Policy Research Working Paper 6381

Caught in a Productivity Trap

A Distributional Perspective on Gender Differences in Malawian Agriculture

Talip Kilic
Amparo Palacios-Lopez
Markus Goldstein

The World Bank
Development Research Group
Poverty and Inequality Team
March 2013

Abstract

In targeting poverty gains, sub-Saharan African governments have emphasized the alleviation of gender differences in agricultural productivity. The empirical studies on the gender gap, however, have frequently used data that were limited regarding geographic and topical coverage, and/or details on intra-household dynamics. The study provides a nationally-representative analysis of the gender gap in Malawi, and decomposes it, for the first time, at the mean and at selected points of the agricultural productivity distribution into (i) a portion driven by gender differences in levels of observable attributes (the endowment effect), and (ii) a portion driven by gender differences in returns to the same set of observables (the structure effect). Sequentially, the authors unpack the relative contributions of different factors towards the gender gap, and suggest future research priorities to inform policy interventions. The authors find that while female-managed plots are, on average, 25 percent less productive, 82 percent of this differential is explained by differences in endowments, mainly due to high-value crop cultivation and levels of household adult male labor inputs. The factors driving the structure effect include child dependency ratio and effectiveness of household adult male labor and inorganic fertilizer. The gender gap increases across the productivity distribution, ranging from 22 percent at the 10^{th} percentile to 37 percent at the 90th percentile. While it is explained predominantly by the endowment effect in the first half of the distribution, the contribution of the structure effect towards the gender gap increases steadily above the median, standing at 34 percent at the 90^{th} percentile.

This paper is a product of the Poverty and Inequality Team, Development Research Group. It is part of a larger effort by the World Bank to provide open access to its research and make a contribution to development policy discussions around the world. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The author may be contacted at tkilic@worldbank.org.

Produced by the Research Support Team

Caught in a Productivity Trap: A Distributional Perspective on Gender Differences in Malawian Agriculture[1]

Talip Kilic[2], Amparo Palacios-Lopez[3], and Markus Goldstein[4]

Keywords: Gender, Agriculture, Productivity, Decomposition Methods, sub-Saharan Africa, Malawi.
JEL Classification: C21, J16, Q12.
Sector Boards: Agriculture and Rural Development (ARD), Gender and Development (GEN).

[1] This study is the first output of a research program on Gender and Agriculture in sub-Saharan Africa that is led by the World Bank Living Standards Measurement Study (LSMS) team, and is funded by the International Fund for Agricultural Development (IFAD) and the World Bank Research Support Budget. The authors would like to thank Solomon Asfaw, Hans Binswanger, Calogero Carletto, Asif Islam, Donald Larson, Ramón López, Paul Winters, Benjamin Wood, the seminar participants at the American University (Washington, DC), and the participants at the Fourth Wye City Group Conference on Statistics on Rural Development and Agriculture Household Income (Rio de Janerio, Brazil) for their comments on earlier versions of the paper. The Appendix including the results from the sensitivity analysis referenced in Sections 5.3 and 7.2 are available upon request from the authors or could be downloaded at http://tinyurl.com/mwgenderandagriculture.
[2] Development Research Group, The World Bank. Corresponding author: tkilic@worldbank.org.
[3] PhD Candidate, Department of Agricultural and Resource Economics, The University of Maryland, College Park.
[4] Development Research Group and the Africa Region, The World Bank.

"[C]hildren shrieking at play; and women bent double - most with infants slung on their backs - hoeing the corn and beans; and the men sitting in the shade stupefying themselves on chibuku, the local beer, or kachasu, the local gin."

Paul Theroux, Dark Star Safari: Overland from Cairo to Cape Town (2002)

"While a great deal has been learned about what works and what does not when it comes to promoting greater gender equality, the truth remains that progress is often held back by the lack of data or adequate solutions to the most 'sticky' problems."

The World Bank World Development Report 2012 *Gender Equality and Development*

1. INTRODUCTION

Globally, 1.4 billion people, or one quarter of the population of the developing world, live in extreme poverty, and an additional 1.2 billion live in moderate poverty. The analysis of regional contributions to global poverty indicates that although sub-Saharan Africa represents only 12 percent of the world population, it accounts for 27 percent of the global poor, and that poverty in sub-Saharan Africa is being reduced at a much slower pace than elsewhere (Chen and Ravallion, 2008).[5] Aggregate agricultural growth has been documented to bring disproportionate gains to the poorest in the developing world.[6] In sub-Saharan Africa, nearly 75 percent of the extreme poor reside in rural areas, and 91 percent of the rural extreme poor are estimated to participate in agriculture. As smallholder agriculture is the predominant form of farm organization in the region (FAO, 2009), smallholder agricultural productivity growth has been identified as a key driver of poverty reduction and increased food security.[7] In targeting sustainable poverty gains through smallholder-based agricultural growth, national development plans across sub-Saharan Africa have emphasized the reduction of gender differences in agricultural productivity. Most recently, FAO (2011) asserted that if female farmers had the same access to productive resources as men, they could increase yields by 20 to 30 percent, which could increase total agricultural output in developing countries by 2.5 to 4 percent and lift 100 to 150 million people out of hunger. Increased productivity among female farmers is also often argued to result in double-barreled payoff: (i) poverty alleviation through positive impact on overall smallholder productivity growth, and (ii) improved development outcomes for the next generation.[8]

[5] The poverty rate in sub-Saharan Africa is estimated to have declined only 3 percentage points, from 54 to 51 percent, throughout the period of 1985-2005.
[6] Ligon and Sadoulet (2008) document that a 1 percent rise in agricultural GDP results in 6 percent income growth for the lowest income decile of the population.
[7] Irz et al. (2001) estimate that for every 10 percent increase in farm yields, there has been a 7 percent reduction in poverty in sub-Saharan Africa.
[8] See WB (2011), and Doepke and Tertilt (2011) for a review.

Although the estimates of gender differences in agricultural productivity (henceforth referred to as the gender gap)[9] across sub-Saharan Africa range widely from 4 to 40 percent, the majority cluster around 20 to 30 percent. The studies that compare productivity outcomes on female- vs. male-managed plots across and within households provide further support for the presence of systematic and persistent gender differences in agricultural productivity in the region (Akresh, 2005; Alene et al., 2008; Gilbert et al., 2002; Goldstein and Udry, 2008; Moock 1976; Peterman et al., 2011; Oladeebo and Fajuyigbe, 2007; Quisumbing et al., 2001; Saito et al., 1994; Tiruneh et al., 2001; Udry, 1996; Vargas Hill and Vigneri, 2011). The major reasons for the observed gender gap have been identified as gender differences in (i) access to and use of agricultural inputs, (ii) tenure security and related investments in land and improved technologies, (iii) market and credit access, (iv) human and physical capital, and (v) informal institutional constraints affecting farm/plot management and marketing of agricultural produce.[10] Regardless of whether the comparisons are made across or within households, the common thread across the relevant literature is that the gender gap disappears or diminishes significantly once the researcher controls for the factors discussed above.

Despite what could be perceived as a well-established evidence base on the extent and proximate causes of the gender gap across sub-Saharan Africa, the overwhelming majority of empirical studies on the topic have used data from small-scale surveys that were limited in terms of geographic coverage, topic, or attention to intra-household dynamics (or, in some cases, all three). With the exception of Akresh (2005), none of the above-referenced papers rely on nationally-representative survey data. Dearth of nationally-representative, methodologically-sound data collected in heterogeneous settings across sub-Saharan Africa has in turn inhibited the computation of externally-valid, rigorous estimates. Our study seeks to start filling this gap by providing a nationally-representative analysis of the gender gap in Malawi, using a different econometric approach than existing studies.

Our econometric approach is underlined by the use of an identification strategy that has been utilized extensively in labor economics since the seminal studies of Oaxaca (1973) and Blinder (1973), most notably in the analyses of the gender wage gap, union wage gap, and growing wage inequality. Specifically, we decompose the average difference in agricultural productivity between male-managed and female-managed plots into (i) the portion that is driven by gender differences in levels of observable attributes (i.e. *the endowment effect*), and (ii) the portion that is driven by gender differences in returns to the same set of observables (i.e. *the structure effect*). To our knowledge, this is the first time this method has been applied to understanding the gender gap.

[9] Agricultural productivity is commonly proxied by major crop production quantity per hectare or gross value of crop output/profit per hectare.
[10] Cultural roles that are assigned to males and females regarding domestic duties and those that may underlie the gender segregation in crop production (i.e. staple vs. cash crop cultivation, high-yielding vs. low-yielding variety cultivation, etc.) could be thought of as informal institutional constraints.

Complementing this aggregate decomposition analysis, we provide a detailed decomposition of the mean gender gap, identifying the contribution of each observable covariate towards the endowment and structure effects. In contrast with the available microeconomic evidence, the detailed decomposition documents, within a partial-equilibrium framework, the relative quantitative importance of each factor in explaining the mean gender differential. This in turn facilitates further analysis to identify the causes of differences in key factors contributing to the gender gap so that the emerging insights could inform the design of policy interventions addressing the gender gap at its roots.[11]

The second contribution of our study relates to the application of the decomposition methodology to distributional statistics beyond the mean through the use of recentered influence function (RIF) regressions. Since key contributors towards the gender gap might differ across farmer subpopulations of varying productivity levels, the RIF decomposition is a useful tool for tracing out the heterogeneity in constraints faced by farmers with different gender and productivity profiles, and thus, tailoring better targeted policies that are underlined by analyses that move beyond the "average" male vs. female farmer. Towards this end, we carry out (i) the aggregate decomposition of the gender gap at each decile of the agricultural productivity distribution, and (ii) the detailed decomposition of the gender gap at the 10^{th}, 50^{th}, and 90^{th} percentiles. The paper also discusses the changes in the shares of endowment and structure effects as part of the aggregate decomposition, and the variations in the contributions of key factors towards the endowment and structure effects at selected percentiles.

Finally, the multi-topic and national-representative nature of our household survey data represents the third contribution to the literature on the gender gap in sub-Saharan Africa. The availability of geo-referenced household and agricultural plot locations also allows us to create synergies with geographic information system (GIS) data for the purpose of incorporating relevant geospatial variables into the modelling efforts.

There are five key findings from our study. First, on average, female-managed plots in Malawi are 25 percent less productive than those that are managed by males. Second, 82 percent of the mean gender gap is explained by the differences in observable covariates, i.e. the endowment effect. The direct pay-off to addressing market and institutional failures that affect men and women differentially is economically significant: ensuring that female plot managers have similar years of schooling and apply similar levels of non-labor agricultural inputs, including inorganic fertilizer, pesticides/herbicides, and improved and/or export crop varieties could reduce the mean gender gap by 50 percent. Deficiencies on female-managed plots regarding household adult male labor input and access to agricultural implements are other key

[11] For instance, if the researcher confirms that female managers, on average, have access to less inorganic fertilizer, and that the gender differences in inorganic fertilizer application is a key contributor towards the gender gap, it becomes crucial to understand why female managers have access to less inorganic fertilizer so that the policy interventions could target the underlying causes of this phenomenon.

factors exacerbating the gender gap. Third, the remaining 18 percent of the mean gender gap is mostly explained by gender differences in *returns* to (i) household adult male labor input and inorganic fertilizer application, which have significantly lower positive effects on the productivity of female-managed plots, and (ii) the child dependency ratio, which has a highly significant and negative effect on the productivity of female-managed plots, in contrast to no effect on the productivity of male-managed plots. Fourth, the gender gap increases significantly across the agricultural productivity distribution: the differential stands at 22 and 37 percent at the 10^{th} and 90^{th} percentile, respectively. Finally, we find that the gender gap is explained predominantly by the endowment effect in the first half of the agricultural productivity distribution, with the endowment effect still explaining close to 90 percent of the gender gap at the median. Above the median, however, the contribution of the endowment effect towards the gender gap declines steadily such that the structure effect culminates in explaining 34 percent of the gender gap at the 90^{th} percentile.

The rest of the paper is organized as follows. Section 2 presents a review of the evidence on the gender gap in sub-Saharan Africa. Section 3 provides an overview of the Malawian context, and describes the data. Sections 4 and 5 present the mean decomposition methodology and the results from the mean decomposition, respectively. Likewise, Sections 6 and 7 present the RIF decomposition methodology and the results from the RIF decomposition, respectively. Section 8 offers concluding remarks and expands on the policy implications of our findings.

2. GENDER DIFFERENCES IN AGRICULTURAL PRODUCTIVITY IN SUB-SAHARAN AFRICA : REVIEW OF EVIDENCE

The studies that investigate the gender gap in sub-Saharan Africa are quite heterogeneous in terms of the type of data and the estimation strategies that they use. The existing literature broadly features two strands. The first strand is composed of studies that conduct their analyses at the household-level and do not link plot-level outcomes to the identity of the managers and/or owners within study households. The second strand is composed of a handful of empirical studies that use plot-level data linked to individual managers within study households. Across these strands, the relevance and applicability of the results for policy have been limited due to shortcomings in terms of questionnaire design, empirical methodology, and/or sample representativeness. "[T]he inconclusiveness of gender research due to either methodological or data limitations obscures the policy and programmatic recommendations that emerge from gender productivity analysis, and do not enable us to ascertain whether gender matters in producing evidence-based agricultural policy" (Peterman et al. 2011, pp. 1486).

The first strand of the literature encompasses the overwhelming majority of the empirical studies on the topic. These studies generally use the gender of the head of household as the main explanatory variable to identify the gender gap. The common assumptions of these research efforts are that the members of a given household do not necessarily differ in their sex, age, productive capacity and/or personality profiles; that information is shared symmetrically between cooperative individuals; and that differences in the quantity and quality of land and non-land inputs used by different individuals within or across study households are negligible (Schultz, 2001; Peterman et al., 2011). The extent to which these assumptions are valid in a given sub-Saharan African setting depends on (i) the complexity of familial structures, including monogamous, polygamous, skipped-generation, and multi-generation households (Peterman et al., 2011), and (ii) the persistence of rights and obligations that affect men and women differently and that are underscored by biological differences, social and religious norms, and customs that jointly dictate the division of labor, land, and proceeds from production units (Saito et al., 1994).

A considerable majority of the studies of the second strand of the literature on the gender gap in sub-Saharan Africa originate from West Africa, specifically from Ghana and Burkina Faso, where it is common for households to have several agricultural plots and for male and female plot managers to coexist in study households. This allows authors to control for unobserved time-invariant household-crop-level heterogeneity in a multivariate regression framework and to estimate agricultural production functions for plots cultivated with the same crop, managed or owned by men and women in the same household. As such, they have evolved to be the most influential studies on gender differences in agricultural productivity in sub-Saharan Africa, documenting the potential Pareto-inefficient nature of within-household allocation of productive resources. The gender gap is typically identified by the magnitude and statistical significance of the regression coefficient associated with the gender of the plot manager/owner.

The evidence from the second strand indicates that in some contexts, descriptive mean differences in agricultural productivity across plots owned/managed by males vs. females continue to be large and statistically significant in multivariate analyses that control for differences in input use (Saito et al., 1994 for Nigeria; Udry, 1996 for Burkina Faso; Quisumbing et al., 2001 for Ghana; Peterman et al., 2011 for Uganda), while in other contexts, the gender gap ceases to be statistically significant once the researcher controls for differential utilization of productive inputs (Saito et al., 1994 for Kenya; Gilbert et al., 2002 for Malawi; Akresh, 2005 for Burkina Faso; Goldstein and Udry, 2008 for Ghana).[12]

A common limitation of these studies is the reliance on data that are at best regionally-representative in terms of population dynamics (with the exception of Akresh, 2005), whereby results have limited external validity beyond the study area, within or across countries. For instance, Akresh (2005) uses nationally-representative data from Burkina Faso, and while he is

[12] See Peterman et al. (2011) for a succinct review of the main findings of the studies cited here. Only Udry (1996), Quisumbing et al. (2001), Akresh (2005), Goldstein and Udry (2008), and Peterman et al. (2011) conduct within-household analysis.

able to replicate the findings of Udry (1996) by focusing on a subset of villages that are in close proximity to the areas underlying Udry's analysis, Akresh cannot recover the same relationships based on the data collected in other parts of the country. This discrepancy highlights the importance of revisiting the body of evidence on the gender gap in sub-Saharan Africa by using nationally-representative data.

