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Gender divide in agricultural productivity in Mozambique

João Morgado[1] and Vincenzo Salvucci[2]

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Abstract: In this study we analyze the gender gap in agricultural productivity in Mozambique applying the Oaxaca-Blinder decomposition approach on data from four agricultural surveys between 2002 and 2012. We find that female-headed households are on average substantially less productive (about 20 per cent) than male-headed households, and that differences are more pronounced in the centre-north compared to the south. The gap persists even though female-headed households are disproportionally found in relatively smaller plots, and a pronounced inverse-size productivity relation exists. We could identify some of the most important drivers of this divide linked to differences in endowments. However, a larger proportion is accounted for by the structural part, potentially linked to technical efficiency, pure discrimination, or other unobservable characteristics.

Keywords: gender gap, agricultural productivity, Mozambique
JEL classification: Q12, J16, O13

Tables: at the end of the paper.

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[1] World Bank, Mozambique Country Office, Maputo, Mozambique; [2] UNU-WIDER, Helsinki, Finland, vincenzo@wider.unu.edu.

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Information and requests: publications@wider.unu.edu

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Katajanokanlaituri 6 B, 00160 Helsinki, Finland

1 Introduction

Agriculture is the most important economic sector for the wellbeing of rural households, especially the most vulnerable ones, and particularly in Sub-Saharan Africa (UN Women et al. 2015; IFAD 2001; World Bank 2007; World Bank et al. 2009). As such, agriculture is strictly linked to the income and consumption levels of rural households, and influences their food security, poverty, and malnutrition status, among other characteristics.

In most Sub-Saharan countries, a significant proportion of the agricultural labour force is composed of women. In these settings, agriculture typically employs low-level technology, and is intensive in the use of both land and labour. FAO (2011) estimates that the proportion of women in the total agriculture labour force varies between 30 and 80 per cent, depending on the country. Among Mozambique's neighbouring countries, Malawi and Tanzania show a proportion of women in the total agriculture labour force above 50 per cent (Palacios-Lopez et al. 2015; UN Women et al. 2015).

However, while playing a central role in food production, women tend to have little control over resources (Mehra and Rojas 2008; Arndt et al. 2011). Also and importantly, in most countries it is observed that the productivity of women farmers is lower on average than the productivity of men farmers. Such a gender gap in agricultural productivity may often be substantial, and may reflect different conditions such as the access to important agricultural inputs, together with other constraints (Sheahan and Barrett 2014). The economic costs associated with the existence of a wide gender gap in agricultural productivity may be substantial (World Bank and ONE 2014). UN Women et al. (2015) estimate that closing the gender gap in agricultural productivity could translate in to GDP gains that in turn could move 238,000 people out of poverty in Malawi, 80,000 people in Tanzania and 119,000 people in Uganda. Indirect effects on malnutrition are also estimated as being significant.[1] Nonetheless, the existence of significant gender gaps in agricultural productivity seems to be persistent over time, despite the potential economic gains.

In this study we analyze the gender gap in agricultural productivity in Mozambique, applying the Oaxaca-Blinder decomposition approach to Agricultural Survey data for 2002, 2005, 2008, and 2012. The analysis is conducted at national and regional levels. Our results suggest that regional differences can be important to explain the agricultural productivity gap between male- and female-headed farming households. In particular, a pronounced gap is found for the centre-north but not in the south, where female-headed households are on average 20 per cent less productive than male-headed households. Given the higher level of development of the southern region compared to the centre-north, this might suggest that overall economic development could be one of the underlying factors linked to the reduction of the gender gap in agricultural productivity. We highlight that the estimated productivity gap would be even bigger if female-headed households were not disproportionally found in relatively smaller plots, in the presence of a strong inverse-size productivity relation. Indeed, the combined effect of these factors generally tends to reduce the gap in agricultural productivity. We could identify some of the most important drivers of this divide linked to the different endowments of female- and male-headed households. However, differences in endowments only explain a small

[1] Indeed, women are found to spend more relative to men on health and education for their children (UN Women et al. 2015; Ruel et al. 2013; Smith et al. 2003).

proportion of the total gap. A larger proportion is accounted for by the structural part, which is potentially linked to technical efficiency, pure discrimination, or other unobservable characteristics.

The paper proceeds as follows: in Section 2 the Mozambican context with respect to agriculture and gender is introduced, and the data used are presented in Section 3. Section 4 discusses the methodology and estimation strategy applied in the paper, while the results are found in Section 5; Section 6 concludes.

2 The Mozambican context

In Mozambique, as in other sub-Saharan countries, the vast majority of households live in rural areas (65 to 70 per cent of the population), and agriculture represents the main economic activity, accounting for about 27 per cent of GDP (World Bank, 2016). With regard to the dependence of the rural poor on agriculture, Mather et al. (2008) estimate that income from farm resources accounts for an average of about 70 to 80 per cent of total income for the poorest 80 per cent of rural households.

According to the Ministry of Agriculture, in 2005 around 25 per cent of farming households in Mozambique were headed by women (MINAG 2005). However, this percentage is estimated to have increased to 36 per cent in 2011 (INE 2013). Arndt et al. (2011) report that the amount of time that women and men allocate to agricultural production is comparable, but that women usually spend relatively more time taking care of food crop production, whereas men tend to control cash crop production. In the same article it is also noted that female-headed households are mostly dependent on female labour for their income. This can be explained by the fact that in most cases women become household heads when a male household member is absent, often because of death or migration. Female-headed households are also found to be poorer than male-headed households (Arndt et al. 2011). Regarding access to resources, female-headed households generally own smaller plots and use fertilizers, pesticides, machinery, and other more modern inputs less than male-headed households (FAO, 2005). This will be discussed in further detail in the following section. In general, it is noted that women farmers have more difficulties in having access to and control over cash, land, and livestock (Johnson et al. 2013; de Brauw 2015).

The referenced studies highlight the importance of analyzing the gender gap in agricultural productivity in a country like Mozambique, as it shares most of the characteristics of other Sub-Saharan countries but also has a number of peculiarities. Mozambique is a vast country with a dispersed population, and it shows important regional differences in many aspects, so that agricultural practices and gender roles also differ from one region to the other (Marenya et al. 2015). In this respect, regional differences play a central role.

3 Data

The analysis is based upon datasets from the TIA (*Trabalho de Inquérito Agrícola*) national agricultural surveys from 2002, 2005, 2008, and the IAI (*Inquérito Agrícola Integrado*) dataset compiled in 2012.[2] The surveys are based on the Agricultural and Livestock Censuses (CAPs) and are stratified by province and agro-ecological zone. TIA data are representative at the national and provincial levels, and represent the best available data for smallholder agriculture in Mozambique. The datasets include a representative sample of small- and medium-sized farms: the holdings are considered 'small' when the cultivated area is less than 10 Ha, and 'medium' with a cultivated area between 10 and 50 Ha. The 'large' farms with a cultivated area larger than 50 Ha[3] are also surveyed but are not considered in this analysis. Small and medium farmers in Mozambique account for more than 98 per cent of the land cultivated in the four years considered and represent more than 99.9 per cent of all holdings. The data, collected by the Ministry of Agriculture, with technical support from Michigan State University, contain information on household demographics, income, assets, land ownership, crop production and sales, services, and technology.

Table 1 presents the descriptive statistics for all the variables used in our analysis. Statistics are presented at the country and regional levels, showing the differences between the south of Mozambique and the rest of the country. This subdivision is motivated by the existence of a strong geographical divide between the two areas of the country, which will be discussed in detail in section 5. In addition to this, we also present statistics for male- and female-headed households, along with the results of Wald tests performed on the mean differences between the two groups.

