006	0.122*	0.073**	0.007	0.116*	0.078**
	(0.015)	(0.063)	(0.034)	(0.015)	(0.062)	(0.037)
Additional plot manager characteristics						
Manager is the head of HH (1 if yes)	-0.045	0.087	-0.000	-0.059	0.106	-0.012
	(0.064)	(0.289)	(0.027)	(0.064)	(0.274)	(0.027)
Manager living in polygamous HH (1 if yes)	0.015	-0.067**	-0.092**	0.015	-0.072**	-0.115***
	(0.012)	(0.029)	(0.042)	(0.012)	(0.029)	(0.042)
Manager is son or daughter of HH (1/0)	0.001	0.007	0.006	0.000	0.008	0.007
	(0.001)	(0.016)	(0.007)	(0.001)	(0.016)	(0.007)
Manager is divorced or widow (1/0)	0.013	0.002	-0.015	0.010	0.002	-0.016

	(0.015)	(0.004)	(0.017)	(0.016)	(0.004)	(0.017)
Manager has right to use output (1 if yes)	0.007	0.026*	0.019	0.006	0.026**	0.020
	(0.014)	(0.014)	(0.021)	(0.013)	(0.013)	(0.020)
Household size	0.005	-0.090	-0.186**	0.003	-0.104**	-0.205***
	(0.007)	(0.056)	(0.076)	(0.007)	(0.050)	(0.077)
Log of total family land	0.008	-0.033	-0.007	0.008	-0.027	0.004
	(0.006)	(0.022)	(0.026)	(0.006)	(0.021)	(0.025)
Plots characteristics						
Log plot size(ha)	-0.562***	-0.040**	-0.095**	-0.546***	-0.042***	-0.094**
	(0.052)	(0.016)	(0.041)	(0.048)	(0.012)	(0.040)
Soil texture [a)]	0.000	0.003	0.019	0.000	0.001	0.018
	(0.005)	(0.018)	(0.029)	(0.005)	(0.017)	(0.026)
Plot topography [a)]	0.006	-0.017	0.006	0.005	0.000	0.004
	(0.004)	(0.020)	(0.046)	(0.004)	(0.019)	(0.045)
Plot fertility [a)]	0.012*	0.005	0.006	0.011*	0.003	0.003
	(0.007)	(0.011)	(0.018)	(0.006)	(0.011)	(0.018)
Additional plot characteristics						
Time to the plot (minutes)				-0.000	-0.020	-0.031
				(0.001)	(0.012)	(0.022)
Number of crops in the plots				0.000	0.023	-0.129
				(0.006)	(0.079)	(0.082)
The land is own by plot manager (1 if yes)				-0.033*	0.153**	0.074**
				(0.018)	(0.065)	(0.033)
Land is inherited (1 if yes)				0.016	-0.110***	-0.030**
				(0.027)	(0.040)	(0.015)
Formal title (1 if yes)				-0.000	-0.003	-0.009**
				(0.001)	(0.002)	(0.004)
Risk of expropriation (1 if yes)				0.001	-0.000	-0.002
				(0.004)	(0.002)	(0.001)
Water source: rainfed (1 if yes)				-0.000	-0.341**	-0.516***
				(0.005)	(0.157)	(0.181)