Another limitation observed in the second strand of the relevant literature is the disproportionate focus on West Africa. It is important to investigate the extent and correlates of the gender gap in alternative sub-Saharan African settings with different sets of rights and obligations that differently affect the distribution of productive resources across men and women. Finally, in the case of empirical studies that document statistically insignificant differences in agricultural productivity between female-managed and male-managed plots, conditional on plot-level observable and household-level unobservable attributes, the analytical framework is not set up to isolate relative contributions of relevant attributes towards the observed gender gap for the purpose of prioritizing areas for policy interventions.

3. MALAWI: AGRICUTURAL PRODUCTIVITY AND GENDER

3.1. THE COUNTRY CONTEXT[13]

Malawi is a small, population-dense, land-locked country in Southern Africa, with 94,080 square kilometers of land. The 2010 mid-year population projection and annual population growth rate stand at 14.5 million persons and 3.25 percent, respectively, and 85 percent of the population reside in rural areas (NSO, 2012). Agriculture is not only the backbone of Malawi's economy but also an essential part of its social fabric. The sector accounts for 30 percent of the Gross Domestic Product (GDP), and 84 percent of Malawian households own and/or cultivate land[14]. The production system is overwhelmingly rainfed, characterized by limited access to irrigation and diminishing average land holding sizes due to population pressures. The rainfall is unimodal, and maize is the main staple crop, grown by nearly 100 percent of the farming household population.[15]

Over the last two decades, agricultural productivity, as measured by maize yields (kilogram/hectare), has been erratic, as shown in Figure 1. The factors that are commonly cited as underlying the agricultural productivity trend include weather variability, declining soil fertility, limited use of improved agricultural technologies and sustainable land management practices, rationed agricultural extension services, market failures, and underdeveloped and poorly maintained infrastructure (World Bank, 2007). The majority of the farming households

[13] Unless otherwise stated, the statistics reported in Section 3.1 originate from data.worldbank.org/country/Malawi.
[14] The GDP contribution of agriculture is for 2011. The estimate of the percentage of Malawian households owning and/or cultivating land is based on the Third Integrated Household Survey (IHS3) data.
[15] The estimate is based on the IHS3 data.

still practice subsistence agriculture: the rates of market participation among farming households in general and maize-producing households in particular are 42 and 15 percent, respectively.[16] The inconsistent agricultural performance has direct implications for living standards, given the predominantly rural nature of the country and its heavy reliance on agriculture.

Poverty remains widespread and persistent, particularly among female headed households. Based on the data from the Second Integrated Household Survey (IHS2) 2004/05 and the Third Integrated Household Survey (IHS3) 2010/11, the national absolute poverty rate of 52.4 percent in 2004/05 declined only marginally to 50.7 percent in 2010/11. The trends in rural poverty followed a similar pattern: a rate of 55.9 percent in 2004/05 vs. 56.6 percent in 2010/11.[17] Focusing on the gender dimensions of poverty, while the absolute poverty rate among male-headed households was estimated at 49 percent in 2010/11, the comparable figure among female-headed households was 57 percent. In an effort to combat poverty and boost national food security, the Malawian Government has embarked on an ambitious annual fertilizer and seed subsidy program known as the Farm Input Subsidy Program (FISP), starting with the 2005/06 agricultural season. During the 2009/10 agricultural season (the reference agricultural season for over 75 percent of our sample), close to 50 percent of the farming household population is estimated to have participated in the program.[18] Stagnant poverty levels raise questions on the effectiveness of the FISP in alleviating poverty and food insecurity in a sustainable fashion, which should be subject to further empirical investigation.[19]

3.2. DATA

This study uses data from the Third Integrated Household Survey (IHS3), collected from March 2010 to March 2011 by the Malawi National Statistical Office, with support from the World Bank Living Standards Measurement Study - Integrated Surveys on Agriculture (LSMS-

[16] The estimate is based on the IHS3 data.
[17] The difference between the IHS2 and the IHS3 national absolute poverty rates is not statistically significant. The IHS3 rural poverty rate is also statistically indistinguishable from its IHS2 counterpart.
[18] The exchange rate for the IHS3 period is MK150 = US$1. During the 2009/10 agricultural season, each FISP beneficiary was entitled to vouchers that allowed them to purchase (i) two 50 kilogram bags of maize fertilizer at 500 Malawi Kwacha (MK) per bag, (ii) either 3 kilograms of hybrid maize seed or 10 kilograms of open-pollinated variety maize seed for the commercial market value net of the 1500 MK subsidy from the Government, (iii) 200 grams of storage pesticide for 100 MK, and (iv) 1 kilogram of legume seed (groundnuts, soybeans, beans and pigeon peas) for free. Upon the allocation of vouchers across the districts and the villages within each district, the program relies on community-based targeting to identify beneficiaries at the local-level, and is supposed to target households that are (i) resource poor, (ii) permanent village residents, and (iii) own and cultivate land, with preference given to heads of households that may be female, orphan, elderly, physically-challenged, or HIV-positive or individuals that look after the elderly and physically-challenged (MoAFS, 2009).
[19] Concerns regarding the effectiveness of FISP in reducing poverty and achieving sustainable gains in maize production have been raised (Ricker-Gilbert and Jayne, 2011; Holden and Lunduka, 2010). More recently, Ricker-Gilbert and Jayne (2012) focus on the question of whether FISP can simultaneously boost maize production and reduce poverty, and document that major returns from subsidized fertilizer accrue almost exclusively to households at the top of the maize production and value of total crop output distributions.

ISA) project.[20] The IHS3 data were collected within a two-stage cluster sampling design, and are representative at the national, urban/rural, regional, and district levels, covering 12,271 households in 768 enumeration areas (EAs). The IHS3 instruments included Household, Agriculture, Fishery, and Community Questionnaires.

All sample households were administered the multi-topic Household Questionnaire that collected individual-disaggregated information on demographics, education, health, wage employment, nonfarm enterprises, anthropometrics, and control of income from non-farm income sources, as well as data on housing, food consumption, food and non-food expenditures, food security, and durable and agricultural asset ownership, among other topics. The sample households that were involved in agricultural activities (through ownership and/or cultivation of land, and/or ownership of livestock) were administered the Agriculture Questionnaire. The Agriculture Questionnaire solicited information on land areas, physical characteristics, labor and non-labor input use, and crop cultivation and production at the plot level, separately for the reference rainy and dry seasons. [21] The data allow for agricultural production estimates at the plot level and for the identification of the manager of the plot[22], as well as household members that owned[23] and/or worked on each plot.[24] Handheld global positioning system (GPS)-based locations and land areas of the plots were recorded, permitting us to link household- and plot-level data to outside geographic information system (GIS) databases.

The descriptive statistics and the results from the tests of mean differences by the gender of the plot manager are presented in Table 1. The full sample consists of 16,372 plots, 26% of them managed by females.[25] Table 1 clearly demonstrates the (unadjusted) gender gap: the

[20] The lead author was the point person for the World Bank technical assistance towards the design and implementation of the IHS3 under the LSMS-ISA initiative, which is a household survey program established by a grant from the Bill and Melinda Gates Foundation to provide financial and technical support to governments in sub-Saharan Africa in the design and implementation of nationally-representative multi-topic panel household surveys with a strong focus on agriculture (www.worldbank.org/lsms-isa). The IHS3 data and documentation are publicly available through the LSMS website (www.worldbank.org/lsms).

[21] A plot was defined as a continuous piece of land on which a unique crop or a mixture of crops is grown, under a uniform, consistent crop management system, not split by a path of more than one meter in width. Plot boundaries were defined in accordance with the crops grown and the operator.

[22] For each plot, the following question was asked to identify the primary decision maker/manager: "Who in this household makes the decisions concerning crops to be planted, input use and the timing of cropping activities on this plot?" The questionnaire allowed for identification of one manager per plot, on whom individual-level information could be recovered from the Household Questionnaire.

[23] For each plot, the following question was asked to identify the plot owners: "Who owns this plot?" The question allowed up to 2 household members to be specified as owners.

[24] 81 percent of the plots in our sample are reported to be owned. Among the owned plots, 15 percent have joint ownership, of which the predominant form is male-female. The remaining 38 percent and 47 percent of the owned plots are under sole male ownership and sole female ownership, respectively.

[25] The IHS3 identified 18,917 plots that were reported to have been owned and/or cultivated during the reference rainy season (2008/09 or 2009/10). 618 plots are not considered for analysis since they lacked either GPS-based plot coordinates or GPS-based plot area. 1,314 plots are dropped since they are either fallow or missing production information. 199 plots are not included in the sample since unit values could not be computed reliably for at least one of the crops reported to be cultivated on the plot. 11 plots do not have a manager identified and 67 plots have at

average gross value of output per hectare, our proxy for agricultural productivity, is 25% lower for the female-managed plot sample.[26] The gender differences in agricultural productivity are also evident in the comparison of the Kernel density estimates of the log of gross value of output per hectare for male- and female-managed plots, as displayed in Figure 2. The overwhelming majority of the differences in the average values of the observable covariates across male- vs. female-managed plots in Table 1 are statistically significant at the 1 percent level. For the purposes of the ensuing discussion, we focus on the differences that are statistically significant at least at the 5 percent level.

The incidence of manager-head of household correspondence is 99 percent for the male-managed plot sample, while the analogous statistic is 80 percent for the female-managed plot sample. Female-managed plots are, on average, overseen by individuals that are 5 years older and have 2 less years of schooling with respect to their male-managed comparators. A significantly higher percentage of female-managed plots exhibit manager-owner correspondence (77 vs. 58 percent) and 75 percent of the female-managed plot sample are exclusively female-owned, featuring either a sole female owner or dual female owners within the household.[27] The incidences of joint ownership and exclusive-male ownership stand at 4 and 3 percent, respectively, among female-managed plots. In comparison, male-managed plots are distributed more evenly across the ownership categories of exclusive-male (43 percent), exclusive-female (23 percent), and joint male-female (15 percent).

Although the average GPS-based plot area is 0.39 hectare, female-managed plots are, on average, 12 percent smaller than their male-managed counterparts. The use of inorganic fertilizer is lower on female-managed plots, whether measured by incidence, average unconditional amount per hectare, or average conditional amount per hectare. These trends may signal gender differences in FISP fertilizer voucher distribution and redemption outcomes. In fact, the IHS3 data indicates that even though female-headed households are just as likely to receive a fertilizer voucher as their male-headed counterparts, conditional on receipt, the *average number* of fertilizer vouchers that are received among female-headed households (1.56) is lower than the analogous statistic for male-headed households (1.63), and the difference is statistically

---

least one missing value among the independent variables of interest. Finally, top and bottom 1 percent of the distribution of the log of gross value of output per hectare are trimmed, corresponding to 336 plots. These exclusions leave us with the final analysis sample of 16,372 rainy season plots.

[26] The plot-level gross value of output in Malawi Kwacha (MK) is calculated by first multiplying the kilogram-equivalent quantity of production for each crop on a given plot by the median crop sales value per kilogram within the corresponding EA, and then aggregating across values of crop production. The median crop sales value per kilogram is computed within the corresponding EA only if at least 10 values are available from the survey data. Otherwise, the median crop sales value per kilogram is computed at a higher level, in the order of traditional authority, district, region, and country. Our outcome variable is computed by normalizing plot-level gross value of output with GPS-based cultivated plot area.

[27] The overwhelming majority of the owned plots (83 percent) are acquired through inheritance. Another 12 percent is reported to have been granted by local leaders. The remaining are acquired as bride price (2 percent), purchased with title (1 percent) and purchased without title (1 percent).

significant at the 1 percent level. Similarly, conditional on receipt, the average number of fertilizer vouchers that are *redeemed* stands at 1.57 and 1.48 for male-headed and female-headed households, respectively, and the difference is again statistically significant at the 1 percent level.[28]

In terms of household labor use, the dynamics are drastically different on female-managed plots *vis-à-vis* their male-managed comparators, as can be seen in Table 1. Although the average incidence, average unconditional amount, and average conditional amount of household adult male labor input per hectare are significantly higher on male-managed plots, the opposite is true concerning household adult female, household child, and exchange labor use on female-managed plots.[29] The relatively higher household child labor and exchange labor input on female-managed plots might be possible responses to being rationed out of household adult male labor. Furthermore, Table 1 shows statistically different cultivation patterns by gender of the plot manager, with female-managed plots exhibiting a higher incidence of intercropping and male-managed plots recording, on average, higher shares of plot area (i) under improved seeds (mainly maize, complemented by groundnuts and rice) and (ii) under export crops (mainly tobacco, complemented by cotton). Female-managed plots are also 4 percentage points less likely to be associated with households that receive agricultural extension service on topics that relate to crop production and marketing. Lastly, male-managed plots are, on average, more likely to be associated with households with higher levels of wealth and access to agricultural implements.[30]

Table 2 presents the naïve plot-level regression results on the gender gap, where the dependent variable is the log of gross value of output per hectare. The findings presented in columns 1, 2 and 3 originate from regressions that, in addition to the dummy variable on female

[28] The factors behind this pattern are being investigated further as part of a parallel research program on the FISP beneficiary targeting performance and productivity impacts.

[29] Adult is defined as being at least 15 years of age. The plot-level measures of household adult male, adult female, and child labor input are the summations of rainy season labor hours across household members reported to have worked on a given plot. Individual labor input is computed as the multiplication of the number of weeks a household member worked on a given plot during the reference rainy season, the typical number of days worked per week during the reported number of weeks, and the typical number of hours worked per day during the reported number of weeks. The plot-level measure of hired labor (exchange) input is the sum of aggregate men, women, and child hired (exchange) labor days.

[30] The household wealth index is constructed using principal component analysis, and takes into account the number of rooms in the dwelling, a set of dummy variables accounting for the ownership of (i) dwelling, (ii) mortar, (ii) bed, (iii) table, (iv) chair, (v) fan, (vi) radio, (vii) tape/CD player, (viii) TV/VCR, (ix) sewing machine, (x) paraffin/ kerosene/ electric/ gas stove, (xi) refrigerator, (xii) bicycle, (xiii) car/motorcycle/minibus/lorry, (xiv) beer brewing drum, (xv) sofa, (xvi) coffee table, (xvii) cupboard, (xviii) lantern, (xix) clock, (xx) iron, (xxi) computer, (xxii) fixed phone line, (xxiii) cell phone, (xxiv) satellite dish, (xxv) air-conditioner, (xxvi) washing machine, (xxvii) generator, (xxviii) solar panel, (xxix) desk, and a vector of dummy variables capturing access to improved (i) outer walls, (ii) roof, (iii) floor, (iv) toilet, and (v) water source. The household agricultural implement access index is also computed using principal components analysis, and covers a range of dummy variables on the ownership of (i) hand hoe, (ii) slasher, (iii) axe, (iv) sprayer, (v) panga knife, (vi) sickle, (vii) treadle pump, (viii) watering can, (ix) ox cart, (x) ox plough, (xi) tractor, (xii) tractor plough, (xiii) ridger, (xiv) cultivator, (xv) generator, (xvi) motorized pump, (xvii) grain mail, (xviii) chicken house, (xix) livestock kraal, (xx) poultry kraal, (xxi) storage house, (xxii) granary, (xxiii) barn, and (xxiv) pig sty.

plot management, control only for agro-ecological zone, regional, and district fixed-effects, respectively. The gender gap estimates range from 22 to 25 percent. These results indicate a statistically and economically large difference between male and female farmers. In what follows, we seek to understand the factors associated with this gap.