In our study we use two alternative measures of agricultural productivity as dependent variables: i) the gross value of the yield/ha in Meticais—the Mozambican currency, also abbreviated as MZN—deflated using the regional CPIs (North, Centre and South); and ii) the amount of maize produced/ha in kilograms. The average output at country level corresponds to 11135.08 MZN/ha. This value is considerably different at the subnational level. On the one hand, the southern region is considerably more productive with an average value of yield/ha, worth roughly 16860 MZN. On the other hand, the north and centre of the country fall below the national average with a mean value of yield/ha, worth approximately 9977 MZN. Looking at our alternative measure of productivity we find a different pattern. In this case, the southern region is less productive than the national average—about 1035 kg of maize/ha—with a mean production/ha of 880 kg. Conversely, the average productivity/ha is 1065 kg of maize in the centre-north. The differences in productivity between female- and male-headed households are discussed in detail in Section 5.

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[2] The IAI follows exactly the same methodology as the TIA and as such they are completely comparable. Other TIA survey data exist for 2003, 2006, and 2007 but they are not as comprehensive as those selected for the present study. In particular, they do not provide complete information on household income components that are deemed important for the object of the study. The TIA/IAI surveys use a universally accepted sampling methodology (Kiregyera et al. 2008).

[3] Other limits are in place for farm categorization. A farm is classified as medium, rather than small, if it achieves at least 1 of the following criteria: more than 10 Ha of land cultivated, more than 10 cattle, more than 50 goats/sheep/pigs, more than 5,000 chickens or more than 5 Ha of cultivated land irrigated. Above these limits, a farm would be classified as large if it achieves at least 1 of the following criteria: more than 50 Ha of land cultivated, more than 100 cattle, more than 500 goats/sheep/pigs, more than 20,000 chickens or more than 10 Ha of cultivated land irrigated.

The independent variables used in our analysis are standard in this literature, and include household head and other household characteristics, agricultural inputs, technical support, market-related variables, cash crop production, wealth and assets, plot size, and temporal and regional controls. Male- and female-headed households present considerably different averages with respect to some of these variables, at both national and subnational levels. To begin with, the amount of labour available to male-headed households is considerably larger, being roughly 57 per cent higher at anational level. In addition to this, the access to other inputs such as mechanical traction, fertilizer or pesticide follows the same pattern. For example, at national level about 42 per cent of male-headed households had access to mechanical traction against only 17 per cent of female-headed households.

A group of other variables also points to a general advantage for households headed by men. Not only is the level of education of male heads consistently higher, but so is their access to extension services (12 per cent versus 7 per cent at the national level). Furthermore, the proportion of male-headed households growing cash crops or participating in agricultural markets is also substantially bigger (27 per cent versus 16 per cent, and 51 per cent versus 37 per cent at the national level, respectively). Finally, the distribution of male- and female-headed households among quintiles of wealth and quintiles of plot area also translates into considerable advantages for the former group. In general, male-headed households are consistently located in bigger plots of land and are substantially wealthier.

4 Methodology/estimation strategy

The gender gap in agricultural productivity between male- and female-headed households has been studied in the literature using different approaches. Some research has focused on differences in resource endowments to explain this phenomenon. A common methodology in this literature consists of testing the allocative efficiency of the distribution of certain inputs—such as fertilizer or pesticide—between male- and female-headed households by regressing these inputs against households' observable characteristics and a variable identifying the head's gender (Larson et al. 2015; Doss and Morris 2000). These inputs are considered to be inefficiently allocated—assuming decreasing marginal returns—when the coefficient of the gender variable is statistically significant.

On the other hand, several other studies have tried to explain the productivity gender gap through differences in technical efficiency. Most of these studies regress the yields on the observable characteristics of a pooled sample of male- and female-headed households including the gender of the head, which accounts for the differences in technical efficiency (Larson et al. 2015). Alternatively, the gap has also been estimated using the difference in the estimated technical efficiency computed through stochastic production frontiers (Oladeebo and Fajuyigbe 2007; Kinkingninhoun-Mêdagbé et al. 2010).

However, none of the approaches described account for differences in resource endowments and technical efficiency simultaneously. In this paper, we employ the Oaxaca-Blinder (OB) decomposition methodology developed for the field of labour economics, which decomposes the gender gap into an explained and an unexplained component (Oaxaca 1973; Blinder 1973). The first component, also referred to as the 'endowment effect', accounts for differences in endowments. The second component, also called the 'structural effect', accounts for differences in the returns to these endowments and for the impact of group membership. This effect can be explained by differences in technical efficiency, the returns to observable and unobservable characteristics, or pure discrimination.

This methodology has been applied to the analysis of the gender gap in agricultural productivity by McCarthy and Kilic (2014), Aguilar et al. (2014), Oseni et al. (2014), Backiny-Yetna and McGee (2015), and Ali et al. (2015), among others.

The first step of the standard OB decomposition involves the estimation of the dependent variable—agricultural productivity in our case—for male- and female-headed households through an OLS model as follows:

$$(1)\ Y_G = \hat{\beta}_{G0} + \Sigma_{k=1}^{K} X_{Gk}\hat{\beta}_{Gk} + \varepsilon_G$$

where G identifies the gender of the household head; Y stands for the measure of agricultural productivity; X is a vector of *k* observable explanatory variables, β is a vector of coefficients associated with the explanatory variables and the intercept, and ε is the error term (assuming that $E(\varepsilon_G) = 0$). The decomposition of the productivity gender gap into the aforementioned components involves a counterfactual comparison between the coefficients computed in equation (1) and the coefficients corresponding to a scenario without gender discrimination, estimated through an OLS model based on the pooled sample of male- and female-headed households:

$$(2)\ Y = \hat{\beta}_0^* + \Sigma_{k=1}^{K} X_k\hat{\beta}_k^* + \hat{\beta}_G^* G + \varepsilon^*$$

where Y stands for the measure of agricultural productivity; X is a vector of *k* observable explanatory variables; β^* is a vector of coefficients associated with the explanatory variables and the intercept; G is a dummy variable identifying the gender of the household head; β_G^* is the coefficient associated with the gender of the household head and ε^* is the error term (assuming that $E(\varepsilon^*)$=0). Following these two steps, the gender gap in productivity is estimated as the mean difference between the productivity of male- and female-headed households:

$$(3)\ E(Y_M) - E(Y_F) = \hat{\beta}_{M0} + \Sigma_{k=1}^{K} E(X_{Mk})\hat{\beta}_{Mk} - \hat{\beta}_{F0} - \Sigma_{k=1}^{K} E(X_{Fk})\hat{\beta}_{Fk}$$

Rearranging equation (3) by adding and subtracting the intercept from the pooled model $(\hat{\beta}_0^*)$ and the returns to the endowments of male- and female-headed households valued at $\hat{\beta}_k^*$ ($\Sigma_{k=1}^{K} X_{Mk}\hat{\beta}_k^*$ and $\Sigma_{k=1}^{K} X_{Fk}\hat{\beta}_k^*$), we obtain the aggregate decomposition as follows:

$$(4)\ E(Y_M) - E(Y_F) = \underbrace{\Sigma_{k=1}^{K}[E(X_{Mk}) - E(X_{Fk})]\hat{\beta}_k^*}_{Endowment\ Effect} +$$

$$\underbrace{(\hat{\beta}_{M0} - \hat{\beta}_0^*) + \Sigma_{k=1}^{K}[E(X_{Mk})(\hat{\beta}_{Mk} - \hat{\beta}_k^*)] + (\hat{\beta}_0^* - \hat{\beta}_{F0}) + \Sigma_{k=1}^{K}[E(X_{Fk})(\hat{\beta}_k^* - \hat{\beta}_{Fk})]}_{Structural\ Effect}$$

where the *endowment effect* can be interpreted as the increase in productivity that female-headed households would obtain if they had the same endowments as male-headed households, and the *structural effect* as the increase that they would obtain if they had the same return on these endowments. As mentioned, the structural effect also accounts for the pure effect of group membership, which appears in equation (4) as the difference between the intercept terms, i.e. $(\hat{\beta}_{M0} - \hat{\beta}_0^*)$ and $(\hat{\beta}_0^* - \hat{\beta}_{F0})$. The structural effect can be further divided into a *male structural advantage* ($(\hat{\beta}_{M0} - \hat{\beta}_0^*) + \Sigma_{k=1}^{K}[E(X_{Mk})(\hat{\beta}_{Mk} - \hat{\beta}_k^*)]$) and a *female structural disadvantage* ($(\hat{\beta}_0^* - \hat{\beta}_{F0}) + \Sigma_{k=1}^{K}[E(X_{Fk})(\hat{\beta}_k^* -$

$\hat{\beta}_{Fk})]$)). These two elements can be interpreted as the difference in agricultural productivity between males (females) and the non-discrimination scenario. This in turn is explained by the differences between the coefficients of each group and the ones obtained through the pooled regression.