Use of inputs						
Use organic fertilizers (1 if yes)	0.022*	-0.021	-0.027*	0.026**	-0.023	-0.025*
	(0.013)	(0.016)	(0.014)	(0.013)	(0.016)	(0.014)
Use chemical fertilizers (1 if yes)	0.064***	-0.006	-0.018	0.057***	-0.011	-0.020
	(0.013)	(0.013)	(0.015)	(0.012)	(0.011)	(0.013)
Use pesticides/fungicides (1 if yes)	0.025**	0.004	0.008	0.024**	0.005	0.010
	(0.010)	(0.016)	(0.020)	(0.010)	(0.016)	(0.020)
Log family male labor (man/day/ha)	0.099***	0.126**	0.035	0.098***	0.089	0.034
	(0.027)	(0.063)	(0.027)	(0.026)	(0.064)	(0.025)
Log family female labor (man/day/ha)	-0.053***	-0.066*	-0.240***	-0.062***	-0.047	-0.262***
	(0.017)	(0.040)	(0.080)	(0.017)	(0.038)	(0.088)
Log family under 15 labor (man/day/ha)	-0.002	0.004	0.041	-0.002	0.003	0.035
	(0.002)	(0.021)	(0.031)	(0.003)	(0.022)	(0.028)
Use hired male labor (1 if yes)	0.012	-0.018	-0.006	0.010	-0.017	0.001
	(0.008)	(0.013)	(0.018)	(0.008)	(0.013)	(0.018)
Use hired female labor (1 if yes)	-0.002	0.023**	0.021	-0.001	0.023**	0.026
	(0.003)	(0.010)	(0.019)	(0.003)	(0.010)	(0.018)
Household characteristics						
Dependency ratio	-0.003	0.054	-0.024	-0.003	0.065	-0.007
	(0.004)	(0.065)	(0.077)	(0.004)	(0.063)	(0.081)
Household Tropical Livestock Unit (TLU)	0.003	0.009	0.043	0.003	0.010	0.034
	(0.003)	(0.012)	(0.035)	(0.003)	(0.011)	(0.033)
Log of farm capital (CFA/ha)	0.021***	0.018	0.016	0.021***	-0.015	0.023
	(0.008)	(0.152)	(0.240)	(0.008)	(0.152)	(0.237)
Staple food crops (1/0)	-0.268***	-0.124	-0.702***	-0.241**	-0.068	-0.656***
	(0.092)	(0.143)	(0.143)	(0.105)	(0.154)	(0.149)
Semi-cash crops (1/0)	0.290***	-0.061	-1.464***	0.270***	-0.040	-1.368***
	(0.066)	(0.056)	(0.279)	(0.073)	(0.061)	(0.293)
Cash crops (1/0)	0.210***	-0.019	-0.956***	0.202***	-0.010	-0.902***

	(0.053)	(0.034)	(0.187)	(0.058)	(0.037)	(0.196)
Village fixed effects	0.009	0.009	-0.076	0.017	0.012	-0.062
	(0.033)	(0.024)	(0.059)	(0.033)	(0.024)	(0.060)

Notes: EF: Endowment Effect, MSA: Male Structural Advantage, FSD: Female Structural Disadvantage. Number of observations. Number of observations is 5,472: [a)] Fixed effects of each sub-characteristic of the plot: Topography, soil texture, and perception of soil fertility by the farmer. Standard errors clustered at the village in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table A 5: Mean decomposition: Household fixed effects model

	Households with more than one plot			Households with both types of plot managers		
	(1)			(2)		
Male-managed plots		11.465***			11.550***	
		(0.048)			(0.117)	
Female-managed plots		11.554***			11.626***	
		(0.091)			(0.118)	
Mean gender differential		-0.089			-0.076	
		(0.072)			(0.078)	
	Endow.Effect	Male Struc.Adv	Female Struc. Desadv	Endow.Effect	Male Struc.Adv	Female Struc. Desadv
Aggregate decomposition	-0.100	0.005	0.006	-0.113	-0.011	0.048
	(0.082)	(0.016)	(0.063)	(0.123)	(0.040)	(0.104)
Detailed decomposition						
Age in years	0.050	-0.474	-0.570	0.189	0.168	-0.917
	(0.057)	(0.384)	(0.480)	(0.144)	(0.628)	(0.800)
Squared of age in years	-0.047	0.287	0.285	-0.155	-0.079	0.469
	(0.052)	(0.199)	(0.240)	(0.140)	(0.322)	(0.392)
Primary education (1 if yes)	-0.003	0.009	0.029	-0.004	0.031*	0.051**
	(0.006)	(0.013)	(0.020)	(0.006)	(0.017)	(0.023)
Manager has off-farm activity (1 if yes)	-0.014	0.044	0.037*	-0.013	0.070	0.068**
	(0.013)	(0.033)	(0.022)	(0.013)	(0.048)	(0.026)
Manager has mobile phone (1 if yes)	0.024	0.159*	0.056	-0.020	0.140	0.020
	(0.020)	(0.088)	(0.041)	(0.030)	(0.204)	(0.058)
Log plot size(ha)	-0.497***	-0.052**	-0.113**	-0.418***	-0.028	-0.040
	(0.053)	(0.022)	(0.057)	(0.058)	(0.024)	(0.059)
Soil texture	-0.000	0.005	-0.003	0.001	-0.028	0.012
	(0.005)	(0.019)	(0.036)	(0.009)	(0.052)	(0.030)
Plot topography	0.007*	-0.013	-0.016	-0.002	-0.048	-0.035
	(0.004)	(0.022)	(0.047)	(0.007)	(0.065)	(0.059)
Plot fertility	0.014	0.026*	0.016	0.012	0.055	0.025
	(0.009)	(0.016)	(0.021)	(0.017)	(0.049)	(0.022)
Use organic fertilizers (1 if yes)	0.023	-0.017	-0.017	0.035	-0.057*	-0.018
	(0.017)	(0.017)	(0.022)	(0.027)	(0.031)	(0.027)
Use chemical fertilizers (1 if yes)	0.065***	-0.009	-0.020	0.091***	0.000	-0.042**