Table 3 provides an additional estimate of the gender gap, but now conditional on additional covariates commonly found in the literature (Peterman et al., 2011). Column 1 presents the results from a pooled regression that includes both male- and female-managed plots. Once we control for key factors of production, the gender gap is reduced to 4.5 percent and is now statistically significant only at the 10 percent level. In the end, this type of analysis does not allow us to delve deeper into the process that underlies the movement from the unconditional gender gap of 25.4 percent to the conditional gender gap of 4.5 percent. In the following section, we apply a decomposition approach that will allow us to unpack the relative contributions of different factors towards this gap and to suggest priority areas for policy interventions.

4. MEAN DECOMPOSITION METHODOLOGY

Regression-based decomposition methods have been widely utilized in labor economics following the seminal papers of Oaxaca (1973) and Blinder (1973), notably as part of the analyses of the gender wage gap, union wage gap, and growing wage inequality (O'Neill & O'Neill, 2006, Fortin, 2006). Despite the extensive use of Oaxaca-Blinder regression-based mean decomposition among applied economists over the last three decades and the advances that have been made to extend the application to the decomposition of distributional statistics besides the mean, the questions attempted to be addressed by the method require a strong set of assumptions (Fortin et. al., 2011).

In particular, these methods follow a partial equilibrium approach, where observed outcomes for one group can be used to construct various counterfactual scenarios for the other group (Fortin et. al., 2011). Another limitation is that while decompositions are useful for quantifying, purely in an accounting sense, the contribution of various factors to a difference in an outcome across groups or a change in an outcome for a particular group over time, they are based on correlations, and hence cannot be interpreted as estimates of underlying causal parameters (Fortin et. al., 2011). However, decomposition methods do document the relative quantitative importance of factors in explaining an observed gap, thus suggesting priorities for further analysis and, ultimately, policy interventions (Fortin et. al., 2011).

To document the extent and drivers of the gender gap in Malawi, we first rely on an Oaxaca-Blinder regression-based mean decomposition. We assume the log of an agricultural productivity measure (Y), namely gross value of agricultural output per hectare, for male- (M) and female- (F) managed plots estimated as:

(1) $Y_G = \beta_{G0} + \sum_{k=1}^{K} X_{Gk}{}'\beta_{Gk} + \varepsilon_G$

where *G* indicates the gender of the plot manager*;* *X* is a vector of k observable, plot-, household- and/or community-level explanatory variables; β is the associated vector of intercept and slope coefficients; and ε is the error term under the assumption that E(ε_M) = E(ε_F) = 0.

The *gender gap* "*D*" is expressed as the mean outcome difference:

(2) $D = E(Y_M) - E(Y_F)$.

Equations (1) and (2) imply that:

(3) $E(Y_M) = E(\beta_{M0} + \sum_{k=1}^{K} X_{Mk}\beta_{Mk} + \varepsilon_M) = \beta_{M0} + \sum_{k=1}^{K} E(X_{Mk})\beta_{Mk}$

(4) $E(Y_F) = E(\beta_{F0} + \sum_{k=1}^{K} X_{Fk}\beta_{Fk} + \varepsilon_F) = \beta_{F0} + \sum_{k=1}^{K} E(X_{Fk})\beta_{Fk}$

and, Equation (2) could be rewritten as:

(5) $D = E(Y_M) - E(Y_F) = \beta_{M0} + \sum_{k=1}^{K} E(X_{Mk})\beta_{Mk} - \beta_{F0} - \sum_{k=1}^{K} E(X_{Fk})\beta_{Fk}$.

Subsequently, we define β^* as the vector of coefficients that is obtained from a regression of Y that is based on the pooled plot sample and includes the group membership identifier, i.e. a dummy variable identifying female-managed plots. The inclusion of the group membership indicator in the pooled regression for the estimation of β^* takes into account the possibility that the mean difference in plot-level productivity measure is explained by gender of the plot manager, avoiding a possible distortion of the decomposition results due to the residual group difference reflected in β^* (Jann, 2008). Rearranging Equation (5) by adding and subtracting (i) the slope coefficient of the pooled regression (β_0^*), and (ii) the return to the observable covariates of each group valued at β^* ($X_{Mk}\beta_k^*$ and $X_{Fk}\beta_k^*$), we obtain:

(6)

$$D = \underbrace{\sum_{k=1}^{K} [E(X_{Mk}) - E(X_{Fk})]\beta_k^*}_{Component\ 1:\ Endowment\ Effect} +$$

$$\underbrace{\underbrace{(\beta_{0M} - \beta_0^*) + \sum_{k=1}^{K} [E(X_{Mk})(\beta_{Mk} - \beta_k^*]}_{Male\ Structural\ Advantage} + \underbrace{(\beta_0^* - \beta_{0F}) + \sum_{k=1}^{K} [E(X_{Fk})(\beta_{Fk} - \beta_k^*]}_{Female\ Structural\ Disadvantage}}_{Component\ 2:\ Structure\ Effect}$$

where $\beta_{M0}, \beta_{F0}, \beta_0^*, \beta_{Mk}, \beta_{Fk}, \beta_k^*$ (k=1….K) are the estimated intercept and slope coefficients of each covariate included in the regressions for the male-managed, female-managed and pooled plot samples.

Equation (6) is known as the *aggregate decomposition*. The first component is the *endowment effect*, i.e. the portion of the gender gap that is explained by differences in the levels of observable covariates between both groups. It is simply the sum across all covariates, of the differences by group, valued at the corresponding "average" return. The second component is the *structure effect*, i.e. the portion of the gender gap driven by deviations of each group's return from the corresponding "average" return. The first term of the structure effect $(\beta_{0M} - \beta_0^*) + \sum_{k=1}^{K}[E(X_{Mk})(\beta_{Mk} - \beta_k^*]$ represents the *male structural advantage*, which is equal to the portion of the gender gap accounted for by deviations of male regression coefficients from pooled counterparts. The second term of the structure effect $(\beta_0^* - \beta_{0F}) + \sum_{k=1}^{K}[E(X_{Fk})(\beta_{Fk} - \beta_k^*]$ represents the *female structural disadvantage*, which is equal to the portion of the gender gap driven by deviations of pooled regression coefficients from female counterparts.[31]

In practice, we estimate equation 1 for (i) male-managed plots, (ii) female-managed plots, and (iii) the pooled plot sample (with a dummy variable identifying female-managed plots), and use the resulting vector of coefficients β_M, β_F, and β^*, together with the mean values for each covariate for each group X_M and X_F to compute the components of equation (6). Moving beyond the aggregate decomposition, the detailed decomposition involves subdividing the endowment and structure effects into the respective contributions of each observable covariate, which correspond to the variable-specific subcomponents of the summations included in equation (6).

Fortin et al. (2011) present a detailed account of the assumptions required to identify the population parameters of interest. Two crucial assumptions for the validity of aggregate decomposition are (i) overlapping support and (ii) ignorability. *Overlapping support* implies that no single value of $X = x$ or $\varepsilon = e$ exists to identify female plot management. *Ignorability* refers to the random assignment of female plot management conditional on observable attributes. The additional essential assumptions required by detailed decomposition to identify the individual contribution of each covariate include *additive linearity* and *zero conditional mean*. The latter implies that ε is independent of X. In other words, we assume that there is no unobservable heterogeneity that jointly determines the outcome and observable attributes. It should be noted that even if the additional assumptions required by detailed decomposition may not hold true,

[31] The use of the term "disadvantage" is tied to the subsequent section's discussion of the regression coefficients estimated from the pooled, male-managed, and female-managed plot samples. With respect to their counterparts estimated from the pooled plot sample, the regression coefficients from the female-managed plot sample that are expected to be positive and that are associated with key factors of production are consistently positive but lower in absolute terms. Conversely, the use of the term "advantage" is linked to the same set of regression coefficients being higher in the male-managed plot sample with respect to those from the pooled plot sample.

aggregate decomposition would remain valid as long as overlapping support and ignorability assumptions are tenable.

In exploring the existence and extent of the gender gap in a multivariate framework, the validity of findings largely depend on the plausibility of ignorability and zero conditional mean assumptions, i.e. the extent to which the identification strategy addresses possible unobservable household-/plot-level heterogeneity that jointly determines plot agricultural productivity and observable covariates, including whether a plot is managed by a female. While the most rigorous studies on the gender gap recognize the need for an instrumental variable strategy to deal with potentially endogenous observables, recovering instrumental variables that predict endogenous covariates without directly influencing the outcome is often not possible. A subset of the studies that are reviewed in Section 2 and that feature plot-level analyses have attempted to address the potential bias by controlling for direct measures of plot soil quality and household-crop fixed effects. With panel data, time fixed effects have also been included in the specifications.

Furthermore, to deal with the possibility that the male and female plots might be physically systematically different from each other along the dimensions that are finer than the observable variations in soil physical infrastructure and quality, an alternative identification strategy has been to rely on a spatial fixed effects estimator that allows for local neighborhood effect in unobserved land quality that could be correlated with the gender of plot manager and the other regressors. The spatial fixed effects are differenced out by modeling the difference between the plot-level outcome and the average of the outcome across plots from other households within a critical distance as a function of a vector of plot-/household-level variables that are differenced from their matched plot-/household-level neighborhood averages (see Goldstein and Udry (2008) for an example of this).

We lack, in our case, plot-level measures of soil quality, and the nature of farm organization as captured in the IHS3 data does not allow us to feature household fixed effects as a central piece of our empirical strategy. The average number of plots cultivated by Malawian farming households is 1.76, significantly less than the comparable statistics from West African settings that have largely informed the analysis of the gender gap in sub-Saharan Africa thus far. The managers identified across agricultural plots cultivated by a given household also correspond to the head of household in an overwhelming sample of households that report to be cultivating multiple plots. Specifically, there are only 109 households that cultivate multiple plots and exhibit within-household variation in terms of the gender of the plot managers, corresponding to 1.7 percent of our plot sample. Nevertheless, we attempt to lend as much support to the overlapping support, ignorability, and zero conditional mean assumptions as possible by relying on all available data and econometric methods at our disposal. These sensitivity analyses are presented later in Section 5.3.

5. MEAN DECOMPOSITION RESULTS

The first step in the mean decomposition is the estimation of equation (1). This is done separately for the pooled, male-managed and female-managed plot samples, and the results reported in Table 3, Columns 1, 2 and 3, respectively.

We find that the log of GPS-based plot area has a negative coefficient that is statistically significant at the 1 percent level in each plot sample. This finding is consistent with recent studies that have investigated and provided support for the inverse yield hypothesis (see Larson et al., 2012 and the references cited therein). A key variable that is positively associated with the log of gross value of output per hectare, irrespective of the plot sample, is the log of inorganic fertilizer use per hectare. However, the return to inorganic fertilizer use (i.e. the coefficient) is higher within the male-managed plot sample in comparison to the female-managed plot sample, and this difference is statistically significant.

The log of household adult male labor hours per hectare has a sizeable and positive coefficient that is statistically significant at the 1 percent level within the male-managed plot sample, while the comparable estimate within the female-managed plot sample is not statistically significant. In contrast, the log of household adult female labor hours per hectare has a positive and statistically significant coefficient across both plot samples, albeit a larger effect, in terms of both magnitude and statistical significance, among female-managed plots.

The coefficients for the shares of plot area under improved seeds and under export crops have sizably positive and statistically significant coefficients at the 1 percent level across all plot samples of interest. Conversely, the child dependency ratio, which is defined as the number of household members below the age of 10 divided by the number of household members aged 10 years and above, has a substantial negative coefficient that is statistically significant at the 1 percent level only within the female-managed plot sample. The comparable statistics for the pooled and male-managed plot samples are not statistically significant.

In addition, although household size has a positive coefficient that is statistically significant irrespective of the plot sample, the magnitude of the coefficient within the female-managed plot sample is three times larger than within the male-managed plot sample. The gender differences in returns to household size and child dependency ratio imply that the burden of childcare is more likely to reduce female agricultural productivity.

The decomposition of the mean gender gap, which is estimated at 25.4 percent, is presented in Table 4. Panel B presents the aggregate decomposition components, namely the endowment effect, the male structural advantage, and the female structural disadvantage. Panel C includes the results from the detailed decomposition, whereby a positive coefficient suggests that the relevant covariate contributes positively to increasing the gender gap.

5.1. AGGREGATE DECOMPOSITION

The aggregate decomposition indicates that the endowment effect (20.9 percentage points), i.e. the portion of the gender gap driven by gender differences in levels of observable attributes, accounts for 82 percent of the mean gender differential in agricultural productivity. The female structural disadvantage is estimated at 4.5 percentage points, explaining the remaining 18 percent of the gender gap. The aggregate decomposition reinforces the notion that large and significant gender disparities in access to inputs and in asset ownership are central factors behind the gender gap.

5.2. DETAILED DECOMPOSITION

The detailed decomposition of the endowment effect is reported in Table 4, Panel C, Column 1. As noted above, the estimates are a function of the mean differences reported in Table 1 by the gender of the plot manager, and the pooled regression coefficients reported in Table 3. The percentage contributions that are noted below should be understood as correlations, rather than causal parameters, and are obtained by dividing the coefficient in question either by the endowment effect (0.209) or by the gender gap (0.254).

In Section 3.2, we noted that male-managed plots tend to be overseen by individuals that have higher years of schooling and who originate from larger and wealthier households that access agricultural extension more frequently. Male-managed plots also exhibit higher (i) incidence of pesticide use, (ii) inorganic fertilizer use per hectare, (iii) household adult male labor input per hectare, (iv) share of plot area under improved seeds, and (v) share of plot area under export crops. In view of the positive correlation with these covariates and agricultural productivity, we find these variables to be contributing positively towards the endowment effect, thereby widening the gender gap. Conversely, the higher rate of household adult female labor and exchange labor provision within the female-managed plot sample, as well as the positive association between these covariates and agricultural productivity imply that these variables contribute negatively towards the endowment effect, hence working to close the gender gap. The smaller plot areas farmed by female managers also appear to be a contributing factor in shrinking the gender gap given that in these data, there is an inverse relationship between cultivated plot area and agricultural productivity.

The factors that comprise the majority of the endowment effect are the log of household adult male labor hours per hectare and the share of plot area under export crops. The covariates explain 46 percent and 40 percent of the endowment effect, and account for 38 percent and 33 percent of the gender gap, respectively. The positive contributions of the other covariates towards the endowment effect (and the gender gap in parenthesis) are as follows: (i) 14 percent (11 percent) for the household agricultural implement access index, (ii) 9 percent (7 percent) for the household wealth index, (iii) 8 percent (6 percent) for manager years of schooling, (iv) 8 percent (6 percent) for the log of plot inorganic fertilizer use per hectare, (v) 6 percent (5 percent) for household size, and (vi) 2 percent (2 percent) for share of plot area under improved seeds. The negative contributions of the aforementioned covariates towards the endowment effect (and the gender gap in parenthesis) are as follows: (i) 24 percent (20 percent) for the log of GPS-based plot area and its squared term combined, (ii) 8 percent for logged household female adult labor hours per hectare, and (iii) 2 percent (2 percent) for the log of exchange labor days per hectare.

The detailed decompositions of the male structural advantage and the female structural disadvantage are presented in Columns 2 and 3 of Table 4, Panel C. The coefficients that are large and statistically significant signal differential treatments of male vs. female plot manager by markets, formal institutions, and informal social institutions. Findings related to inorganic fertilizer use, plot measures of household adult male and adult female labor provision, household size, and child dependency ratio are noteworthy.