According to Fortin et al. (2010), the validity of the aggregate decomposition depends on two assumptions which we assume to hold in our model—Overlapping Support and Ignorability. The first one requires that no combination of observable and unobservable characteristics can (exactly) identify group membership. In other words, this implies that there is no characteristic (or combination of characteristics) that can only be found among male-headed or female-headed households.[4] The second assumption imposes that the distribution of omitted variables conditional on the observable characteristics is the same for both groups. This can be thought as a weaker version of the traditional conditional independence assumption for OLS models ($E(\varepsilon|X) = 0)$.

The OB methodology also permits the decomposition of both the endowment and the structural effect into the individual contribution of each observable covariate—the so-called detailed decomposition. As the endowment and structural effects are equal to the sum of the coefficients of these covariates, we can easily determine the percentage of the gap that is driven by each variable. This decomposition has relevant policy implications as it helps to identify the drivers of the gender gap.

While the interpretation of the individual contributions to the endowment effect is fairly straightforward, the same does not apply to the decomposition of the structural effect. As mentioned above, the structural effect includes the difference between the male and female intercepts (the group membership term), and between the coefficients (the return to the endowments). For this reason, when the OB decomposition includes categorical variables (as is often the case), the interpretation of the coefficients associated with these categorical variables and the group membership component is not meaningful. This occurs because changing the categorical variables reference group changes the coefficients associated with them and with the group membership term.[5] As such, the standard decomposition of the structural effect can only be interpreted for non-categorical variables (those with a natural zero point).[6] A solution to the identification problem just described was developed by Yun (2005). The solution departs from the assumption that the average of the coefficients associated with categorical variables obtained after estimating the same model through 'every possible specification of the reference groups' is equal to the categorical variables' true contributions to the gender gap (Yun, 2003: 2). In order words, this solution uses normalized regressions to compute the OB decomposition instead of the equations (1) and (2) described above.[7] With this methodology, the structural effect, the

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[4] This condition seems to hold in our model as there is no observable characteristic among our variables (and no obvious unobservable characteristic we can think of) that can exactly identify the gender of the household head.

[5] For a detailed explanation see Fortin, Lemieux and Firpo (2010). For a practical example see Botezat (2012).

[6] In addition to the previous caveat, the validity of the detailed decomposition depends on two additional assumptions: zero conditional mean, and additive linearity. Even though the first assumption can be relaxed for the aggregate decomposition, it needs to hold in the detailed decomposition case. Regarding the second assumption, it holds when the model is expressed as linear additively separable functions in the observable and unobservable characteristics. See Fortin, Lemieux and Firpo (2010).

[7] In normalized regressions we impose the restriction that the sum of the categorical variables' coefficients is equal to zero, since no category is omitted.

endowment effect, the detailed decomposition of the endowment effect, and the contribution of continuous variables to the structural effect are not altered.[8]

5 Results

Table 3 presents the mean gender gap and its aggregate and detailed decompositions obtained through the OB methodology. As mentioned, results are presented for two different measures of agricultural productivity: the gross value of the yield/ha and the production of maize/ha in kilograms—the most important crop for smallholders in Mozambique. The second outcome variable serves as a robustness check since the gross value of the yield might be highly sensitive to price variations across the years and between regions. We treat the observations from the TIAs of 2002, 2005, 2008 and 2012 as a cross-sectional database. Year-specific effects are controlled with temporal dummies.

Besides the decomposition at the national level, we also present results obtained for the southern region and the centre-north. This subdivision is motivated by the observation that the southern region differs substantially from the rest of the country with regard to the gender divide. This is evident from the descriptive statistics presented in Table 1. A similar strategy has also been employed for the case of Nigeria by Oseni et al. (2014), who acknowledge substantial regional differences and find sensibly different results for different regions of the country. These differences between the southern region and the rest of the country are also reported in anthropological studies focused on gender issues in Mozambique. Tvedten (2011), for example, stresses that 'the economic development and migration in the south led to a higher degree of 'modernisation' and change in social relationships than in the rest of the country' (Tvedten 2011: 4).

At a national level, we observe that the average productivity of male- and female-headed households is only statistically different when maize/ha is used as the outcome variable—male-headed households being 24 per cent more productive on average. The average productivity in terms of yield/ha at the national level is actually higher among female-headed households despite not being statistically different from male-headed counterparts. However, Table 2 shows that this pattern is reversed when the sample is divided by quintiles of plot size. This division not only shows that agricultural productivity decreases with plot size, but also that male-headed households are consistently more productive at all quintiles. This suggests that the existence of an inverse-size productivity relationship might have a considerable influence on the gender gap. An inverse-size productivity relationship exits when farmers are more productive in smaller plots. This can be explained, among other reasons, by a more intensive use of inputs—the access to which is constrained—in smaller areas. Given that women are more concentrated in smaller plots (as shown in Table 1), this relationship might explain the overall higher average productivity among female-headed households observed at the national level in terms of yield/ha.

As expected, the mean differences in agricultural productivity between male- and female-headed households are not statistically significant in the southern region in contrast with the rest of the country. In the north and centre, male-headed households are on average 21 per cent more productive in terms of the gross value of the yield/ha and 26 per cent more productive in terms of the production

[8] See Yun (2005) for a proof.

of maize/ha.[9] In the southern region, even though the mean difference is not statistically significant, the average productivity of female-headed households in terms of yield/ha is actually higher than that of male-headed households.[10]

Looking at the aggregate decomposition of the productivity gaps that are statistically significant it can be observed that the endowment effect only explains a small portion of the existing gaps. For the centre and north of the country, differences in endowments only explain about 10 per cent of the gap in terms of yield/ha and 8 per cent in terms of maize/ha. At the national level, the endowment effect only accounts for 21 per cent of the gap observed in the productivity of maize. Thus, the gaps in productivity seem to be mostly driven by unexplained or structural effects. In addition to that, the unexplained or structural effects are also statistically significant, in contrast with the endowment effects.

The detailed decomposition of the endowment effects in the three cases in which the gender gap is statistically significant allows us to identify the observables with consistently strong and statistically significant contributions. Among the inputs, the amount of labour and the access to mechanical traction are both statistically significant across the board. The contribution of these covariates to the endowment effect varies between 94 and 283 per cent in the case of labour, and between 87 and 162 per cent in the case of mechanical traction. In addition to this, two other factors are positively associated with the gender gap in the three cases: the production of cash crops (between 50 and 125 per cent) and market participation (between 115 and 258 per cent). As one would expect, all these covariates reflect characteristics where male-headed households have an advantage as observed in the descriptive statistics.