	(0.015)	(0.017)	(0.019)	(0.031)	(0.024)	(0.018)
Use pesticides/fungicides (1 if yes)	0.040***	-0.036*	-0.041	0.023**	-0.015	-0.010
	(0.014)	(0.021)	(0.026)	(0.010)	(0.019)	(0.027)
Log family male labor (man/day/ha)	0.094***	0.197***	0.072**	0.018	0.163	0.063
	(0.027)	(0.068)	(0.033)	(0.019)	(0.125)	(0.040)
Log family female labor (man/day/ha)	-0.053**	-0.076*	-0.164*	-0.036	-0.039	-0.143*
	(0.021)	(0.040)	(0.093)	(0.024)	(0.102)	(0.084)
Log family under 15 labor (man/day/ha)	-0.001	0.016	0.056*	0.002	0.038	0.056
	(0.003)	(0.030)	(0.032)	(0.005)	(0.061)	(0.041)
Use hired male labor (1 if yes)	0.011	-0.012	0.009	0.020	0.047	0.027
	(0.009)	(0.017)	(0.018)	(0.020)	(0.042)	(0.022)
Use hired female labor (1 if yes)	0.003	0.015	0.028*	-0.002	0.012	0.023
	(0.003)	(0.010)	(0.015)	(0.003)	(0.036)	(0.020)
Staple food crops (1/0)	-0.331***	-0.193*	-0.328***	-0.231***	-0.814*	-0.168***
	(0.079)	(0.104)	(0.114)	(0.071)	(0.474)	(0.100)
Semi-cash crops (1/0)	0.313***	-0.075*	-0.671***	0.113***	-0.353*	-0.341***
	(0.062)	(0.045)	(0.241)	(0.061)	(0.210)	(0.131)
Cash crops (1/0)	0.212***	-0.037	-0.432***	0.102***	-0.166*	-0.261***
	(0.047)	(0.025)	(0.159)	(0.032)	(0.100)	(0.113)
Household fixed effects	-0.019	0.046	0.041	-0.032	0.003	0.061
	(0.029)	(0.052)	(0.045)	(0.028)	(0.034)	(0.048)
Household fixed effects	0.006	0.115*	0.385**	-0.002	0.151	1.444***
	(0.050)	(0.069)	(0.150)	(0.052)	(0.352)	(0.277)
Number of observations (plots)	5,260			1,766		

Table A 6: List of main crops planted on the surveyed plots

Category	Crops
Staples food crops	Millet (1,785), Sorghum (3,226), Maize (2,552),Fonio (26)
Semi-cash crops	Cowpea (974), Rice (661), sorrel and Okra (257), Tiger nut and Bambara groundnut (101)
Cash crops	Sesame (523), Peanut (1,307), cotton (592), eggplant + cabbage + onion + tomatoes (192), melon (9), green peas (53); yam, potato and cassava (60), mango and coffee (10) and other vegetables such as: carotte, celeries, cucumber, pepper, lettuce (61)
Notes: There are 43 plots where unknown crops are planted. Number of plots in parentheses.	