First, it is not only the differences in the inorganic fertilizer endowment that contribute to the gender gap, but also the relatively higher return to inorganic fertilizer among the male-managed plots in comparison to their female-managed counterparts. The same applies to the log of household adult male labor hours per hectare. The underlying causes of this finding are the subject of future research but may indicate household adult male labor supervision difficulties on female-managed plots.

The fact that household adult male labor input is associated with a wider gender gap is, however, partially offset by the higher returns that household adult female labor provides on female-managed plots. Regarding the child dependency ratio, although the contribution of this factor towards the endowment effect is zero, its contribution towards the female structural disadvantage is large and positive, driven by the sizeable and highly significant negative association between this variable and agricultural productivity solely within the female-managed plot sample. This result highlights the differential productivity impacts of heterogeneous household roles assumed by male and female managers. Since female managers, who are just as likely to be household heads or spouses, are more likely to combine farm management with household duties, including child care, their pattern of time use is directly related to their low productivity outcomes.

5.3. SENSITIVITY ANALYSES

As noted earlier, the crucial assumptions for the validity of the aggregate decomposition include overlapping support and ignorability. The key assumptions additionally required by the detailed decomposition are additive linearity and zero conditional mean. A methodology that is proposed by Imbens and Rubin (2009) to assess the feasibility of the overlapping support assumption is centered on the idea of calculating a scale-free normalized difference for each covariate. They assert that the overlapping support across the groups of interest, in our case female- vs. male-managed plots, is adequate if the scale-free normalized differences across the covariates are less than 0.25. Table A.1 in the Appendix[32] presents the scale-free normalized difference of the variables used in the regressions. Only 2 out of 29 independent variables have a normalized difference greater than 0.25.

In trying to lend support to ignorability and zero conditional mean assumptions, we use all available data and econometric tools at our disposal, and first rely on an empirical approach that was pioneered by Altonji (1988), Murphy and Topel (1990), and Altonji et al. (2005), based on the idea that the amount of selection on observable variables provides a guide to the extent of selection on unobservable counterparts. We use an informal version of the methodology applied by Acemoglu et al. (2001) and Altonji et al. (2005), and incorporate into our base specification, in a phased-in fashion, thematically-grouped control variables such that each regression is estimated with a different set of additional independent variables and that the results are compared to those from the base specification. Our purpose is to gauge the stability of the key regression coefficients that underlie our decomposition results. If the coefficients on the covariates included in the base specification, including the female plot management dummy in the pooled regression, are stable subsequent to the incorporation of additional covariates, they are less likely to change if we are able to take into account potentially missing omitted variables.

To perform this analysis, we consider the following sets of variables: (i) district fixed effects, (ii) plot geospatial characteristics informed by GIS data, (iii) other plot characteristics solicited by the IHS3, (iv) additional household characteristics, and (v) additional community characteristics. Table A.2 in the Appendix includes the detailed list of the variables included in each set. Tables 5, 6 and 7 present the base regression results and the estimates from the regressions including the additional controls for the pooled, male-managed, and female-managed plot samples, respectively. An overwhelming majority of the coefficients, with respect to the base specification, are stable across the specifications and the plot samples, and do not change sign or significance. This suggests that the assumptions of ignorability and zero conditional mean might not be unfounded.

---

[32] The Appendix including the results from the sensitivity analysis referenced in Sections 5.3 and 7.2 are available upon request from the authors or could be downloaded at http://tinyurl.com/mwgenderandagriculture.

As part of the sensitivity analyses, we also conduct our analysis on the subset of plot observations from households in which male and female plot managers coexist. The size of this sample is 292 plots (approximately 2 percent of our sample) originating from 109 households. The concern motivating this analysis is that there might be unobserved household characteristics that might jointly determine productivity outcomes and within-household assignment of plots to managers, which may be biasing our estimates. Table A.3 in the Appendix presents the results from pooled regressions that use the aforementioned sample of 292 plots, and that are compared with the estimates from the base regression that is informed by the entire pooled sample (Column 1). Column 2 includes the coefficient estimates from a regression that is identical to the base specification but is estimated using the reduced plot sample, and Column 3 presents the findings from a regression that is fit among the same sample of plots but with household fixed effects incorporated in the base specification.

Although the coefficients associated with female plot management in Columns 2 and 3 are not statistically significant (likely due to the small sample), they are economically relevant, with values of 6.6 percent and 11.4 percent, respectively. Furthermore, Table A.4 in the Appendix presents the decomposition of the mean gender gap using the sample of 292 plots, but informed by the regression set-up that is identical to the base specification. The mean gender gap is equal to 27.4 percent, and the differential is mostly explained by the endowment effects of the inorganic fertilizer use and the share of plot area under export crops. These results are consistent with the findings presented earlier.

Finally, we replicate the entire analysis by using the plots cultivated with maize and the log of maize production per hectare as an alternative proxy for agricultural productivity. These results are available upon request and are strongly in line with the findings reported thus far. As shown in Column 1 of Table 10, the gender gap in maize yields is equal to 22.4 percent, and approximately three-quarters of the observed differential are driven by the endowment effect. The similarity of the results supports the hypothesis that the independent variables in our base specification that uses the log of plot-level gross value of output per hectare as the dependent variable capture the possible bias that unobserved technology choice parameters may otherwise cause.

6. RECENTERED INFLUENCE FUNCTION (RIF) DECOMPOSITION

Our decomposition findings suggest that more than 80 percent of the mean gender gap is explained by differences in observable covariates, and the direct pay-off to addressing market and institutional failures that affect men and women differentially is economically significant. While it is important to show this with nationally-representative data, going beyond the "average" farmer and understanding the *heterogeneity* in constraints faced by farmers with different gender and productivity profiles is crucial for the design and implementation of better targeted interventions aimed at bridging the gap. An important question is whether our findings, which are based on the sample means, are robust to the decomposition of alternative distributional statistics beyond the mean.

A method that is similar in spirit to the mean decomposition uses the recentered influence function (RIF) regressions proposed by Firpo et al. (2009) and provides a straightforward framework within which across-group differences in any distributional statistic could be decomposed. We rely on the RIF decomposition to provide estimates of the aggregate and detailed decomposition of the gender gap at different percentiles of the agricultural productivity distribution.

A RIF regression is similar to a standard OLS regression, except that the dependent variable, Y, is replaced by the RIF of the distributional statistic of interest. The approach assumes that the conditional expectation of the $RIF(Y; v)$ can be modeled as a linear function of observable attributes, X, such that $E[RIF(Y; v)|X] = X\gamma$, as in the mean decomposition. Assuming that $IF(y; v)$ is the influence function corresponding to an observed productivity outcome y, for the distributional statistic $v(F_Y)$, the RIF is defined as:

(7) $RIF(y; v) = v(F_Y) + IF(y; v)$.

In the case of quantiles, the influence function is equal to:

(8) $IF(Y; Q_T) = \frac{(T - \mathbf{1}\{Y \leq Q_T\})}{f_Y(Q_T)}$,

where $\mathbf{1}\{Y \leq Q_T\}$ is an indicator function equal to 1 if the value of the outcome variable is smaller than or equal to the quantile Q_T and 0 otherwise, $f_Y(Q_T)$ is the density of the marginal distribution of Y, and Q_T is the population T-quantile of the *unconditional* distribution of Y. Consequently,

(9) $RIF(Y; Q_T) = Q_T + IF(Y; Q_T)$.

In practice, the RIF is first estimated as a function of the sample quantile Q_T (e.g. the 10^{th} percentile), the dummy variable identifying whether the observed outcome, Y, is smaller than or equal to the sample quantile, and the density estimated using kernel methods at the point of the sample quantile. In the second stage, the estimated RIF is used as a dependent variable in an OLS regression that is run separately for the male-managed, female-managed and pooled plot samples. The resulting parameters $\boldsymbol{\gamma}_M$, $\boldsymbol{\gamma}_F$ and $\boldsymbol{\gamma}^*$ replace the $\boldsymbol{\beta}$ counterparts in Equation (6) and are used together with the group-specific mean values for each covariate, X_M and X_F, to perform aggregate and detailed decompositions of any distributional statistic beyond the mean within the framework provided in Section 4.

7. RIF DECOMPOSITION RESULTS

7.1. RIF AGGREGATE DECOMPOSITION

Table 8 presents the gender gap estimates and aggregate RIF decompositions at the mean, and at each decile of the agricultural productivity distribution. The graphical representation of these findings are reported in Figure 3. The estimations are underlined by RIF regressions that use the same set of independent variables included in the base specification for the mean decomposition.

Two key findings emerge from Table 8. First, the estimates of the gender gap and the share of the gender gap attributed to female structural disadvantage increase steadily across the agricultural productivity distribution. While the gender gap is estimated at 25.4 and 23.3 percent at the mean and median, respectively, the estimates at the 10^{th} and 90^{th} percentiles are 22.6 and 37.6 percent, respectively. The female structural disadvantage component accounts for 17.7 percent of the gender gap at the mean and 33.5 percent of the gender gap at the 90^{th} percentile.

Second, the gender gap at the lowest three deciles of the agricultural productivity distribution is explained fully by differences in observable covariates, with the endowment effect still accounting for close to 90 percent of the gender gap at the median. Given the trends in the female structural disadvantage component, the percentage contribution of the endowment effect toward the gender gap declines throughout and is more of a dominant force in the first half of the distribution.

7.2. RIF DETAILED DECOMPOSITION

In the interest of brevity, we provide the detailed RIF decompositions at the 10^{th}, 50^{th} and 90^{th} percentiles. The RIF regressions underlying the detailed decompositions are reported in Tables A5 through A7 in the Appendix. The key variables that will be the subject of the RIF detailed decomposition discussion are in line with those that have been emphasized as part of the mean decomposition results. While this indicates that the policies need to address these factors for all women, their relative importance in fact changes across the distribution.

Before discussing the detailed decomposition results in depth, we focus on the graphical representations of RIF regression coefficients for key explanatory variables estimated separately within the pooled, male-managed, and female-managed plot samples at each decile of the agricultural productivity distribution.[33] The trends in RIF regression coefficients for (i) the log of household adult male labor, (ii) the share of plot area under export crop cultivation, (iii) the log

[33] The decile-specific RIF regression results for each plot sample are available upon request.

of inorganic fertilizer use, and (iv) the child dependency ratio are depicted in Figures 4A, 4B, 4C and 4D, respectively. We find that the evolution of the returns to inorganic fertilizer use and the share of plot area under export cultivated area are at odds with one another. The coefficient associated with inorganic fertilizer use declines steadily throughout the agricultural productivity distribution, while the return to the share of plot area under export cultivation is significantly higher at each decile. This result holds true independent of the plot sample in question.

Moreover, the distribution of returns to household adult male labor is considerably different within the male-managed plot sample *vis-à-vis* its female-managed counterpart. The return to household adult male labor on female-managed plots declines steadily and dips below zero starting with the 70th percentile. The coefficient of interest is, conversely, always positive, and displays a stagnant evolution across the deciles within the male-managed plot sample. The evolution of the coefficient associated with household child dependency ratio among male-managed is also always positive across the distribution, but negative at each decile within the female-managed plot sample and is highest, in absolute terms, at the 90th percentile.

The detailed RIF decompositions at the 10th, 50th, and 90th percentiles are reported in Table 9.[34] We observe that at the median, the decomposition is comparable to its counterpart at the mean. The fact that females manage smaller plots reduces the gender gap through its negative contribution to the endowment effect across the majority of the agricultural productivity distribution. At the first decile, the log of plot area is associated with a 32 percent reduction in the endowment effect. Household adult female labor input is the other key variable that is associated with negative contributions towards both the endowment effect and the male structural advantage component at each decile. Although the magnitude of the relationship between the variable and the endowment effect decreases in relative and absolute terms towards the higher end of the agricultural productivity distribution, it remains economically significant and indicates the importance of household female adult labor in the context of labor market failures and insufficient household male adult labor. The sustained negative contributions towards the male structural advantage components are driven by lower returns to household adult female labor on male-managed plots *vis-à-vis* pooled and female-managed plots.

The log of inorganic fertilizer use per hectare is associated with positive but decreasing contributions towards the endowment effect. The share of plot area cultivated with improved seeds exhibits a similar trend. Addressing gender differences in access to inorganic fertilizer and improved seeds would, therefore, alleviate the gender gap mostly within the first half of the

[34] To lend support towards the assumptions of ignorability and zero conditional mean associated with the RIF decomposition, we follow the added-control approach proposed by Altonji et al. (2005), and implemented in Section 5.3 for the mean decomposition. Tables A8 through A16 in the Appendix present the results of the RIF regressions including the additional controls for the pooled, male-managed, and female-managed plot samples for the 10th, 50th and 90th percentiles. We find that the coefficients are largely stable in terms of magnitude, and do not change sign or significance in response to additional control variables that span five domains.

productivity distribution. The sustained increases in returns to the share of plot area under export crop cultivation at each decile of the agricultural productivity distribution underlies, in contrast, the surge in the portion of the endowment effect attributed to this variable. The share of plot area under export crop cultivation accounts for 40 and 56 percent of the gender gap at the 10^{th} and 90^{th} percentile, respectively. Diversification into high-value, export-oriented agriculture among female farmers, independent of productivity level, is, therefore, a clear channel through which large strides could be attained in closing the gender gap.

Furthermore, household adult male labor input at the plot level contributes differently toward the endowment and structure effect at different points of the agricultural productivity distribution. At the 10^{th} percentile, its statistically significant contribution towards the gender gap exists only through the endowment effect, while at the 90^{th} percentile, its effect exists only through the structure effect. The gender gap widening effect of being rationed out of household male labor is more pronounced for female farmers in the first half of the agricultural productivity distribution. At the upper deciles of the agricultural productivity distribution, the variable is associated with higher gender gap instead through its contribution towards the male structural advantage and the female structural disadvantage. While the underlying causes of this pattern need to be studied deeper, informal institutional constraints, including potential supervision difficulties associated with household adult male labor on female-managed plots, that may lead to higher returns to household adult male labor on male-managed plots could be more binding for female farmers of high productivity levels.

Finally, household wealth and access to agricultural implements are associated with sustained, positive contributions towards the endowment effect at each decile of interest. The latter finding marks the importance of access to labor-saving technologies in bridging the gap, especially since the farm duties of female managers are usually compounded by their duties at home. The sustained positive contributions of household child dependency ratio towards the structure effect throughout the productivity distribution lends support to this argument, since, as noted above, the relationship between this variable and agricultural productivity on female-managed plots is consistently negative.

8. CONCLUSION

This study offers a fresh look at gender differences in sub-Saharan African agricultural productivity, the alleviation of which have been advocated by governments and international donor community as one of the key drivers of broad, agriculture-based economic growth and ensuing gains in living standards. Our contribution to the literature is to (i) apply decomposition techniques that identify the relative quantitative importance of factors explaining the gender gap at the mean and other points of the agricultural productivity distribution, and (ii) to use nationally-representative data, collected within a multi-topic framework and with emphasis on agriculture.

While the gender gap in Malawi is estimated at 25.4 percent at the mean, it ranges from 22.6 percent at the 10th percentile to 37.6 percent at the 90th percentile. The findings support the view that large and significant gender disparities in use of inputs and asset ownership are the central factors behind the gender gap, particularly in the first half of the agricultural productivity distribution. At the mean and the median, the differences in observable covariates are associated with 82 and 87 percent of the gender gap, respectively. Above the median, the percentage contribution of the endowment effect towards the gender gap declines steadily, whereby at the 80th and 90th deciles of the distribution of agricultural productivity, the structure effect, which is driven by gender differences in returns to factors of production, explains 30 and 34 percent of the gender gap, respectively.