Two additional points emerge from the decomposition of the endowment effects. First, the covariate identifying the 5th quintile of our indicator of wealth has a positive and statistically significant contribution to the gender gap in the three cases (between 51 and 156 per cent). This result is in accordance with the composition of the 5th quintile of wealth where 83 per cent of the households have a male head. Second, the 2nd, 4th and 5th plot size quintiles have statistically significant contributions in the three relevant decompositions (the reference group being the 1st quintile of plot size). Whereas being in the 2nd quintile is positively associated with the gender gap, belonging to the 4th or 5th quintiles contributes to its reduction. These results are understandable in the presence of a strong inverse-size-productivity relationship.[11] Overall, these coefficients support our previous

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[9] This pattern is also verified when analyzing the north and center individually. The gender gap is statistically significant in both regions for the two measures of productivity considered in this study. In terms of yield/ha, male-headed households are on average 26 percent more productive in the central part of the country and 14 percent more productive in the north. In terms of maize/ha, households with a male head are on average 28 percent more productive in the center and 17 percent more productive in the north.

[10] As in the case of the gender gap in terms of yield/ha at the national level, this pattern also fades out when the sample is divided by quintiles of plot size (see Table 2).

[11] As mentioned before, the average agricultural productivity of smallholders in Mozambique strictly decreases with plot size. As a consequence, these coefficients show the impact of the relative concentration of male- and female-headed households in each quintile of plot size on the gender gap, in comparison with the reference group. The descriptive statistics show that female-headed households are more concentrated in the first two quintiles than male-headed households and much less concentrated in the 4th and 5th (the difference is not statistically significant for the 3rd quintile). As follows, the higher concentration of female heads in the 2nd quintile must increase the gap while a higher share of male heads in the 4th and 5th quintiles must reduce it.

conclusion that the higher concentration of female-headed households in smaller plots translates into a reduced gender gap.

As introduced, the interpretation of the standard decomposition of the structural effect is not meaningful for categorical variables, which constitute the great majority of our covariates. Even so, Aguilar et al. (2014) state that this decomposition still allows us to identify 'the factors to which the productivity generating function is more sensitive' (Aguilar et al. 2014; p. 13). For the sake of a complete analysis, we will compare the results of the standard decomposition with the 'normalized' one to identify any common patterns between the two.

From Table 4 we can observe that very few variables present statistically significant coefficients across the three relevant decompositions, regardless of the methodology employed (standard or normalized). The coefficients associated with the access to pesticide are statistically significant (at the 5 and 10 per cent significance levels) and positive in the two decompositions computed for the centre-north using both the standard and normalized approaches. This result seems to indicate that male-headed households in that part of the country obtain a higher return from the use of pesticides, a fact that can be explained by factors such as their higher access to extension services. The only other coefficients that are statistically significant in more than one specification across both methodologies are the ones associated with the fourth and fifth quintiles of plot areas and non-farm income. Whereas non-farm income presents inconsistent coefficients[12], the effects associated with the last quintiles of plot size are associated with a reduction in the gender gap in the three decompositions deemed relevant in this section. The latter result is probably explained by the set of factors underlying the inverse-size productivity relationship, which are not the focus of the present study. Other factors, such as the use of fertilizers, animal traction, market participation or household size, also present statistically significant coefficients but these effects are not consistent across the different decompositions. Finally, the constant terms are statistically significant at the 1 per cent significance level and are by far the largest statistically significant coefficients in the three standard decompositions. However, these effects disappear, as expected, when the normalization is applied.

Overall, it was noticed that the structural effect accounts for most of the gender gap in agricultural productivity. Nonetheless, we could only find a limited number of explanatory variables with consistent effects. In the labour economics literature, the existence of a large and significant structural effect is generally interpreted as pure discrimination. However, unlike wage discrimination, differences in productivity are not driven by exogenous factors such as the decision of an employer to pay lower wages to women. For this reason, we believe that a number of factors that are not observable in the present dataset might explain the magnitude of the structural effect observed in this analysis. Several elements have been discussed in the literature, such as differences in physical strength, discrimination in the access to land in terms of soil quality, or even the amount of time spent on other activities (domestic or commercial) by female heads. A study by Marenya et al. (2015) on fertilizer use in Mozambique suggests that intra-household input, land, and crop output and income allocation have important implications for agricultural productivity. Unfortunately, the TIA data in use do not allow us to dwell on these factors at this stage.

[12] This variable shows a positive contribution to the gender gap of maize productivity at a national scale, while it seems to be reducing the gap in terms of yield/ha for the center-north.

6 Conclusions

The existence of sizeable gender gaps in agricultural productivity has been identified by the existing literature as one of the potential constraints to GDP growth, poverty reduction, or improved nutrition in Sub-Saharan Africa. In this paper, we study the gender gap in agricultural productivity for the case of Mozambique and seek to determine its main drivers.

Our results show that a gender divide exists in Mozambique, following a strong geographical pattern. While a significant gender gap favouring male-headed households is found for the centre-north of the country, this does not seem to be the case for the southern region. In the centre-north male-headed households are on average 20 per cent more productive than female-headed ones.

We also observe that female-headed households are disproportionately concentrated in relatively smaller plots. Given that a strong inverse-size-productivity relationship is in place, female-headed households end up being more productive (on average) than their male counterparts. In other words, the concentration of women in smaller plots is concealing the real dimension of the productivity gap. This result highlights the importance of further exploring the inverse-size-productivity relationship in Mozambique.

According to our results, the gender gap is mostly explained by structural factors, potentially including technical efficiency, pure discrimination, or other unobservable characteristics. The differences in endowments of male- and female-headed households only account for roughly 10 to 20 per cent of the gender productivity divide. Nonetheless, the so-called 'endowment effect' seems to be driven by factors for which male-headed households clearly have an advantage, such as access to labour, mechanical traction, markets or the production of cash crops. Hence, improving the access of female-headed households to these factors could have a small but potentially significant impact on the gender productivity gap in Mozambique.

Concerning the structural component of the divide, our analysis could only identify a limited number of explanatory variables with consistent effects. Furthermore, unlike discrimination in the labour market, differences in productivity cannot be explained by pure discrimination. The gender gap in Mozambique is likely to be driven by factors that are not observable in our data, such as physical strength, soil quality, or even cultural aspects such as the role of women within the household in different regions. Including at least some of these variables in future agricultural surveys could allow researchers to better identify the elements restraining the productivity of female-headed households compared to male-headed ones.

Overall, our analysis reveals the existence of a strong regional divide concerning the agricultural productivity gender gap in Mozambique. The fact that the southern region is substantially more developed with respect to many economic and social indicators compared to the centre-north suggests that general economic development could be associated with the reduction of the gender agricultural productivity gap. The available data does not allow us to establish a clear link between the two. However, the present study provides a solid set of elements to serve as a basis for further research.