Table A 7: Effect of management type on the probability of planting crop type *i*

	Staples food crops			Semi-cash crops			Cash crops		
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Male	0.650***	0.653***	0.667***	0.133***	0.127***	0.118***	0.339***	0.342***	0.332***
	(0.012)	(0.012)	(0.014)	(0.008)	(0.008)	(0.009)	(0.015)	(0.015)	(0.015)
Female	0.241***	0.258***	0.262***	0.420***	0.398***	0.404***	0.116***	0.118***	0.114***
	(0.014)	(0.015)	(0.015)	(0.019)	(0.020)	(0.021)	(0.011)	(0.011)	(0.012)
Collective	0.681***	0.686***	0.681***	0.117***	0.112***	0.114***	0.201***	0.206***	0.204***
	(0.009)	(0.008)	(0.009)	(0.005)	(0.005)	(0.006)	(0.007)	(0.007)	(0.007)
Manager characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Households and village characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Plots characteristics	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Land and market access variables	No	No	Yes	No	No	Yes	No	No	Yes

Notes: This table shows the margins calculated at the sample mean from multinomial logistic regression. Number of observations is 12,033(including all crops and surveyed plots without restrictions). **Village characteristics:** Matrilocality, women cooperative, existence of extension service, cereals are the main crops in the village. **Land and markets access** controls: total land owned plots manager, plot manager has a telephone, number of motorbike/bicycles owned by household distance of the village to the nearest town and paved road (1/0).

Table A 8: Use of labor inputs by crop and across gender

Panel A

Crop	Millet			Sorghum			Paddy			Sorghum		
Variable	(1) Male	(2) Female	(2)-(1) Difference	(1) Male	(2) Female	(2)-(1) Difference	(1) Male	(2) Female	(2)-(1) Difference	(1) Male	(2) Female	(2)-(1) Difference
Family male labor (man/day/ha)	95.185	23.978	-71.206***	94.347	48.885	-45.461***	236.278	79.855	-156.423***	90.903	34.020	-56.882**
	(186.003)	(61.356)	(18.953)	(189.436)	(138.185)	(15.552)	(559.889)	(172.915)	(45.556)	(286.583)	(67.843)	(26.883)
Family female labor (man/day/ha)	97.375	90.457	-6.918	141.009	110.855	-30.154	234.216	202.068	-32.148	91.169	95.346	4.177
	(196.850)	(103.968)	(20.458)	(316.789)	(135.254)	(24.995)	(560.088)	(384.546)	(55.553)	(208.842)	(100.279)	(19.914)
Family under 15 labor (man/day/ha)	103.482	62.007	-41.475	116.004	61.736	-54.268	193.112	130.382	-62.730	77.919	83.964	6.045
	(335.799)	(181.885)	(34.956)	(550.975)	(171.478)	(43.033)	(562.724)	(216.166)	(47.306)	(205.445)	(171.168)	(20.410)
Hired male labor (man/day/ha)	8.522	15.853	7.331*	6.581	6.661	0.080	19.281	7.879	-11.402**	10.891	13.855	2.964
	(30.036)	(50.072)	(3.909)	(31.292)	(21.506)	(2.552)	(52.355)	(44.804)	(5.752)	(85.916)	(45.473)	(8.230)
Hired female labor (man/day/ha)	4.006	14.929	10.923***	2.824	5.329	2.505***	19.105	6.073	-13.032***	5.649	6.711	1.062
	(14.897)	(44.695)	(2.673)	(9.880)	(15.134)	(0.958)	(50.463)	(26.556)	(4.562)	(20.626)	(21.851)	(2.122)
Observations	405	99	504	678	168	846	117	172	289	593	115	708