Higher levels of household adult male labor and area under export crop cultivation on male-managed plots, in particular, widen the gender gap; a result that holds true across the vast majority of the agricultural productivity distribution. These disparities appear to be compounded by gender differences in the availability of time devoted to productive activities, as negative returns to household child dependency ratio on female managed plots are found to exacerbate the female structural disadvantage component of the gender gap at each decile of the agricultural productivity distribution. In addition, lower and declining returns to household adult male labor on female managed plots *vis-à-vis* male-managed comparators across the agricultural productivity distribution might be suggestive of potential household adult male labor supervision difficulties on female-managed plots. These mutually reinforcing constraints appear to generate a female productivity trap; as such, policies need to prioritize and target the key factors underlying the gender gap.

Our study shows a number of factors that seem to be driving the gender differences in agricultural productivity in Malawi. While we demonstrate that diversification among female farmers into high-value agriculture (with appropriate adoption support and risk mitigation mechanisms), and counteracting the effects of household male labor shortages on female-managed plots with enhanced access to inorganic fertilizer, improved seeds and labor-saving agricultural implements could lead to significant contractions in the gender gap across the agricultural productivity distribution, our analysis alone is not enough to inform effective policy interventions that will ensure the realization of these outcomes. In other words, while we can quantify the relative contributions of various factors towards the gender gap, we cannot determine why inequalities in time use, access and returns to agricultural inputs, and the like persist. Although this limitation is inherent in the use of decomposition methods, our empirical approach identifies the key inequalities that will be the focus of our future research, which will seek to map out their determinants in order to inform policy interventions aimed at addressing the gender gap at its roots in Malawi and other parts of sub-Saharan Africa.

REFERENCES

Acemoglu, D., Johnson, S., & Robinson, J. A. (2001). "The colonial origins of comparative development: An empirical investigation." *American Economic Review*, 91 (5), 1369-1401.

Alene, A. D., Manyong, V. M., Omanya, G. O., Mignouna, H. D., Bokanga, M., & Odhiambo, G. D. (2008). "Economic efficiency and supply response of women as farm managers: Comparative evidence from Western Kenya." *World Development* 36 (7), 1247–1260.

Akresh, R. (2005). "Understanding pareto inefficient intrahousehold allocations." Discussion Paper No. 1858, IZA. Retrieved from http://ftp.iza.org/dp1858.pdf.

Altonji, J. (1988). "The effects of family background and school characteristics on education and labor market outcomes." Manuscript, Department of Economics, Northwestern University.

Altonji, J., Elder, T., & Taber, C. (2005). "Selection on observed and unobserved variables: Assessing the effectiveness of Catholic schools." *Journal of Political Economy*, 113, 151-184.

Blinder, A. (1973). "Wage discrimination: reduced form and structural estimates." *Journal of Human Resources*, 8, 436–455.

Chen, S., & Ravallion, M. (2008). "The developing world is poorer than we thought but no less successful in the fight against poverty." Washington, DC: The World Bank.

Doepke, M., & Tertilt, M. (2011). "Does female empowerment promote economic development?" Discussion Paper No. DP8441, CEPR.

FAO (2011). T*he state of food and agriculture: Women in agriculture – closing the gender gap for development.* Rome, Italy: FAO. Retrieved from http://www.fao.org/docrep/013/i2050e/i2050e.pdf.

_____ (2009). H*ow to feed the world in 2050. High level expert forum – the special challenge for sub-Saharan Africa.* Rome, Italy: FAO. Retrieved from http://www.fao.org/fileadmin/templates/wsfs/docs/Issues_papers/HLEF2050_Africa.pdf.

Firpo, S., Fortin, N. M., & Lemieux, T. (2009). "Unconditional quantile regressions." *Econometrica*, 77 (3), 953–973.

Fortin, N. M. (2006). "Greed, altruism, and the gender wage gap." Working Paper, Department of Economics, University of British Columbia. Retrieved from http://faculty.arts.ubc.ca/nfortin/Fortinat8.pdf.

Fortin, N., T. Lemieux, S. Firpo (2011). "Decomposition methods." In O. Ashenfelter & D. Card (Eds.), *Handbook of labor economics* (Vol. 4, Part A, 1-102) Amsterdam, Netherlands: North-Holland.

Gilbert, R. A., Sakala, W. D., & Benson, T. D. (2002). "Gender analysis of a nationwide cropping system trial survey in Malawi." *African Studies Quarterly*, 6 (1), Retrieved from http://web.africa.ufl.edu/asq/v6/v6i1a9.htm.

Goldstein, M., & Udry, C. (2008). "The profits of power: Land rights and agricultural investment in Ghana." *Journal of Political Economy* 116 (6), 981–1022.

Holden, S.T., R. Lunduka (2010). "Too poor to be efficient? Impacts of the targeted fertilizer subsidy program in Malawi on farm plot level input use, crop choice and land productivity." Noragric Report No. 55, Department of Economics and Resource Management, Norwegian University of Life Sciences.

Irz, X., Lin, L., Thirtle, C., & Wiggins, S. (2001). "Agricultural productivity growth and poverty alleviation." *Development Policy Review*, 19 (4), 449-466.

Imbens, W.G., & Rubin, B.D. (2009). *Causal inference in statistics, and in the social and biomedical sciences*. New York, NY: Cambridge University Press.

Jann, B. (2008). "The Blinder-Oaxaca decomposition for linear regression models." *The Stata Journal*¸ 8 (4), 453-479.

Larson, D. F., Otsuka, K., Matsumoto, T., & Kilic, T. (2012). "Should African rural development strategies depend on smallholder farms? An exploration of the inverse productivity hypothesis." Policy Research Working Paper No. 6190, The World Bank. Retrieved from http://elibrary.worldbank.org/content/workingpaper/10.1596/1813-9450-6190.

Ligon, E., & Sadoulet, E. (2008). "Estimating the effects of aggregate agricultural growth on the distribution of expenditures." Background Paper for the World Bank World Development Report 2008.

Malawi Ministry of Agriculture and Food Security (MoAFS) (2009). *The 2009/10 farm input subsidy programme implementation guidelines.* Lilongwe, Malawi: MoAFS.

Malawi National Statistical Office (NSO) (2012). *Malawi third integrated household survey 2010-2011 basic information document.* Zomba, Malawi: NSO.

Moock, P. R. (1976). "The efficiency of women as farm managers: Kenya." *American Journal of Agricultural Economics*, 58 (5), 831–835.

Murphy, K. M., & Topel, R. H. (1990). "Efficiency wages reconsidered: Theory and evidence." In Y. Weiss & R. H. Topel (Eds.), *Advances in the theory and measurement of unemployment* (204-240). New York, NY: St. Martin's Press.

Neumark, D. (1988). "Employers' discriminatory behavior and the estimation of wage discrimination." *Journal of Human Resources*, 23, 279–295.

Oaxaca, R. (1973). "Male-female wage differentials in urban labor markets." *International Economic Review*, 14, 693–709.

Oladeebo, J. O., & Fajuyigbe, A. A. (2007). "Technical efficiency of men and women upland rice farmers in Osun State, Nigeria." *Journal of Human Ecology*, 22 (2), 93–100.

O'Neill, J. E., & O'Neill, D. M. (2006). "What do wage differentials tell about labor market discrimination?" In S. W. Polachek, C. Chiswick & H. Rapoport (Eds.) *The economics of immigration and social diversity* (Research in labor economics series, Vol. 24, 293-357). Amsterdam, Netherlands: Elsevier.

Peterman, A., Quisumbing, A., Behrman, J., & Nkonya, E. (2011). "Understanding the complexities surrounding gender differences in agricultural productivity in Nigeria and Uganda." *Journal of Development Studies*, 47 (10), 1482-1509.

Quisumbing, A., Payongayong, E., Aidoo, J. B., & Otsuka, K. (2001). "Women's land rights in the transition to individualized ownership: Implications for the management of tree resources in western Ghana." *Economic Development and Cultural Change*, 50 (1), 157–182.

Ricker-Gilbert, J., & Jayne, T. (2012). "Do fertilizer subsidies boost staple crop production and reduce poverty across the distribution of smallholders in Africa? Quantile regression results from Malawi." Selected paper prepared for presentation at the International Association of Agricultural Economists (IAAE) Triennial Conference, Foz do Iguaçu, Brazil, 18-24 August, 2012. Retrieved from http://iaae.confex.com/iaae/iaae28/webprogram/Paper16263.html.

________________________ (2011). "What are the enduring effects of fertilizer subsidy programs on recipient farm households? Evidence from Malawi." Staff Paper, Department of Agricultural, Food and Resource Economics, Michigan State University.

Saito, K. A., Mekonnen, H., & Spurling, D. (1994). "Raising the productivity of women farmers in sub-Saharan Africa." Discussion Paper Series 230, Africa Technical Department, The World Bank. Retrieved from http://elibrary.worldbank.org/content/book/9780821327494.

Schultz, T. P. (2001). "Women's role in the agricultural household bargaining and human capital investments." In B. Gardner & G. Rausser (Eds.), *Agricultural and resource economics handbook* (383–456). Amsterdam, Netherlands: Elsevier.

Theroux, P. (2004). *Dark star safari: Overland from Cairo to Cape Town.* New York, NY: Houghton Mifflin Company.

Tiruneh, A., Testfaye, T., Mwangi, W., & Verkuijl, H. (2001). "Gender differentials in agricultural production and decision-making among smallholders in Ada, Lume, and Gimbichu woredas of the central highlands of Ethiopia." International Maize and Wheat

Improvement Center and Ethiopian Agricultural Research Organization: Mexico, DF, and Addis Ababa. Retrieved from http://repository.cimmyt.org/xmlui/bitstream/handle/10883/1018/73252.pdf?sequence=1

Udry, C. (1996). "Gender, agricultural production, and the theory of the household." *Journal of Political Economy,* 104 (5), 1010–1046.

Vargas Hill, R., & Vigneri, M. (2011). "Mainstreaming gender sensitivity in cash crop markets supply chains." Working Paper No. 11-08, ESA, FAO. Retrieved from http://www.fao.org/docrep/013/am313e/am313e00.pdf.

World Bank (WB) (2011). W*orld development report 2012: Gender equality and development.* Washington, DC: The World Bank. Retrieved from http://siteresources.worldbank.org/INTWDR2012/Resources/7778105-1299699968583/7786210-1315936222006/Complete-Report.pdf.

_________________ (2007). *Malawi: Country assistance strategy FY2007-FY2010.* Washington, DC: The World Bank.

Table 1: Descriptive Statistics & Results from Tests & Mean Differences by Gender of the Plot Manager

	Pooled Sample	*Male-Managed Plot Sample*	*Female-Managed Plot Sample*	*Difference*	
Outcome Variable					
Plot Gross Value of Output (MK)/HA	53,067	56,810	42,477	14,334	***
Plot Manager Characteristics					
Manager & Owner Overlap †	0.63	0.58	0.77	-0.19	***
Age (Years)	42.97	41.59	46.89	-5.30	***
Years of Schooling	5.06	5.67	3.33	2.33	***
Relationship to Household Head					
Head †	0.94	0.99	0.80	0.19	***
Wife/Husband †	0.05	0.01	0.19	-0.18	***
Child/Adopted Child †	0.01	0.00	0.01	-0.01	***
Other Relative †	0.00	0.00	0.00	0.00	*
Non-Relative †	0.00	0.00	0.00	0.00	
Plot Area					
GPS-Based Plot Area (HA)	0.39	0.41	0.36	0.05	***
Plot Ownership Status					
Exclusively Male Owned †	0.33	0.43	0.04	0.39	***
Exclusively Female Owned †	0.36	0.23	0.75	-0.53	***
Joint Male-Female Owned †	0.12	0.15	0.03	0.12	***
Not Owned †	0.19	0.19	0.17	0.01	
Plot Non-Labor Input Use					
Incidence of Pesticide/Herbicide Use †	0.02	0.02	0.01	0.01	***
Incidence of Organic Fertilizer Use †	0.12	0.12	0.11	0.01	
Incidence of Inorganic Fertilizer Use †	0.64	0.65	0.62	0.03	**
Inorganic Fertilizer Use (KG)/HA [Unconditional]	143.61	147.61	132.29	15.33	***
Inorganic Fertilizer Use (KG)/HA [Conditional]	224.35	228.03	213.49	14.54	***
Plot Labor Input Use					
Incidence of Household Male Labor Use †	0.83	0.97	0.43	0.55	***
Household Male Labor Use (Hours)/HA [Unconditional]	434.54	526.87	173.32	353.56	***
Household Male Labor Use (Hours)/HA [Conditional]	523.55	541.51	407.35	134.17	***
Incidence of Household Female Labor Use †	0.95	0.94	0.98	-0.04	***
Household Female Labor Use (Hours)/HA [Unconditional]	506.88	455.52	652.18	-196.66	***
Household Female Labor Use (Hours)/HA [Conditional]	532.83	484.20	664.76	-180.56	***
Incidence of Household Child Labor Use †	0.25	0.22	0.32	-0.10	***
Household Child Labor Use (Hours)/HA [Unconditional]	64.59	54.35	93.54	-39.19	***
Household Child Labor Use (Hours)/HA [Conditional]	261.13	245.86	290.83	-44.98	***
Incidence of Hired Labor Use †	0.23	0.24	0.23	0.01	
Hired Labor Use (Days)/HA [Unconditional]	6.46	6.33	6.83	-0.50	
Hired Labor Use (Days)/HA [Conditional]	27.66	26.80	30.19	-3.38	*
Incidence of Exchange Labor Use †	0.10	0.09	0.12	-0.04	***
Exchange Labor Use (Days)/HA [Unconditional]	1.34	1.15	1.87	-0.72	***
Exchange Labor Use (Days)/HA [Conditional]	14.06	13.52	15.10	-1.58	**
Plot Location					
Elevation (M)	928.38	946.02	878.46	67.56	***

Table 1 (Cont'd)

	Pooled Sample	*Male-Managed Plot Sample*	*Female-Managed Plot Sample*	*Difference*	
Plot Location					
Distance to Household (KM)	2.17	2.29	1.85	0.44	
Plot Cultivation					
Intercropped †	0.33	0.30	0.41	-0.11	***
Share of Plot Area Under Improved Seeds	0.38	0.39	0.35	0.04	***
Share of Plot Area Under Export Crops	0.08	0.10	0.03	0.07	***
Household Farm Organization					
Number of Plots Cultivated	2.26	2.34	2.03	0.31	***
Cultivates…					
1 Plot †	0.27	0.24	0.35	-0.11	***
2 Plots †	0.39	0.38	0.40	-0.02	
3 Plots †	0.22	0.25	0.16	0.08	***
4 Plots †	0.09	0.09	0.07	0.03	***
5+ Plots †	0.04	0.04	0.02	0.02	**
Other Household Characteristics					
Household Size	4.92	5.14	4.29	0.85	***
Child Dependency Ratio	0.69	0.68	0.71	-0.03	
Agricultural Extension Receipt †	0.28	0.29	0.25	0.04	***
Access to Non-Farm Labor Income †	0.43	0.44	0.39	0.05	***
Access to Non-Farm Non-Labor Income †	0.22	0.22	0.23	0.00	
Wealth Index	-0.63	-0.54	-0.89	0.35	***
Agricultural Implement Access Index	0.67	0.85	0.16	0.69	***
Distance to Nearest ADMARC (KM)	8.03	8.02	8.07	-0.04	
Household Agro-Ecological Zone Classification					
Tropic-warm/semiarid †	0.48	0.49	0.48	0.01	
Tropic-warm/subhumid †	0.30	0.28	0.35	-0.07	***
Tropic-cool/semiarid †	0.15	0.16	0.12	0.04	***
Tropic-cool/subhumid †	0.07	0.07	0.05	0.03	***
Household Regional Location					
North †	0.14	0.15	0.11	0.04	***
Central †	0.46	0.49	0.38	0.10	***
South †	0.40	0.36	0.51	-0.15	***
Observations	16,372	12,029 (73.5%)	4343 (26.5%)		

Note: The estimates are weighted in accordance with the complex survey design. ***/**/* indicate statistical significance at the 1/5/10 percent level, respectively. †denotes a dummy variable.