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Tables

Table 1. Descriptive statistics

Variable	Country					South					Centre & North				
	All	Male	Female	Difference		All	Male	Female	Difference		All	Male	Female	Difference	
Gender†	0.74	1.00	0.00	_	_	0.64	1.00	0.00	_	_	0.77	1.00	0.00	_	_
Value of Yield/ha	11135	10998	11536	-538		16860	15251	19603	-4352		9977	10293	8930	1363	***
Maize/ha (kgs)	1035	1084	878	206	***	880	888	865	23		1066	1116	883	233	***
Inputs															
Labor [a]	3.23	3.56	2.28	1.29	***	2.71	3.02	2.17	0.85	***	3.35	3.66	2.31	1.35	***
Animal Traction†	0.11	0.11	0.11	0.00		0.37	0.40	0.33	0.07	***	0.05	0.06	0.04	0.02	***
Mechanical Traction†	0.36	0.42	0.17	0.25	***	0.13	0.15	0.08	0.07	***	0.41	0.47	0.21	0.27	***
Fertilizer†	0.04	0.04	0.02	0.02	***	0.04	0.04	0.03	0.01	***	0.04	0.04	0.02	0.02	***
Manure†	0.04	0.04	0.04	0.00		0.12	0.12	0.10	0.02	***	0.02	0.03	0.02	0.01	***
Pesticide†	0.06	0.06	0.03	0.03	***	0.04	0.04	0.03	0.02	***	0.06	0.07	0.03	0.03	***
Irrigation†	0.08	0.08	0.07	0.00		0.19	0.20	0.17	0.03	***	0.05	0.06	0.04	0.02	***
Household Head Characteristics															
Education	2.75	3.26	1.27	1.99	***	3.02	3.80	1.67	2.13	***	2.69	3.16	1.13	2.03	***
Technical Support															
Extension†	0.10	0.12	0.07	0.05	***	0.08	0.09	0.06	0.03	***	0.11	0.12	0.07	0.05	***
Association†	0.05	0.06	0.04	0.02	***	0.06	0.07	0.06	0.01		0.05	0.06	0.03	0.03	***
Cashcrops/Horticulture															
Practised Cash Crops†	0.24	0.27	0.16	0.12	***	0.11	0.11	0.10	0.01	*	0.27	0.30	0.18	0.13	***
Practised Horticulture†	0.42	0.42	0.41	0.01	**	0.51	0.52	0.50	0.02		0.40	0.40	0.37	0.03	***
Markets															
Market Participation†	0.47	0.51	0.37	0.14	***	0.21	0.22	0.20	0.02	*	0.53	0.56	0.43	0.13	***
Sold Fruit†	0.15	0.15	0.13	0.03	***	0.13	0.13	0.13	0.00		0.15	0.16	0.13	0.03	***
Information on Market Prices†	0.43	0.45	0.36	0.10	***	0.31	0.31	0.29	0.02		0.45	0.48	0.38	0.10	***
Household Characteristics															

Household Size	5.09	5.39	4.21	1.17	***	5.52	6.12	4.47	1.64	***	4.99	5.25	4.13	1.13	***
Child Dependency Ratio	0.40	0.40	0.39	0.02	***	0.34	0.35	0.34	0.01	**	0.41	0.41	0.40	0.01	**
Household Wealth/Assets															
Land Title†	0.02	0.02	0.02	0.00		0.05	0.06	0.04	0.01	**	0.01	0.01	0.01	0.00	
Wealth Q1† [b]	0.23	0.19	0.37	-0.18	***	0.12	0.08	0.19	-0.10	***	0.26	0.21	0.43	-0.22	***
Wealth Q2† [b]	0.17	0.17	0.19	-0.03	***	0.10	0.08	0.12	-0.04	***	0.19	0.18	0.22	-0.03	***
Wealth Q3† [b]	0.21	0.22	0.17	0.05	***	0.15	0.12	0.18	-0.06	***	0.22	0.24	0.17	0.07	***
Wealth Q4† [b]	0.19	0.21	0.14	0.07	***	0.21	0.21	0.21	0.00		0.18	0.21	0.11	0.09	***
Wealth Q5† [b]	0.20	0.22	0.13	0.09	***	0.42	0.50	0.29	0.21	***	0.15	0.17	0.07	0.09	***
Tropical Life Units	0.96	1.08	0.60	0.48	***	1.71	2.10	1.03	1.07	***	0.80	0.90	0.45	0.45	***
Non-Farm Income†	0.59	0.63	0.45	0.18	***	0.63	0.70	0.51	0.18	***	0.58	0.62	0.43	0.19	***
Plot Size															
Plot Area	1.45	1.56	1.12	0.44	***	1.24	1.36	1.02	0.35	***	1.49	1.59	1.15	0.44	***
Plot Area Q1†	0.21	0.18	0.29	-0.12	***	0.32	0.29	0.38	-0.08	***	0.18	0.16	0.26	-0.11	***
Plot Area Q2†	0.19	0.18	0.22	-0.04	***	0.20	0.19	0.22	-0.02	**	0.19	0.18	0.23	-0.05	***
Plot Area Q3†	0.20	0.20	0.20	0.00		0.16	0.17	0.16	0.01		0.21	0.21	0.22	-0.01	
Plot Area Q4†	0.20	0.21	0.17	0.05	***	0.15	0.16	0.13	0.02	***	0.21	0.22	0.18	0.05	***
Plot Area Q5†	0.20	0.23	0.12	0.11	***	0.16	0.19	0.11	0.08	***	0.21	0.24	0.12	0.12	***
Year															
2002†	0.22	0.23	0.21	0.01	**	0.22	0.24	0.19	0.05	***	0.22	0.22	0.22	0.00	
2005†	0.24	0.24	0.23	0.00		0.24	0.25	0.24	0.01		0.23	0.24	0.23	0.00	
2008†	0.26	0.27	0.25	0.02	***	0.26	0.25	0.26	-0.01		0.27	0.27	0.24	0.03	***
2012†	0.28	0.27	0.31	-0.04	***	0.28	0.27	0.31	-0.04	***	0.28	0.27	0.31	-0.04	***
Region															
North†	0.36	0.38	0.32	0.06	***	_	_	_	_		0.44	0.45	0.42	0.02	**
Centre†	0.46	0.47	0.43	0.04	***	_	_	_	_		_	_	_	_	
South†	0.18	0.15	0.25	-0.10	***	_	_	_	_		_	_	_	_	

Note: The results from a Wald test for the weighted mean difference between male and female managed plots are shown under difference. *** p<0.01, ** p<0.05; * p<0.1. † indicates dummy variable. Estimates are weighted. [a] This variable was built taking into account the age and main activity (agriculture or other) of the members of the household and whether the external workers were reported as full time or part time workers. [b] The quintiles of wealth derive from a wealth indicator built through the principal component analysis of a group of relevant variables namely, the quality of the walls and roof of the household, the possession of a motorcycle, truck, oil lamp, latrine, bicycle, radio or mechanical tools.

Source: authors’ calculations (based on the TIA/IAI national agricultural surveys from 2002, 2005, 2008, 2012).

Table 2. Productivity per Plot Area Quintile

Plot Area Q	Country					South					Centre and North				
	All	Male	Women	Difference		All	Male	Women	Difference		All	Male	Women	Difference	
						Mean Value of Yield per hectar									
Mean	11135	10998	11536	-538		16860	15252	19603	-4352		9977	10293	8930	1363	***
						Mean per Plot Area Quintile									
Q1	24607	26320	21701	4619		38046	37761	38395	-634		20141	23126	14465	8661	***
Q2	11081	11087	11066	22		13212	11593	15709	-4116		10606	10993	9574	1419	*
Q3	8367	8731	7318	1413	***	9542	9222	10115	-892		8171	8662	6630	2032	***
Q4	6609	6841	5741	1100	**	5342	5620	4773	846		6799	6993	5987	1006	
Q5	5893	6182	4220	1962	***	4559	4800	3873	926	*	6114	6377	4335	2041	***
						Mean Amount of Maize per hectar (Kgs)									
Mean	1035	1084	878	206	***	880	888	865	23		1066	1116	883	233	***
						Mean per Plot Area Quintile									
Q1	2014	2301	1506	795	***	1734	1830	1614	216		2135	2468	1441	1027	***
Q2	1111	1201	883	318	***	898	1006	727	279		1160	1239	937	302	***
Q3	943	1010	744	267	***	600	670	478	192	***	999	1056	811	245	***
Q4	776	819	617	201	***	433	453	391	62		826	863	671	192	***
Q5	726	761	522	240	***	370	366	381	-15		779	812	562	250	***

Note: Estimates are weighted. The results from a Wald test for the weighted mean difference between male and female managed plots are shown under difference. * p<0.1, ** p<0.05, *** p<0.01.

Source: authors' calculations (based on the TIA/IAI national agricultural surveys from 2002, 2005, 2008, 2012).