Panel B

Crop	Cowpea			Peanut			Sesam			Vegetables		
Variable	(1) Male	(2) Female	(2)-(1) Difference	(1) Male	(2) Female	(2)-(1) Difference	(1) Male	(2) Female	(2)-(1) Difference	(1) Male	(2) Female	(2)-(1) Difference
Family male labor (man/day/ha)	51.408	59.266	7.859	103.352	53.600	-49.752***	60.873	39.504	-21.369	280.464	75.244	-205.219***
	(163.499)	(197.492)	(13.202)	(200.494)	(125.935)	(14.086)	(92.208)	(59.115)	(16.117)	(678.567)	(290.158)	(50.125)
Family female labor (man/day/ha)	65.948	142.554	76.606***	102.406	151.953	49.547**	77.417	109.855	32.439	75.365	273.193	197.829***
	(134.367)	(356.030)	(18.162)	(170.700)	(257.497)	(21.302)	(161.122)	(157.246)	(30.159)	(204.448)	(437.746)	(38.936)
Family under 15 labor (man/day/ha)	69.469	130.145	60.675***	67.571	126.638	59.067**	62.879	36.631	-26.248	49.549	143.148	93.599***
	(293.797)	(343.270)	(23.360)	(152.739)	(305.000)	(24.273)	(154.212)	(67.692)	(26.145)	(140.675)	(389.240)	(33.812)
Hired male labor (man/day/ha)	2.329	7.180	4.850**	4.005	9.354	5.349	4.987	5.531	0.544	16.902	0.372	-16.530***
	(8.437)	(39.762)	(1.893)	(14.794)	(52.957)	(4.056)	(14.630)	(18.248)	(2.927)	(76.509)	(1.985)	(4.947)
Hired female labor (man/day/ha)	2.285	12.362	10.077**	6.992	8.170	1.178	4.222	4.230	0.008	3.406	4.772	1.365
	(9.889)	(100.046)	(4.635)	(21.896)	(30.096)	(2.534)	(13.474)	(19.871)	(2.863)	(22.431)	(42.357)	(3.829)
Observations	473	291	764	177	369	546	119	37	156	143	239	382

Table A 9: Use of non-labor inputs by crop and across gender

Panel A

Crop		Millet			Sorghum			Paddy			Sorghum	
Variable	(1) Male	(2) Female	(2)-(1) Difference	(1) Male	(2) Female	(2)-(1) Difference	(1) Male	(2) Female	(2)-(1) Difference	(1) Male	(2) Female	(2)-(1) Difference
Organic fertlizers(kg/ha)	176.453	12.707	-163.745	54.965	95.966	41.001	11.040	0.223	-10.817**	136.604	56.035	-80.568
	(238.513)	(48.066)	(124.592)	(328.645)	(654.386)	(35.676)	(71.772)	(2.925)	(5.475)	(680.807)	(394.552)	(65.544)
Chemical fertlizers(kg/ha)	18.287	16.736	-1.551	867.383	71.248	-796.136	166.298	236.587	70.289	318.229	171.273	-146.956
	(44.750)	(45.507)	(5.034)	(93.967)	(76.924)	(541.992)	(178.897)	(889.662)	(83.416)	(568.862)	(863.330)	(427.755)
Chemical pesticides(liter/ha)	0.042	0.010	-0.032	0.098	0.015	-0.083**	0.520	0.578	0.058	0.256	0.299	0.043
	(0.297)	(0.072)	(0.030)	(0.536)	(0.111)	(0.042)	(1.502)	(1.604)	(0.187)	(0.900)	(1.858)	(0.113)
Observations	405	99	504	678	168	846	117	172	289	593	115	708

Panel B

Crop		Cowpea			Peanut			Sesam			Vegetables	
Variable	(1) Male	(2) Female	(2)-(1) Difference	(1) Male	(2) Female	(2)-(1) Difference	(1) Male	(2) Female	(2)-(1) Difference	(1) Male	(2) Female	(2)-(1) Difference
Organic fertlizers(kg/ha)	38.968	31.788	-7.180	20.840	10.183	-10.656	4.559	5.089	0.531	73.000	10.094	-62.906**
	(227.963)	(343.852)	(20.699)	(180.085)	(79.198)	(11.099)	(18.611)	(18.822)	(3.512)	(415.358)	(59.783)	(27.306)
Chemical fertlizers(kg/ha)	5.928	14.016	8.088	12.860	43.653	30.793	8.870	15.553	6.683	393.932	13.176	-380.756***
	(20.329)	(149.841)	(6.989)	(54.680)	(657.719)	(49.543)	(34.866)	(46.538)	(7.137)	`(111.086)	(69.086)	(74.895)
Chemical pesticides(liter/ha)	0.253	0.136	-0.117*	0.055	0.163	0.108	0.358	0.499	0.140	2.725	0.156	-2.569***
	(1.023)	(0.806)	(0.070)	(0.439)	(2.874)	(0.217)	(1.057)	(1.722)	(0.234)	(13.171)	(0.982)	(0.855)
Observations	473	291	764	177	369	546	119	37	156	143	239	382