Table 2: Naïve Regression Results on Gender Differences in Agricultural Productivity

	Dependent Variable: Log[Plot Gross Value of Output (MK)/HA)		
	(1)	(2)	(3)
Female Plot Management †	-0.253***	-0.223***	-0.234***
	(0.023)	(0.023)	(0.022)
Fixed Effects	Agro-Ecological Zones	Regions	Districts
Observations	16,372	16,372	16,372
R-Squared	0.014	0.023	0.065

Note: The estimates are weighted in accordance with the complex survey design. ***/**/* indicate statistical significance at the 1/5/10 percent level, respectively. †denotes a dummy variable.

Table 3: Base OLS Regression Results Underlying the Mean Decomposition

Dependent Variable: Log[Plot Gross Value of Output (MK)/HA]

	Pooled Sample	*Male-Managed Plot Sample*	*Female-Managed Plot Sample*
Plot Manager Characteristics			
Female †	-0.045*		
	(0.027)		
Manager & Owner Overlap †	0.016	0.020	-0.015
	(0.020)	(0.022)	(0.040)
Age (Years)	-0.001	-0.002*	0.001
	(0.001)	(0.001)	(0.001)
Years of Schooling	0.007**	0.005	0.015***
	(0.003)	(0.003)	(0.005)
Plot Area			
Log[GPS-Based Plot Area (HA)]	-0.282***	-0.261***	-0.296***
	(0.030)	(0.034)	(0.046)
Log[GPS-Based Plot Area (HA) Squared]	0.044***	0.043***	0.042***
	(0.009)	(0.010)	(0.013)
Plot Non-Labor Input Use			
Incidence of Pesticide/Herbicide Use †	0.395***	0.360***	0.491***
	(0.076)	(0.077)	(0.136)
Incidence of Organic Fertilizer Use †	0.043	0.054*	0.017
	(0.027)	(0.032)	(0.045)
Log[Inorganic Fertilizer Use (KG)/HA]	0.077***	0.081***	0.066***
	(0.004)	(0.004)	(0.007)
Plot Labor Input Use			
Log[Household Male Labor Use (Hours)/HA]	0.028***	0.067***	0.005
	(0.005)	(0.009)	(0.007)
Log[Household Female Labor Use (Hours)/HA]	0.032***	0.016**	0.053***
	(0.007)	(0.008)	(0.015)
Log[Household Child Labor Use (Hours)/HA]	0.001	0.006	-0.011*
	(0.004)	(0.005)	(0.006)
Log[Hired Labor Use (Days)/HA]	0.079***	0.080***	0.088***
	(0.008)	(0.009)	(0.014)
Log[Exchange Labor Use (Days)/HA]	0.040***	0.042***	0.033
	(0.012)	(0.014)	(0.020)
Plot Location			
Elevation (M)	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)
Distance to Household (KM)	-0.001**	-0.001	-0.002***
	(0.001)	(0.001)	(0.001)
Plot Cultivation			
Intercropped †	0.110***	0.089***	0.165***
	(0.025)	(0.028)	(0.039)
Share of Plot Area Under Improved Seeds	0.099***	0.095***	0.099**
	(0.023)	(0.025)	(0.041)
Share of Plot Area Under Export Crops	1.213***	1.187***	1.255***
	(0.040)	(0.040)	(0.090)

Table 3 (Cont'd)

	Pooled Sample	*Male-Managed Plot Sample*	*Female-Managed Plot Sample*
Household Characteristics			
Household Size	0.014***	0.011*	0.033***
	(0.005)	(0.006)	(0.008)
Child Dependency Ratio	-0.011	0.032	-0.076***
	(0.016)	(0.020)	(0.029)
Agricultural Extension Receipt †	0.077***	0.053**	0.157***
	(0.021)	(0.022)	(0.040)
Access to Non-Farm Labor Income †	-0.076***	-0.075***	-0.057
	(0.019)	(0.021)	(0.037)
Access to Non-Farm Non-Labor Income †	-0.054**	-0.035	-0.097**
	(0.027)	(0.031)	(0.043)
Wealth Index	0.055***	0.062***	0.048***
	(0.006)	(0.006)	(0.011)
Agricultural Implement Access Index	0.042***	0.041***	0.043***
	(0.008)	(0.010)	(0.014)
Distance to Nearest ADMARC (KM)	0.001	0.004	-0.005
	(0.003)	(0.003)	(0.005)
Household Agro-Ecological Zone Classification			
Tropic-warm/semiarid †	0.170**	0.186**	0.071
	(0.071)	(0.077)	(0.085)
Tropic-warm/subhumid †	0.099	0.135*	-0.035
	(0.073)	(0.081)	(0.093)
Tropic-cool/semiarid †	0.073	0.119	-0.103
	(0.079)	(0.086)	(0.090)
Observations	16,372	12,029	4,343
R-Squared	0.336	0.342	0.307

Note: The estimates are weighted in accordance with the complex survey design. ***/**/* indicate statistical significance at the 1/5/10 percent level, respectively. †denotes a dummy variable.

Table 4: Decomposition of the Gender Differential in Agricultural Productivity

Agricultural Productivity Proxied by Log[Plot Gross Value of Output (MK)/HA]

A. Mean Gender Differential			
Mean Male-Managed Plot Agricultural Productivity		10.454***	
		(0.017)	
Mean Female-Managed Plot Agricultural Productivity		10.199***	
		(0.024)	
Mean Gender Differential in Agricultural Productivity		0.254***	
		(0.023)	

B. Aggregate Decomposition	*Endowment Effect*	*Male Structural Advantage*	*Female Structural Disadvantage*
TOTAL	0.209***	0.000	0.045*
	(0.024)	(0.002)	(0.027)
Share of the Gender Differential	82%	0%	18%

C. Detailed Decomposition	*Endowment Effect*	*Male Structural Advantage*	*Female Structural Disadvantage*
Plot Manager Characteristics			
Manager & Owner Overlap †	-0.003	0.002	0.024
	(0.004)	(0.006)	(0.027)
Age (Years)	0.004	-0.036*	-0.072*
	(0.003)	(0.019)	(0.044)
Years of Schooling	0.016**	-0.011	-0.028*
	(0.007)	(0.007)	(0.015)
Plot Area			
Log[GPS-Based Plot Area (HA)]	-0.035***	-0.025	-0.018
	(0.007)	(0.017)	(0.054)
Log[GPS-Based Plot Area (HA) Squared]	-0.016***	-0.001	0.004
	(0.004)	(0.010)	(0.026)
Plot Non-Labor Input Use			
Incidence of Pesticide/Herbicide Use †	0.003***	-0.001	-0.001
	(0.001)	(0.000)	(0.001)
Incidence of Organic Fertilizer Use †	0.000	0.001	0.003
	(0.000)	(0.002)	(0.005)
Log[Inorganic Fertilizer Use (KG)/HA]	0.016***	0.012*	0.035*
	(0.004)	(0.007)	(0.018)
Plot Labor Input Use			
Log[Household Male Labor Use (Hours)/HA]	0.096***	0.220***	0.055***
	(0.018)	(0.043)	(0.011)
Log[Household Female Labor Use (Hours)/HA]	-0.017***	-0.084***	-0.129*
	(0.004)	(0.018)	(0.077)
Log[Household Child Labor Use (Hours)/HA]	-0.000	0.006**	0.020**
	(0.002)	(0.003)	(0.009)
Log[Hired Labor Use (Days)/HA]	0.001	0.001	-0.006
	(0.003)	(0.003)	(0.008)
Log[Exchange Labor Use (Days)/HA]	-0.004***	0.000	0.002
	(0.002)	(0.002)	(0.005)
Plot Location			
Elevation (M)	0.015***	-0.020	-0.035
	(0.004)	(0.021)	(0.054)
Distance to Household (KM)	-0.001	0.001	0.002
	(0.000)	(0.001)	(0.002)

Table 4 (Cont'd)

C. Detailed Decomposition (cont.)	*Endowment Effect*	*Male Structural Advantage*	*Female Structural Disadvantage*
Plot Cultivation			
Intercropped †	-0.012***	-0.006	-0.023*
	(0.003)	(0.004)	(0.013)
Share of Plot Area Under Improved Seeds	0.004***	-0.002	-0.000
	(0.001)	(0.005)	(0.012)
Share of Plot Area Under Export Crops	0.084***	-0.003**	-0.001
	(0.007)	(0.001)	(0.002)
Household Characteristics			
Household Size	0.012***	-0.017	-0.080**
	(0.004)	(0.015)	(0.032)
Child Dependency Ratio	0.000	0.029***	0.047***
	(0.001)	(0.011)	(0.016)
Household Characteristics			
Agricultural Extension Receipt †	0.003**	-0.007**	-0.020**
	(0.001)	(0.003)	(0.008)
Access to Non-Farm Labor Income †	-0.004**	0.001	-0.007
	(0.002)	(0.005)	(0.012)
Access to Non-Farm Non-Labor Income †	0.000	0.004	0.010
	(0.001)	(0.003)	(0.009)
Wealth Index	0.019***	-0.004**	-0.007
	(0.004)	(0.002)	(0.008)
Agricultural Implement Access Index	0.029***	-0.000	-0.000
	(0.006)	(0.004)	(0.002)
Distance to Nearest ADMARC (KM)	-0.000	0.024**	0.052**
	(0.000)	(0.010)	(0.022)
Household Agro-Ecological Zone Classification [Aggregated]	-0.003	0.001	0.014
	(0.004)	(0.004)	(0.018)
Observations		16,372	

Note: The estimates are weighted in accordance with the complex survey design. ***/**/* indicate statistical significance at the 1/5/10 percent level, respectively. †denotes a dummy variable.

Table 5: Exploring the Presence of Omitted Variable Bias in Base OLS Regression Results Underlying the Mean Decomposition

Dependent Variable: Log[Plot Gross Value of Output (MK)/HA]

Pooled Sample

		Category of Additional Covariates Integrated into the Base Regression				
	Base	*District Fixed Effects*	*Plot Geospatial Characteristics*	*Other Plot Characteristics*	*Household Characteristics*	*Community Characteristics*
Plot Manager Characteristics						
Female †	-0.045*	-0.059**	-0.051*	-0.049*	-0.048*	-0.041
	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)
Manager & Owner Overlap †	0.016	0.004	0.022	0.015	0.016	0.014
	(0.020)	(0.019)	(0.019)	(0.020)	(0.020)	(0.020)
Age (Years)	-0.001	-0.001	-0.001	-0.001	0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Years of Schooling	0.007**	0.003	0.006**	0.007**	0.007**	0.007**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Plot Area						
Log[GPS-Based Plot Area (HA)]	-0.282***	-0.296***	-0.284***	-0.284***	-0.278***	-0.287***
	(0.030)	(0.029)	(0.030)	(0.030)	(0.030)	(0.029)
Log[GPS-Based Plot Area (HA) Squared]	0.044***	0.045***	0.045***	0.044***	0.045***	0.043***
	(0.009)	(0.008)	(0.009)	(0.009)	(0.009)	(0.009)
Plot Non-Labor Input Use						
Incidence of Pesticide/Herbicide Use †	0.395***	0.436***	0.377***	0.390***	0.397***	0.397***
	(0.076)	(0.068)	(0.074)	(0.078)	(0.077)	(0.075)
Incidence of Organic Fertilizer Use †	0.043	0.042	0.051**	0.046*	0.043	0.041
	(0.027)	(0.027)	(0.026)	(0.028)	(0.027)	(0.027)
Log[Inorganic Fertilizer Use (KG)/HA]	0.077***	0.081***	0.080***	0.077***	0.077***	0.078***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Plot Labor Input Use						
Log[Household Male Labor Use (Hours)/HA]	0.028***	0.027***	0.027***	0.028***	0.030***	0.029***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)	(0.005)
Log[Household Female Labor Use (Hours)/HA]	0.032***	0.030***	0.031***	0.032***	0.034***	0.032***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.008)	(0.007)
Log[Household Child Labor Use (Hours)/HA]	0.001	0.000	0.003	0.001	-0.003	-0.000
	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.004)
Log[Hired Labor Use (Days)/HA]	0.079***	0.075***	0.074***	0.080***	0.079***	0.078***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Log[Exchange Labor Use (Days)/HA]	0.040***	0.026**	0.032***	0.038***	0.041***	0.039***
	(0.012)	(0.011)	(0.011)	(0.012)	(0.012)	(0.012)
Plot Location						
Elevation (M)	0.000***	0.000	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Table 5 (Cont'd)

		Category of Additional Covariates Integrated into the Base Regression				
	Base	*District Fixed Effects*	*Plot Geospatial Characteristics*	*Other Plot Characteristics*	*Household Characteristics*	*Community Characteristics*
Plot Location						
Distance to Household (KM)	-0.001**	-0.001	-0.001	-0.001**	-0.001**	-0.001**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Plot Cultivation						
Intercropped †	0.110***	0.291***	0.179***	0.096***	0.111***	0.114***
	(0.025)	(0.027)	(0.025)	(0.026)	(0.025)	(0.025)
Share of Plot Area Under Improved Seeds	0.099***	0.079***	0.100***	0.094***	0.097***	0.100***
	(0.023)	(0.022)	(0.022)	(0.022)	(0.023)	(0.023)
Share of Plot Area Under Export Crops	1.213***	1.183***	1.218***	1.230***	1.213***	1.205***
	(0.040)	(0.040)	(0.040)	(0.041)	(0.039)	(0.040)
Household Characteristics						
Household Size	0.014***	0.011**	0.012***	0.013***	-0.067***	0.015***
	(0.005)	(0.004)	(0.004)	(0.005)	(0.024)	(0.005)
Child Dependency Ratio	-0.011	-0.014	-0.020	-0.008	-0.014	-0.012
	(0.016)	(0.015)	(0.015)	(0.016)	(0.022)	(0.016)
Agricultural Extension Receipt †	0.077***	0.034*	0.071***	0.075***	0.079***	0.082***
	(0.021)	(0.019)	(0.020)	(0.021)	(0.021)	(0.021)
Access to Non-Farm Labor Income †	-0.076***	-0.076***	-0.075***	-0.076***	-0.080***	-0.075***
	(0.019)	(0.017)	(0.018)	(0.019)	(0.019)	(0.019)
Access to Non-Farm Non-Labor Income †	-0.054**	-0.010	-0.027	-0.053*	-0.057**	-0.054**
	(0.027)	(0.025)	(0.024)	(0.028)	(0.027)	(0.027)
Wealth Index	0.055***	0.059***	0.055***	0.056***	0.055***	0.055***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Agricultural Implement Access Index	0.042***	0.030***	0.038***	0.041***	0.042***	0.041***
	(0.008)	(0.008)	(0.008)	(0.009)	(0.009)	(0.009)
Distance to Nearest ADMARC (KM)	0.001	0.003	0.002	0.001	0.002	0.001
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Household Agro-Ecological Zone Classification						
Tropic-warm/semiarid †	0.170**	0.017	0.190***	0.175**	0.171**	0.183***
	(0.071)	(0.088)	(0.069)	(0.072)	(0.074)	(0.065)
Tropic-warm/subhumid †	0.099	0.157*	0.158**	0.096	0.101	0.115
	(0.073)	(0.086)	(0.073)	(0.075)	(0.076)	(0.071)
Tropic-cool/semiarid †	0.073	-0.044	0.098	0.069	0.068	0.093
	(0.079)	(0.089)	(0.074)	(0.080)	(0.081)	(0.075)
Observations	16,372	16,372	16,016	16,153	16,372	16,234
Adjusted R-Squared	0.335	0.365	0.357	0.335	0.336	0.336

Note: The estimates are weighted in accordance with the complex survey design. ***/**/* indicate statistical significance at the 1/5/10 percent level, respectively. †denotes a dummy variable.