Table 3. Standard Oaxaca-Blinder Decomposition

Blinder-Oaxaca Linear Decomposition	Country				South				Centre and North			
Dependent Variable	Value of Yield/ha		Maize/ha		Value of Yield/ha		Maize/ha		Value of Yield/ha		Maize/ha	
Mean Male Value of Yield/ha	10,965***		1,084***		15,327***		888.9***		10,213***		1,116***	
	(411.7)		(32.96)		(1,868)		(78.86)		(358.3)		(36.33)	
Mean Female Value of Yield/ha	11,293***		878.2***		19,650***		865.4***		8,434***		882.5***	
	(1,048)		(32.82)		(3,904)		(95.34)		(366.5)		(30.04)	
Difference in Value of Yield/ha	-328.1		206.0***		-4,323		23.46		1,779***		233.2***	
	(1,095)		(43.44)		(4,263)		(113.1)		(459.3)		(43.35)	
Aggregate Decomposition												
Explained	-308.8		43.99		311.6		17.09		174.7		18.15	
	(450.9)		(32.43)		(1,324)		(82.24)		(322.3)		(37.95)	
Structural	-19.23		162.0***		-4,635		6.369		1,604***		215.1***	
	(1,246)		(59.14)		(4,827)		(147.8)		(479.9)		(64.83)	
Detailed Decomposition	Expl	Struct	Expl	Struct	Expl	Struct	Expl	Struct	Expl	Struct	Expl	Struct
Inputs												
Labor	120.5**	1,085	46.58***	51.92	-552.1	5,681	2.754	132.7	164.2***	18.40	51.38***	29.60
	(60.89)	(1,005)	(14.40)	(54.27)	(517.9)	(4,637)	(16.60)	(126.5)	(55.45)	(455.5)	(15.46)	(53.93)
Animal Traction	7.062	-245.6	0.131	24.50*	-256.2	-2,410	-12.95*	27.58	-25.60	1.134	2.463	5.622
	(17.06)	(612.9)	(0.430)	(14.63)	(275.9)	(2,956)	(7.523)	(59.45)	(19.32)	(59.26)	(2.530)	(6.827)
Mechanical Traction	209.0	-162.3	38.15***	10.21	-45.73	647.1	39.13	42.60	283.1*	-440.7	29.15**	13.69
	(163.7)	(345.5)	(14.41)	(26.91)	(215.2)	(812.4)	(24.48)	(63.47)	(159.2)	(311.5)	(13.50)	(25.35)
Fertilizer	68.71*	153.2	3.456	-5.507	-90.09	69.72	-15.94	-18.39	113.9***	115.8**	4.499*	-3.037
	(37.98)	(120.0)	(2.633)	(9.954)	(153.7)	(509.2)	(18.29)	(30.45)	(31.81)	(52.89)	(2.622)	(11.48)
Manure	30.51	-81.41	0.125	20.35*	399.4	115.6	-0.627	108.0*	-2.957	0.314	0.841	2.771
	(32.96)	(510.0)	(0.425)	(11.29)	(301.4)	(2,323)	(5.995)	(61.76)	(14.10)	(35.46)	(1.713)	(5.413)

Pesticide	69.95*	192.3	3.320	10.56	-70.77	431.1	18.85	21.93	79.62***	129.0**	1.302	13.00*
	(37.59)	(117.9)	(4.437)	(7.879)	(172.4)	(632.0)	(21.74)	(33.95)	(30.62)	(56.99)	(3.630)	(7.558)
Irrigation	12.32	-253.3	0.000852	-8.267	102.0	-1,520	7.466	-66.53	-4.024	-65.07	-1.283	2.599
	(16.11)	(340.6)	(0.237)	(16.38)	(112.7)	(1,491)	(6.274)	(77.79)	(14.44)	(83.10)	(1.546)	(9.907)
Household Head Characteristics												
Education	1,035**	-1,410	5.022	-73.92	3,080*	-5,825	42.49	-225.6	519.0*	274.9	-4.999	-10.18
	(421.9)	(1,428)	(18.28)	(46.96)	(1,816)	(6,012)	(64.28)	(173.2)	(307.1)	(308.9)	(17.04)	(24.93)
Technical Support												
Extension	123.3	182.6	2.406	-14.19	533.2	1,549	7.686	15.05	18.70	-38.09	0.972	-16.03
	(91.79)	(234.2)	(4.101)	(14.01)	(445.6)	(1,444)	(12.82)	(47.07)	(23.60)	(86.68)	(3.782)	(14.30)
Association	-5.965	7.790	1.834	-8.133	-40.35	-74.32	2.763	-3.573	14.20	-17.89	0.494	-5.830
	(24.81)	(134.5)	(1.679)	(12.27)	(64.34)	(644.6)	(4.047)	(46.38)	(17.24)	(52.12)	(1.760)	(9.028)
Cashcrops/Horticu lture												
Practised Cash Crops	46.61	-121.1	22.01***	22.22	-56.51	-493.1	6.379	44.09	105.1*	56.94	22.68***	14.53
	(72.81)	(338.2)	(8.304)	(23.05)	(88.35)	(1,141)	(7.042)	(50.00)	(56.83)	(229.2)	(7.968)	(25.99)
Practised Horticulture	-9.129	1,789**	-0.696	13.45	-190.4	5,852	1.137	8.213	9.333	481.0	1.629	4.100
	(11.34)	(782.0)	(2.430)	(38.32)	(143.1)	(3,731)	(2.718)	(103.2)	(16.97)	(417.1)	(3.106)	(37.70)
Markets												
Market Participation	828.5***	-349.6	50.70***	76.43**	448.6	918.5	8.821	57.19	436.9***	290.2	46.83***	75.80
	(136.3)	(933.5)	(8.811)	(38.97)	(315.4)	(2,214)	(7.368)	(64.50)	(69.15)	(370.2)	(8.833)	(46.85)
Sold Fruit	125.7**	-375.4	3.186	34.49*	-12.68	-593.4	-0.338	17.92	104.8***	-89.01	4.985	30.74
	(49.79)	(556.9)	(2.440)	(20.26)	(170.4)	(2,308)	(2.008)	(42.09)	(35.97)	(203.3)	(3.402)	(21.51)
Information on Market Prices	-153.4*	683.1	-1.455	-30.15	-207.0	1,989	0.233	-7.533	-81.56	234.8	-2.134	-33.19
	(85.62)	(812.3)	(4.213)	(34.80)	(184.3)	(3,163)	(1.884)	(61.85)	(61.98)	(414.9)	(4.611)	(38.64)
Household Characteristics												
Household Size	611.7**	-5,571	14.66	-225.4*	2,506	-21,160	58.00	-591.1*	446.8***	1,349	5.162	-49.61