Table 6: Exploring the Presence of Omitted Variable Bias in Base OLS Regression Results Underlying the Mean Decomposition

Dependent Variable: Log[Plot Gross Value of Output (MK)/HA]

Male-Managed Plot Sample

		Category of Additional Covariates Integrated into the Base Regression				
	Base	*District Fixed Effects*	*Plot Geospatial Characteristics*	*Other Plot Characteristics*	*Household Characteristics*	*Community Characteristics*
Plot Manager Characteristics						
Female †						
Manager & Owner Overlap †	0.020	-0.005	0.024	0.018	0.021	0.018
	(0.022)	(0.022)	(0.022)	(0.023)	(0.022)	(0.022)
Age (Years)	-0.002*	-0.002*	-0.002*	-0.002**	0.000	-0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Years of Schooling	0.005	0.002	0.004	0.005	0.005	0.005
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Plot Area						
Log[GPS-Based Plot Area (HA)]	-0.261***	-0.267***	-0.260***	-0.262***	-0.262***	-0.268***
	(0.034)	(0.034)	(0.035)	(0.035)	(0.034)	(0.034)
Log[GPS-Based Plot Area (HA) Squared]	0.043***	0.046***	0.045***	0.044***	0.043***	0.042***
	(0.010)	(0.010)	(0.011)	(0.011)	(0.010)	(0.010)
Plot Non-Labor Input Use						
Incidence of Pesticide/Herbicide Use †	0.360***	0.405***	0.326***	0.358***	0.367***	0.363***
	(0.077)	(0.070)	(0.075)	(0.078)	(0.077)	(0.077)
Incidence of Organic Fertilizer Use †	0.054*	0.046	0.063**	0.056*	0.055*	0.052*
	(0.032)	(0.032)	(0.031)	(0.032)	(0.032)	(0.031)
Log[Inorganic Fertilizer Use (KG)/HA]	0.081***	0.084***	0.083***	0.080***	0.081***	0.081***
	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)
Plot Labor Input Use						
Log[Household Male Labor Use (Hours)/HA]	0.067***	0.066***	0.063***	0.067***	0.065***	0.069***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Log[Household Female Labor Use (Hours)/HA]	0.016**	0.015*	0.017**	0.017**	0.019**	0.017**
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Log[Household Child Labor Use (Hours)/HA]	0.006	0.007	0.007	0.006	0.004	0.005
	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)	(0.005)
Log[Hired Labor Use (Days)/HA]	0.080***	0.076***	0.076***	0.081***	0.081***	0.080***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Log[Exchange Labor Use (Days)/HA]	0.042***	0.028**	0.036***	0.040***	0.044***	0.041***
	(0.014)	(0.014)	(0.013)	(0.014)	(0.014)	(0.014)
Plot Location						
Elevation (M)	0.000***	0.000	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Table 6 (Cont'd)

		Category of Additional Covariates Integrated into the Base Regression				
	Base	*District Fixed Effects*	*Plot Geospatial Characteristics*	*Other Plot Characteristics*	*Household Characteristics*	*Community Characteristics*
Plot Location						
Distance to Household (KM)	-0.001	-0.000	0.000	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Plot Cultivation						
Intercropped †	0.089***	0.270***	0.156***	0.077***	0.089***	0.094***
	(0.028)	(0.032)	(0.029)	(0.029)	(0.028)	(0.029)
Share of Plot Area Under Improved Seeds	0.095***	0.078***	0.091***	0.088***	0.093***	0.098***
	(0.025)	(0.023)	(0.024)	(0.025)	(0.024)	(0.025)
Share of Plot Area Under Export Crops	1.187***	1.162***	1.191***	1.202***	1.183***	1.178***
	(0.040)	(0.040)	(0.040)	(0.042)	(0.040)	(0.040)
Household Characteristics						
Household Size	0.011*	0.008	0.008	0.010*	-0.061**	0.012**
	(0.006)	(0.006)	(0.006)	(0.006)	(0.028)	(0.006)
Child Dependency Ratio	0.032	0.024	0.024	0.033	0.039	0.029
	(0.020)	(0.019)	(0.020)	(0.021)	(0.028)	(0.021)
Agricultural Extension Receipt †	0.053**	0.015	0.048**	0.053**	0.054**	0.056**
	(0.022)	(0.021)	(0.022)	(0.022)	(0.022)	(0.023)
Access to Non-Farm Labor Income †	-0.075***	-0.076***	-0.081***	-0.073***	-0.076***	-0.071***
	(0.021)	(0.020)	(0.021)	(0.021)	(0.022)	(0.022)
Access to Non-Farm Non-Labor Income †	-0.035	0.004	-0.011	-0.028	-0.035	-0.031
	(0.031)	(0.029)	(0.029)	(0.032)	(0.031)	(0.030)
Wealth Index	0.062***	0.066***	0.061***	0.063***	0.062***	0.062***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Agricultural Implement Access Index	0.041***	0.029***	0.038***	0.041***	0.041***	0.040***
	(0.010)	(0.010)	(0.009)	(0.010)	(0.010)	(0.010)
Distance to Nearest ADMARC (KM)	0.004	0.005*	0.003	0.004	0.004	0.004
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Household Agro-Ecological Zone Classification						
Tropic-warm/semiarid †	0.186**	0.038	0.213***	0.196**	0.189**	0.215***
	(0.077)	(0.091)	(0.076)	(0.078)	(0.081)	(0.070)
Tropic-warm/subhumid †	0.135*	0.168*	0.174**	0.136*	0.136*	0.161**
	(0.081)	(0.091)	(0.080)	(0.082)	(0.082)	(0.077)
Tropic-cool/semiarid †	0.119	-0.005	0.158**	0.117	0.118	0.152*
	(0.086)	(0.093)	(0.080)	(0.087)	(0.088)	(0.082)
Observations	12,029	12,029	11,755	11,887	12,029	11,920
R-Squared	0.341	0.369	0.360	0.341	0.341	0.343

Note: The estimates are weighted in accordance with the complex survey design. ***/**/* indicate statistical significance at the 1/5/10 percent level, respectively. †denotes a dummy variable.

Table 7: Exploring the Presence of Omitted Variable Bias in Base OLS Regression Results Underlying the Mean Decomposition

Dependent Variable: Log[Plot Gross Value of Output (MK)/HA]

Female-Managed Plot Sample

		Category of Additional Covariates Integrated into the Base Regression				
	Base	*District Fixed Effects*	*Plot Geospatial Characteristics*	*Other Plot Characteristics*	*Household Characteristics*	*Community Characteristics*
Plot Manager Characteristics						
Female †						
Manager & Owner Overlap †	-0.015	0.026	-0.004	-0.009	-0.018	-0.014
	(0.040)	(0.038)	(0.038)	(0.041)	(0.040)	(0.040)
Age (Years)	0.001	-0.000	0.000	0.001	0.002	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Years of Schooling	0.015***	0.011**	0.015***	0.015***	0.015***	0.014***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Plot Area						
Log[GPS-Based Plot Area (HA)]	-0.296***	-0.326***	-0.322***	-0.292***	-0.288***	-0.299***
	(0.046)	(0.046)	(0.049)	(0.047)	(0.046)	(0.046)
Log[GPS-Based Plot Area (HA) Squared]	0.042***	0.039***	0.040***	0.043***	0.044***	0.041***
	(0.013)	(0.013)	(0.014)	(0.013)	(0.013)	(0.013)
Plot Non-Labor Input Use						
Incidence of Pesticide/Herbicide Use †	0.491***	0.526***	0.536***	0.471***	0.487***	0.501***
	(0.136)	(0.118)	(0.119)	(0.139)	(0.137)	(0.134)
Incidence of Organic Fertilizer Use †	0.017	0.030	0.020	0.022	0.013	0.008
	(0.045)	(0.044)	(0.043)	(0.046)	(0.046)	(0.046)
Log[Inorganic Fertilizer Use (KG)/HA]	0.066***	0.068***	0.070***	0.065***	0.065***	0.065***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Plot Labor Input Use						
Log[Household Male Labor Use (Hours)/HA]	0.005	0.004	0.003	0.006	0.007	0.006
	(0.007)	(0.006)	(0.006)	(0.007)	(0.008)	(0.007)
Log[Household Female Labor Use (Hours)/HA]	0.053***	0.050***	0.051***	0.056***	0.050***	0.054***
	(0.015)	(0.015)	(0.015)	(0.016)	(0.015)	(0.016)
Log[Household Child Labor Use (Hours)/HA]	-0.011*	-0.013**	-0.007	-0.011*	-0.015**	-0.011*
	(0.006)	(0.006)	(0.006)	(0.006)	(0.007)	(0.006)
Log[Hired Labor Use (Days)/HA]	0.088***	0.087***	0.084***	0.090***	0.088***	0.090***
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Log[Exchange Labor Use (Days)/HA]	0.033	0.023	0.018	0.030	0.029	0.032*
	(0.020)	(0.019)	(0.018)	(0.020)	(0.020)	(0.019)
Plot Location						
Elevation (M)	0.000***	0.000	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Table 7 (Cont'd)

		Category of Additional Covariates Integrated into the Base Regression				
	Base	*District Fixed Effects*	*Plot Geospatial Characteristics*	*Other Plot Characteristics*	*Household Characteristics*	*Community Characteristics*
Plot Location						
Distance to Household (KM)	-0.002***	-0.002***	-0.003***	-0.002**	-0.002***	-0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Plot Cultivation						
Intercropped †	0.165***	0.344***	0.233***	0.146***	0.167***	0.169***
	(0.039)	(0.040)	(0.039)	(0.040)	(0.038)	(0.038)
Share of Plot Area Under Improved Seeds	0.099**	0.070*	0.107***	0.101**	0.098**	0.093**
	(0.041)	(0.040)	(0.037)	(0.041)	(0.042)	(0.043)
Share of Plot Area Under Export Crops	1.255***	1.212***	1.245***	1.273***	1.277***	1.257***
	(0.090)	(0.096)	(0.089)	(0.092)	(0.090)	(0.091)
Household Characteristics						
Household Size	0.033***	0.028***	0.028***	0.031***	-0.020	0.032***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.044)	(0.008)
Child Dependency Ratio	-0.076***	-0.080***	-0.090***	-0.072**	-0.047	-0.075**
	(0.029)	(0.027)	(0.026)	(0.029)	(0.032)	(0.029)
Agricultural Extension Receipt †	0.157***	0.103***	0.147***	0.149***	0.157***	0.168***
	(0.040)	(0.038)	(0.036)	(0.041)	(0.040)	(0.040)
Access to Non-Farm Labor Income †	-0.057	-0.048	-0.041	-0.059	-0.060	-0.062*
	(0.037)	(0.035)	(0.034)	(0.037)	(0.037)	(0.037)
Access to Non-Farm Non-Labor Income †	-0.097**	-0.045	-0.068*	-0.106**	-0.113***	-0.104**
	(0.043)	(0.038)	(0.040)	(0.044)	(0.042)	(0.043)
Wealth Index	0.048***	0.054***	0.051***	0.047***	0.043***	0.045***
	(0.011)	(0.011)	(0.011)	(0.012)	(0.011)	(0.011)
Agricultural Implement Access Index	0.043***	0.030**	0.042***	0.042***	0.042***	0.041***
	(0.014)	(0.014)	(0.012)	(0.014)	(0.014)	(0.014)
Distance to Nearest ADMARC (KM)	-0.005	-0.002	-0.000	-0.006	-0.004	-0.004
	(0.005)	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)
Household Agro-Ecological Zone Classification						
Tropic-warm/semiarid †	0.071	-0.127	0.096	0.053	0.071	0.026
	(0.085)	(0.138)	(0.085)	(0.090)	(0.088)	(0.087)
Tropic-warm/subhumid †	-0.035	0.046	0.078	-0.055	-0.022	-0.064
	(0.093)	(0.136)	(0.093)	(0.098)	(0.094)	(0.095)
Tropic-cool/semiarid †	-0.103	-0.217	-0.117	-0.115	-0.116	-0.127
	(0.090)	(0.135)	(0.090)	(0.096)	(0.095)	(0.092)
Observations	4,343	4,343	4,261	4,266	4,343	4,314
R-Squared	0.303	0.338	0.334	0.299	0.308	0.303

Note: The estimates are weighted in accordance with the complex survey design. ***/**/* indicate statistical significance at the 1/5/10 percent level, respectively. †denotes a dummy variable.

Table 8: Aggregate Decomposition of the Gender Differential in Agricultural Productivity At Selected Points of the Agricultural Productivity Distribution

Agricultural Productivity Proxied by Log[Plot Gross Value of Output (MK)/HA]

	Mean	*10th Percentile*	*20th Percentile*	*30th Percentile*	*40th Percentile*	*50th Percentile*	*60th Percentile*	*70th Percentile*	*80th Percentile*	*90th Percentile*
A. Gender Differential										
Male-Managed Plot Value	10.454***	9.202***	9.654***	9.963***	10.220***	10.455***	10.685***	10.932***	11.256***	11.737***
	(0.017)	(0.029)	(0.023)	(0.019)	(0.018)	(0.017)	(0.017)	(0.019)	(0.020)	(0.025)
Female-Managed Plot Value	10.200***	8.976***	9.456***	9.750***	9.997***	10.223***	10.423***	10.671***	10.937***	11.361***
	(0.023)	(0.043)	(0.034)	(0.028)	(0.026)	(0.024)	(0.024)	(0.027)	(0.025)	(0.041)
Gender Differential	0.254***	0.226***	0.198***	0.213***	0.223***	0.233***	0.262***	0.260***	0.319***	0.376***
	(0.023)	(0.045)	(0.036)	(0.029)	(0.027)	(0.025)	(0.024)	(0.028)	(0.028)	(0.043)
B. Aggregate Decomposition										
Endowment Effect	0.209***	0.244***	0.236***	0.218***	0.199***	0.203***	0.188***	0.207***	0.224***	0.250***
	(0.024)	(0.042)	(0.033)	(0.031)	(0.029)	(0.026)	(0.026)	(0.031)	(0.030)	(0.042)
Share of the Gender Differential	82.3%	107.9%	118.8%	102.4%	89.1%	87.3%	71.9%	79.6%	70.2%	66.5%
Male Structural Advantage	0.000	0.000	0.000	-0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.002)	(0.003)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.003)
Share of the Gender Differential	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Female Structural Disadvantage	0.045*	-0.018	-0.037	-0.005	0.024	0.030	0.074**	0.053	0.095***	0.126**
	(0.027)	(0.053)	(0.044)	(0.037)	(0.037)	(0.034)	(0.033)	(0.037)	(0.035)	(0.052)
Share of the Gender Differential	17.7%	-7.9%	-18.8%	-2.4%	10.9%	12.7%	28.1%	20.4%	29.8%	33.5%
Observations	16,372									

Note: The estimates are weighted in accordance with the complex survey design. ***/**/* indicate statistical significance at the 1/5/10 percent level, respectively.