	(277.5)	(4,197)	(13.50)	(133.7)	(1,549)	(14,313)	(43.43)	(313.2)	(166.2)	(1,134)	(14.45)	(98.84)
Child Dependency Ratio	-112.8**	379.4	0.0991	93.46	-266.0	1,333	-4.751	128.0	-50.05	-1,812	0.692	55.54
	(48.95)	(1,878)	(2.105)	(87.85)	(204.5)	(6,271)	(6.889)	(197.3)	(33.52)	(1,181)	(1.136)	(87.63)
Household Wealth/Assets												
Land Title	0.0750	130.0	-0.903	1.312	-8.516	341.2	17.14	-21.67	4.325	21.18	0.658	9.755
	(5.297)	(154.6)	(2.766)	(17.78)	(88.95)	(727.3)	(12.46)	(60.02)	(7.911)	(48.83)	(1.910)	(11.83)
Wealth Q2	-22.59	-169.8	-0.465	-22.10	111.2	-193.0	3.017	21.43	-28.81	-249.4	-1.135	-34.19
	(16.28)	(237.5)	(1.320)	(23.68)	(141.2)	(725.8)	(6.335)	(33.11)	(18.85)	(232.2)	(1.951)	(27.72)
Wealth Q3	107.0*	-1,068	1.856	-4.662	-523.6	-4,150	7.296	44.36	64.98	5.075	4.292	-21.60
	(62.52)	(781.9)	(2.531)	(23.49)	(531.6)	(2,601)	(9.695)	(44.76)	(48.99)	(228.2)	(4.252)	(24.20)
Wealth Q4	103.7	-181.2	8.983	-8.935	3.032	-1,396	-0.213	36.04	106.1	159.9	16.33*	-18.61
	(70.86)	(580.6)	(6.173)	(24.46)	(32.56)	(2,388)	(1.600)	(76.42)	(66.77)	(156.4)	(8.980)	(21.66)
Wealth Q5	207.4*	823.8	22.49***	-36.77	-161.1	4,212	18.28	58.19	263.7***	-219.6	28.23***	-43.04**
	(120.5)	(508.2)	(8.681)	(26.24)	(868.5)	(3,451)	(34.89)	(111.1)	(94.30)	(192.7)	(10.67)	(20.77)
Tropical Life Units	-8.322	419.8*	4.212	3.030	-184.1	1,533*	10.75	73.84***	64.56*	1.771	1.027	-22.08*
	(33.79)	(243.0)	(3.108)	(10.36)	(138.3)	(923.8)	(8.980)	(25.79)	(35.84)	(85.63)	(4.458)	(11.27)
Non-Farm Income	34.59	158.2	8.162	74.43*	-395.5	4,522	-7.324	62.40	130.4	-911.0**	11.50	57.73
	(124.0)	(1,048)	(8.154)	(39.27)	(630.5)	(4,558)	(20.73)	(122.5)	(80.29)	(400.7)	(9.420)	(39.66)
Plot Size												
Plot Area Q2	634.3***	-1,101	47.81***	-105.4**	498.5	-1,007	17.14	4.404	513.8***	-1,760***	54.63***	-146.7**
	(145.5)	(901.7)	(12.05)	(52.13)	(377.6)	(2,815)	(13.84)	(80.30)	(128.7)	(543.8)	(15.76)	(63.68)
Plot Area Q3	64.30	-941.1	18.66	-126.6**	-170.7	-300.4	1.679	-33.79	165.5	-1,769***	32.13*	-172.5**
	(156.2)	(763.9)	(13.27)	(55.72)	(382.1)	(1,963)	(16.68)	(49.61)	(151.9)	(527.9)	(17.21)	(74.21)
Plot Area Q4	-928.7***	-922.9	-57.48***	-143.8***	-892.4**	131.4	-37.31**	-51.09	-704.5***	-1,871***	-48.22**	-187.7***
	(201.7)	(711.8)	(18.07)	(53.55)	(419.4)	(1,667)	(17.65)	(46.03)	(195.1)	(504.2)	(22.91)	(71.27)
Plot Area Q5	-2,679***	-778.9	-215.8***	-135.2***	-2,803***	-418.3	-124.1***	-98.85**	-2,312***	-1,477***	-227.2***	-161.3***
	(270.2)	(612.6)	(25.64)	(48.67)	(579.2)	(1,379)	(24.95)	(50.07)	(258.2)	(410.8)	(33.44)	(62.18)
Year												
2005	0.271	-431.7	-6.590	-56.68**	82.89	-2,416	-11.17	3.707	-3.341	223.7	-3.842	-75.32**

	(3.897)	(799.8)	(4.015)	(27.50)	(152.5)	(3,721)	(7.643)	(42.26)	(17.88)	(243.8)	(4.444)	(32.00)
2008	43.55	-149.7	-7.387*	-79.37***	-41.63	-1,206	1.588	-102.4	25.72	262.6	-14.40**	-66.80**
	(30.19)	(504.1)	(4.116)	(28.09)	(84.15)	(2,014)	(3.551)	(72.97)	(24.90)	(243.8)	(5.842)	(27.72)
2012	-270.9***	117.5	-4.028	-83.07**	-484.7	-881.0	-40.79**	-107.5	-229.3***	825.9*	0.292	-48.82
	(88.61)	(994.3)	(4.256)	(35.87)	(319.5)	(3,162)	(16.68)	(82.52)	(80.41)	(448.0)	(4.294)	(35.91)
Region												
North	-378.2***	2,099	19.25***	34.42								
	(137.9)	(1,558)	(6.300)	(45.82)								
Centre	-224.1**	2,976	15.67**	111.1					-18.41	559.7	-0.784	89.68*
	(103.7)	(1,873)	(6.422)	(69.99)					(16.91)	(559.8)	(1.356)	(51.86)
Constant Term		3,099		748.4***		10,082		426.5		7,313***		926.5***
		(5,699)		(271.4)		(11,410)		(399.7)		(2,278)		(312.8)
Observations	22170		17831		6422		4780		15748		13051	

Note: Clustered standard errors in parentheses. *** p<0.01, ** p<0.05; * p<0.1.

Source: authors' calculations (based on the TIA/IAI national agricultural surveys from 2002, 2005, 2008, 2012).

Table 4.Normalized Oaxaca-Blinder Decomposition

Blinder-Oaxaca Linear Decomposition	Country		South		Centre and North	
Dependent Variable	Value of Yield/ha	Maize/ha	Value of Yield/ha	Maize/ha	Value of Yield/ha	Maize/ha
Mean Male Value of Yield/ha	10,965***	1,084***	15,327***	888.9***	10,213***	1,116***
	(411.7)	(32.96)	(1,868)	(78.86)	(358.3)	(36.33)
Mean Female Value of Yield/ha	11,293***	878.2***	19,650***	865.4***	8,434***	882.5***
	(1,048)	(32.82)	(3,904)	(95.34)	(366.5)	(30.04)
Difference in Value of Yield/ha	-328.1	206.0***	-4,323	23.46	1,779***	233.2***
	(1,095)	(43.44)	(4,263)	(113.1)	(459.3)	(43.35)
Aggregate Decomposition						
Explained	-308.8	43.99	311.6	17.09	174.7	18.15
	(450.9)	(32.43)	(1,324)	(82.24)	(322.3)	(37.95)
Structural	-19.23	162.0***	-4,635	6.369	1,604***	215.1***
	(1,246)	(59.14)	(4,827)	(147.8)	(479.9)	(64.83)
Detailed Decomposition	Structural	Structural	Structural	Structural	Structural	Structural
Inputs						
Labor	1,085	51.92	5,681	132.7	18.40	29.60
	(1,005)	(54.27)	(4,637)	(126.5)	(455.5)	(53.93)
No Animal Traction	897.8	-84.53*	1,951	-22.40	-34.99	-50.41
	(2,244)	(50.26)	(2,364)	(46.12)	(634.2)	(61.85)
Animal Traction	-122.8	12.25*	-1,205	13.79	0.567	2.811
	(306.5)	(7.315)	(1,478)	(29.72)	(29.63)	(3.413)
No Mechanical Traction	217.1	-15.58	-3,079	-166.5	658.4	-16.63
	(644.6)	(41.52)	(3,642)	(245.8)	(455.1)	(32.88)
Mechanical Traction	-81.13	5.105	323.6	21.30	-220.4	6.845
	(172.7)	(13.46)	(406.2)	(31.73)	(155.8)	(12.68)
No Fertilizer	-2,700	79.75	-1,140	347.6	-2,179**	42.30
	(2,053)	(155.1)	(7,887)	(577.4)	(935.8)	(168.8)
Fertilizer	76.58	-2.753	34.86	-9.195	57.88**	-1.518
	(59.98)	(4.977)	(254.6)	(15.23)	(26.44)	(5.740)
No Manure	1,009	-229.4*	-546.2	-417.6*	0.446	-62.19
	(6,351)	(126.0)	(9,524)	(237.3)	(977.5)	(121.9)
Manure	-40.71	10.17*	57.80	54.02*	0.157	1.385
	(255.0)	(5.644)	(1,162)	(30.88)	(17.73)	(2.706)
No Pesticide	-2,429	-128.4	-6,628	-381.7	-1,581**	-147.4*
	(1,537)	(95.37)	(9,366)	(588.8)	(653.1)	(81.96)
Pesticide	96.17	5.282	215.5	10.96	64.50**	6.500*
	(58.93)	(3.939)	(316.0)	(16.97)	(28.49)	(3.779)
No Irrigation	1,579	46.14	3,485	144.2	742.3	-23.52
	(2,118)	(91.10)	(3,374)	(167.2)	(928.1)	(90.25)
Irrigation	-126.6	-4.134	-759.9	-33.26	-32.53	1.300
	(170.3)	(8.189)	(745.3)	(38.90)	(41.55)	(4.953)
Household Head Characteristics						
Education	-1,410	-73.92	-5,825	-225.6	274.9	-10.18
	(1,428)	(46.96)	(6,012)	(173.2)	(308.9)	(24.93)
Technical Support						
No Extension	-1,012	76.21	-9,538	-95.69	218.1	82.82

	(1,299)	(74.51)	(8,739)	(285.2)	(468.8)	(73.42)
Extension	91.30	-7.093	774.3	7.527	-19.04	-8.017
	(117.1)	(7.004)	(721.8)	(23.54)	(43.34)	(7.149)
No Association	-52.50	78.33	541.0	23.08	238.3	67.57
	(1,429)	(117.8)	(4,593)	(294.8)	(666.3)	(104.5)
Association	3.895	-4.067	-37.16	-1.787	-8.946	-2.915
	(67.24)	(6.134)	(322.3)	(23.19)	(26.06)	(4.514)
Cashcrops/Horticulture						
Did not Practice Cash Crops	208.7	-42.33	1,897	-172.5	-86.50	-23.19
	(708.0)	(41.27)	(4,600)	(192.4)	(414.5)	(40.04)
Practised Cash Crops	-60.56	11.11	-246.6	22.05	28.47	7.265
	(169.1)	(11.52)	(570.4)	(25.00)	(114.6)	(12.99)
Did not Practice Horticulture	-1,136**	-7.007	-2,353	-2.504	-347.9	-2.411
	(496.8)	(19.98)	(1,500)	(36.23)	(302.8)	(21.90)
Practised Horticulture	894.3**	6.724	2,926	4.107	240.5	2.050
	(391.0)	(19.16)	(1,865)	(51.61)	(208.6)	(18.85)
Markets						
No Market Participation	238.6	-43.86*	-1,630	-92.42	-172.3	-34.22
	(650.5)	(23.03)	(3,834)	(105.0)	(208.8)	(21.73)
Market Participation	-174.8	38.21**	459.2	28.59	145.1	37.90
	(466.7)	(19.49)	(1,107)	(32.25)	(185.1)	(23.42)
Did not Sell Fruit	1,147	-99.89*	1,783	-51.98	271.5	-90.11
	(1,717)	(58.72)	(6,936)	(122.5)	(637.7)	(62.85)
Sold Fruit	-187.7	17.24*	-296.7	8.962	-44.51	15.37
	(278.5)	(10.13)	(1,154)	(21.04)	(101.7)	(10.76)
No Information on Market Prices	-533.2	21.67	-2,310	7.802	-166.5	22.00
	(638.0)	(25.06)	(3,683)	(64.67)	(293.8)	(25.49)
Information on Market Prices	341.5	-15.08	994.4	-3.767	117.4	-16.60
	(406.1)	(17.40)	(1,582)	(30.93)	(207.5)	(19.32)
Household Characteristics						
Household Size	-5,571	-225.4*	-21,160	-591.1*	1,349	-49.61
	(4,197)	(133.7)	(14,313)	(313.2)	(1,134)	(98.84)
Child Dependency Ratio	379.4	93.46	1,333	128.0	-1,812	55.54
	(1,878)	(87.85)	(6,271)	(197.3)	(1,181)	(87.63)
Household Wealth/Assets						
No Land Title	-3,424	-32.50	-3,287	194.3	-1,022	-433.7
	(4,057)	(439.6)	(7,041)	(543.8)	(2,371)	(520.2)
Land Title	64.99	0.656	170.6	-10.83	10.59	4.877
	(77.30)	(8.888)	(363.6)	(30.01)	(24.42)	(5.916)
Wealth Q1	57.28	25.77	512.1	-24.64	163.4	60.48*
	(346.8)	(28.72)	(694.6)	(31.54)	(303.7)	(36.12)
Wealth Q2	-113.0	-6.175	222.5	3.270	-155.3	0.0144
	(196.4)	(13.17)	(459.7)	(17.33)	(186.2)	(16.17)
Wealth Q3	-990.0	12.27	-3,532	17.83	94.05	10.74
	(791.4)	(12.66)	(2,461)	(21.50)	(179.9)	(13.96)
Wealth Q4	-105.4	6.245	-516.4	0.950	229.4**	6.779
	(487.0)	(15.39)	(1,893)	(44.22)	(108.1)	(13.22)
Wealth Q5	902.9**	-22.83	6,036**	-1.967	-169.7	-25.48*

	(459.8)	(17.54)	(2,923)	(64.98)	(140.6)	(13.68)
Tropical Life Units	419.8*	3.030	1,533*	73.84***	1.771	-22.08*
	(243.0)	(10.36)	(923.8)	(25.79)	(85.63)	(11.27)
Non-Farm Income	158.2	74.43*	4,522	62.40	-911.0**	57.73
	(1,048)	(39.27)	(4,558)	(122.5)	(400.7)	(39.66)
Plot Size						
Plot Area Q1	895.7	92.81**	653.9	63.91	1,455***	99.08**
	(670.2)	(36.61)	(2,462)	(58.15)	(405.6)	(39.60)
Plot Area Q2	-267.2	-3.714	-575.8	51.61	-269.1	-19.58
	(383.0)	(17.63)	(1,365)	(55.10)	(199.2)	(18.04)
Plot Area Q3	-130.5	-14.68	17.90	6.807	-239.1*	-24.16
	(190.3)	(14.90)	(658.2)	(20.90)	(143.3)	(19.03)
Plot Area Q4	-182.1	-37.00***	396.2	-14.82	-471.2***	-45.30***
	(182.6)	(13.59)	(493.9)	(20.81)	(156.0)	(17.07)
Plot Area Q5	-149.6	-41.63***	-201.3	-63.35**	-336.5***	-40.93**
	(169.1)	(13.69)	(415.9)	(24.84)	(117.9)	(16.43)
Year						
2002	118.1	48.19***	970.8	40.07	-286.3*	44.92**
	(372.5)	(17.38)	(1,438)	(35.62)	(160.7)	(18.91)
2005	-304.0	-9.577	-1,302	39.46	-75.68	-30.88*
	(600.0)	(15.17)	(2,675)	(24.70)	(186.9)	(17.72)
2008	-42.92	-25.67*	-102.7	-49.30	24.11	-20.98
	(374.2)	(15.12)	(1,252)	(37.16)	(162.1)	(14.93)
2012	278.0	-19.64	318.5	-56.94	444.2	9.650
	(653.2)	(20.61)	(2,129)	(50.89)	(312.1)	(19.79)
Region						
North	666.1	-3.692			-204.0	-31.85*
	(606.0)	(18.75)			(203.7)	(18.45)
Centre	1,035*	58.29*			279.9	44.84*
	(599.8)	(31.09)			(279.9)	(25.93)
South	-926.4	-24.14				
	(631.6)	(19.94)				
Constant Term	9,392	511.4	23,827	987.0	5,322*	728.5
	(5,795)	(421.2)	(16,103)	(838.8)	(2,891)	(528.5)
Observations	22170	17831	6422	4780	15748	13051

Note: Clustered standard errors in parentheses. *** p<0.01, ** p<0.05; * p<0.1.

Source: authors' calculations (based on the TIA/IAI national agricultural surveys from 2002, 2005, 2008, 2012).