Table 9: Detailed Decomposition of the Gender Differential in Agricultural Productivity At Selected Points of the Agricultural Productivity Distribution

Agricultural Productivity Proxied by Log[Plot Gross Value of Output (MK)/HA]

A. Gender Differential	**Mean**	**10th Percentile**	**50th Percentile**	**90th Percentile**
Male-Managed Plot Value	10.454***	9.202***	10.455***	11.737***
	(0.017)	(0.029)	(0.017)	(0.025)
Female-Managed Plot Value	10.199***	8.976***	10.223***	11.361***
	(0.024)	(0.043)	(0.024)	(0.041)
Gender Differential	0.254***	0.226***	0.233***	0.376***
	(0.023)	(0.045)	(0.025)	(0.043)

B. Aggregate Decomposition	*Endowment Effect*				*Male Structural Advantage*				*Female Structural Disadvantage*			
	Mean	*10th*	*50th*	*90th*	*Mean*	*10th*	*50th*	*90th*	*Mean*	*10th*	*50th*	*90th*
TOTAL	0.209***	0.244***	0.203***	0.250***	0.000	0.000	0.000	0.000	0.045*	-0.018	0.030	0.126**
	(0.024)	(0.042)	(0.026)	(0.042)	(0.002)	(0.003)	(0.002)	(0.003)	(0.027)	(0.053)	(0.034)	(0.052)
Share of the Gender Differential	82.1%	107.9%	87.3%	66.5%	0.0%	0.0%	0.0%	0.0%	17.6%	-7.9%	12.7%	33.5%

C. Detailed Decomposition	*Endowment Effect*				*Male Structural Advantage*				*Female Structural Disadvantage*			
	Mean	*10th*	*50th*	*90th*	*Mean*	*10th*	*50th*	*90th*	*Mean*	*10th*	*50th*	*90th*
Plot Manager Characteristics												
Manager & Owner Overlap †	-0.003	-0.018**	-0.001	0.006	0.002	-0.000	0.003	0.008	0.024	0.006	0.036	0.041
	(0.004)	(0.008)	(0.004)	(0.007)	(0.006)	(0.012)	(0.007)	(0.012)	(0.027)	(0.058)	(0.031)	(0.055)
Age (Years)	0.004	0.005	-0.000	0.006	-0.036*	-0.042	-0.051**	0.017	-0.072*	-0.098	-0.091*	0.021
	(0.003)	(0.008)	(0.004)	(0.006)	(0.019)	(0.048)	(0.021)	(0.037)	(0.044)	(0.106)	(0.049)	(0.087)
Years of Schooling	0.016**	0.022	0.023***	0.007	-0.011	-0.024	-0.007	-0.020	-0.028*	-0.061*	-0.015	-0.053
	(0.007)	(0.014)	(0.008)	(0.011)	(0.007)	(0.016)	(0.009)	(0.017)	(0.015)	(0.032)	(0.018)	(0.037)
Plot Area												
Log[GPS-Based Plot Area (HA)]	-0.035***	-0.078***	-0.036***	0.009	-0.025	-0.054	-0.049***	-0.033	-0.018	-0.161	-0.079	-0.050
	(0.007)	(0.015)	(0.007)	(0.007)	(0.017)	(0.038)	(0.019)	(0.040)	(0.054)	(0.134)	(0.059)	(0.121)
Log[GPS-Based Plot Area (HA) Sq.]	-0.016***	0.023***	-0.011***	-0.071***	-0.001	0.001	0.017*	-0.030	0.004	0.034	0.047*	-0.036
	(0.004)	(0.007)	(0.003)	(0.015)	(0.010)	(0.017)	(0.010)	(0.029)	(0.026)	(0.054)	(0.025)	(0.068)
Plot Non-Labor Input Use												
Incidence of Pesticide/Herbicide Use †	0.003***	0.002*	0.002***	0.005***	-0.001	-0.001*	-0.001**	0.001	-0.001	-0.003	-0.002*	0.005
	(0.001)	(0.001)	(0.001)	(0.002)	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)	(0.002)	(0.001)	(0.003)
Incidence of Organic Fertilizer Use †	0.000	0.001	0.001	0.001	0.001	-0.002	0.000	0.005	0.003	-0.005	0.001	0.014
	(0.000)	(0.001)	(0.001)	(0.001)	(0.002)	(0.004)	(0.002)	(0.004)	(0.005)	(0.011)	(0.005)	(0.010)
Log[Inorganic Fertilizer Use (KG)/HA]	0.016***	0.028***	0.015***	0.007***	0.012*	-0.009	0.008	0.009	0.035*	-0.017	0.027	0.032
	(0.004)	(0.008)	(0.004)	(0.002)	(0.007)	(0.016)	(0.009)	(0.014)	(0.018)	(0.042)	(0.022)	(0.037)
Plot Labor Input Use												
Log[HH Male Labor Use (Hours)/HA]	0.096***	0.181***	0.100***	0.046	0.220***	0.128	0.217***	0.404***	0.055***	0.024	0.047***	0.114***
	(0.018)	(0.034)	(0.020)	(0.034)	(0.043)	(0.083)	(0.050)	(0.088)	(0.011)	(0.022)	(0.014)	(0.024)
Log[HH Female Labor Use (Hours)/HA]	-0.017***	-0.026***	-0.013***	-0.015**	-0.084***	-0.115***	-0.080***	-0.128***	-0.129*	-0.372**	-0.099	-0.227
	(0.004)	(0.007)	(0.004)	(0.007)	(0.018)	(0.037)	(0.020)	(0.042)	(0.077)	(0.167)	(0.085)	(0.182)
Log[HH Child Labor Use (Hours)/HA]	-0.000	0.000	-0.000	-0.001	0.006**	0.007	0.006*	0.001	0.020**	0.015	0.022**	0.005
	(0.002)	(0.005)	(0.003)	(0.005)	(0.003)	(0.006)	(0.004)	(0.006)	(0.009)	(0.020)	(0.011)	(0.018)

Table 9 (Cont'd)

	Endowment Effect				*Male Structural Advantage*				*Female Structural Disadvantage*			
	Mean	*10th*	*50th*	*90th*	*Mean*	*10th*	*50th*	*90th*	*Mean*	*10th*	*50th*	*90th*
Log[Hired Labor Use (Days)/HA]	0.001	0.001	0.001	0.002	0.001	-0.003	0.002	-0.001	-0.006	-0.012	-0.003	-0.017
	(0.003)	(0.002)	(0.003)	(0.004)	(0.003)	(0.006)	(0.003)	(0.007)	(0.008)	(0.015)	(0.010)	(0.019)
Log[Exchange Labor Use (Days)/HA]	-0.004***	-0.005**	-0.005**	-0.002	0.000	0.000	0.001	-0.001	0.002	0.004	0.003	-0.001
	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.004)	(0.005)	(0.009)	(0.006)	(0.010)
Plot Location												
Elevation (M)	0.015***	0.035***	0.012***	-0.006	-0.020	-0.032	-0.005	-0.068*	-0.035	-0.081	-0.002	-0.165*
	(0.004)	(0.009)	(0.004)	(0.005)	(0.021)	(0.047)	(0.024)	(0.038)	(0.054)	(0.120)	(0.063)	(0.100)
Distance to Household (KM)	-0.001	-0.001	-0.001	0.001	0.001	-0.000	0.001	0.002	0.002	-0.003	0.002	0.003
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)	(0.004)	(0.002)	(0.003)
Plot Cultivation												
Intercropped †	-0.012***	-0.008	-0.014***	-0.013***	-0.006	-0.016*	-0.003	-0.005	-0.023*	-0.051*	-0.012	-0.016
	(0.003)	(0.005)	(0.004)	(0.004)	(0.004)	(0.009)	(0.005)	(0.007)	(0.013)	(0.029)	(0.016)	(0.023)
Share of Plot Area Under Improved Seeds	0.004***	0.006**	0.006***	-0.000	-0.002	0.016	-0.002	-0.002	-0.000	0.048*	-0.002	0.006
	(0.001)	(0.002)	(0.002)	(0.002)	(0.005)	(0.011)	(0.005)	(0.009)	(0.012)	(0.028)	(0.013)	(0.022)
Share of Plot Area Under Export Crops	0.084***	0.019***	0.066***	0.211***	-0.003**	0.004	-0.001	-0.009**	-0.001	0.006	0.003	-0.014
	(0.007)	(0.003)	(0.005)	(0.018)	(0.001)	(0.002)	(0.001)	(0.004)	(0.002)	(0.004)	(0.002)	(0.009)
Household Characteristics												
Household Size	0.012***	0.018**	0.008*	0.013**	-0.017	-0.019	-0.008	-0.055*	-0.080**	-0.089	-0.065*	-0.163***
	(0.004)	(0.008)	(0.005)	(0.007)	(0.015)	(0.031)	(0.018)	(0.029)	(0.032)	(0.064)	(0.038)	(0.063)
Child Dependency Ratio	0.000	-0.001	-0.000	0.001	0.029***	0.041*	0.019	0.038**	0.047***	0.065**	0.031	0.067***
	(0.001)	(0.001)	(0.000)	(0.001)	(0.011)	(0.022)	(0.013)	(0.018)	(0.016)	(0.031)	(0.019)	(0.026)
Household Characteristics												
Agricultural Extension Receipt †	0.003**	0.005*	0.004**	0.003	-0.007**	-0.006	-0.009**	-0.007	-0.020**	-0.015	-0.025**	-0.021
	(0.001)	(0.002)	(0.002)	(0.002)	(0.003)	(0.006)	(0.004)	(0.006)	(0.008)	(0.017)	(0.010)	(0.016)
Access to Non-Farm Labor Income †	-0.004**	-0.006**	-0.003**	-0.006**	0.001	0.026**	-0.002	-0.002	-0.007	0.062**	-0.014	-0.024
	(0.002)	(0.003)	(0.002)	(0.003)	(0.005)	(0.011)	(0.005)	(0.009)	(0.012)	(0.027)	(0.014)	(0.025)
Access to Non-Farm Non-Labor Income †	0.000	0.000	0.000	0.000	0.004	0.008	0.008**	0.003	0.010	0.014	0.021**	0.007
	(0.001)	(0.002)	(0.001)	(0.000)	(0.003)	(0.006)	(0.004)	(0.006)	(0.009)	(0.018)	(0.010)	(0.017)
Wealth Index	0.019***	0.018***	0.021***	0.019***	-0.004**	-0.002	-0.005**	-0.001	-0.007	-0.007	-0.014	0.014
	(0.004)	(0.004)	(0.004)	(0.005)	(0.002)	(0.003)	(0.002)	(0.004)	(0.008)	(0.012)	(0.009)	(0.018)
Agricultural Implement Access Index	0.029***	0.031***	0.030***	0.024***	-0.000	-0.011*	-0.001	-0.002	-0.000	-0.007*	-0.000	-0.002
	(0.006)	(0.011)	(0.007)	(0.009)	(0.004)	(0.006)	(0.004)	(0.006)	(0.002)	(0.004)	(0.003)	(0.003)
Distance to Nearest ADMARC (KM)	-0.000	0.000	-0.000	-0.000	0.024**	0.043*	0.016*	0.045***	0.052**	0.105**	0.034	0.101***
	(0.000)	(0.000)	(0.001)	(0.000)	(0.010)	(0.023)	(0.009)	(0.014)	(0.022)	(0.047)	(0.023)	(0.034)
Household Agro-Ecological Zone Classification [Aggregated]	-0.003	-0.008	-0.001	0.002	0.001	-0.006	0.002	-0.005	0.014	0.003	0.015	-0.010
	(0.004)	(0.008)	(0.004)	(0.005)	(0.004)	(0.009)	(0.005)	(0.010)	(0.018)	(0.041)	(0.022)	(0.038)
Observations	16,372				16,372				16,372			

Note: The estimates are weighted in accordance with the complex survey design. ***/**/* indicate statistical significance at the 1/5/10 percent level, respectively. †denotes a dummy variable.

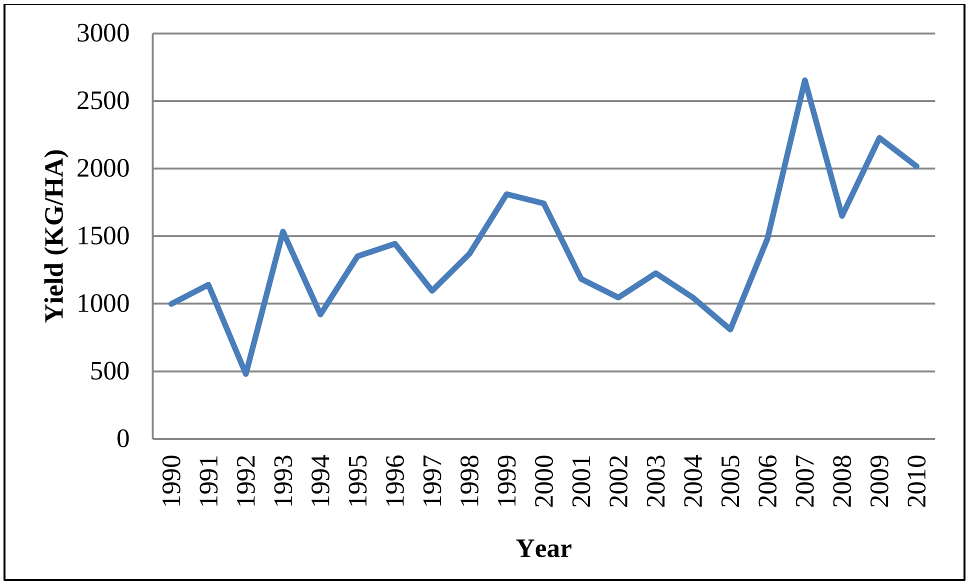
Table 10: Decomposition of the Gender Differential in Agricultural Productivity At Selected Points of the Agricultural Productivity Distribution

Agricultural Productivity Proxied by Log[Plot Quantity of Maize Production (KG)/HA]

A. Gender Differential	*Mean*	*10th Percentile*	*20th Percentile*	*30th Percentile*	*40th Percentile*	*50th Percentile*	*60th Percentile*	*70th Percentile*	*80th Percentile*	*90th Percentile*
Male-Managed Plot Value	6.959***	5.777***	6.268***	6.569***	6.814***	7.031***	7.236***	7.456***	7.713***	8.040***
	(0.019)	(0.040)	(0.027)	(0.024)	(0.022)	(0.020)	(0.018)	(0.019)	(0.020)	(0.020)
Female-Managed Plot Value	6.734***	5.555***	6.026***	6.322***	6.583***	6.791***	7.006***	7.225***	7.473***	7.837***
	(0.026)	(0.042)	(0.040)	(0.034)	(0.031)	(0.028)	(0.029)	(0.028)	(0.029)	(0.029)
Gender Differential	0.224***	0.222***	0.242***	0.247***	0.231***	0.241***	0.230***	0.231***	0.240***	0.202***
	(0.026)	(0.051)	(0.040)	(0.034)	(0.032)	(0.030)	(0.030)	(0.030)	(0.031)	(0.031)
B. Aggregate Decomposition	*Mean*	*10th Percentile*	*20th Percentile*	*30th Percentile*	*40th Percentile*	*50th Percentile*	*60th Percentile*	*70th Percentile*	*80th Percentile*	*90th Percentile*
Endowment Effect	0.165***	0.250***	0.226***	0.206***	0.183***	0.177***	0.160***	0.130***	0.105***	0.110***
	(0.025)	(0.048)	(0.038)	(0.034)	(0.031)	(0.028)	(0.027)	(0.028)	(0.031)	(0.033)
Share of the Gender Differential	74%	112%	94%	83%	80%	74%	70%	57%	44%	54%
Male Structural Advantage	-0.000	0.000	0.000	0.000	0.000	0.000	-0.000	-0.000	-0.000	-0.000
	(0.001)	(0.003)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Share of the Gender Differential	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Female Structural Disadvantage	0.059**	-0.028	0.016	0.041	0.047	0.064*	0.069*	0.100***	0.135***	0.093**
	(0.030)	(0.061)	(0.048)	(0.043)	(0.040)	(0.037)	(0.037)	(0.039)	(0.042)	(0.042)
Share of the Gender Differential	26.3%	-12.5%	6.5%	16.8%	20.4%	26.4%	30.2%	43.5%	56.3%	45.7%
Observations	11,763									

Note: The estimates are weighted in accordance with the complex survey design. ***/**/* indicate statistical significance at the 1/5/10 percent level.

Figure 1: Malawi Annual Maize Yield Estimates (1990-2010)



Source: FAOSTAT

Figure 2: Kernel Density Estimates of the Log of Gross Value of Output per Hectare for Male- and Female-Managed Plot Samples

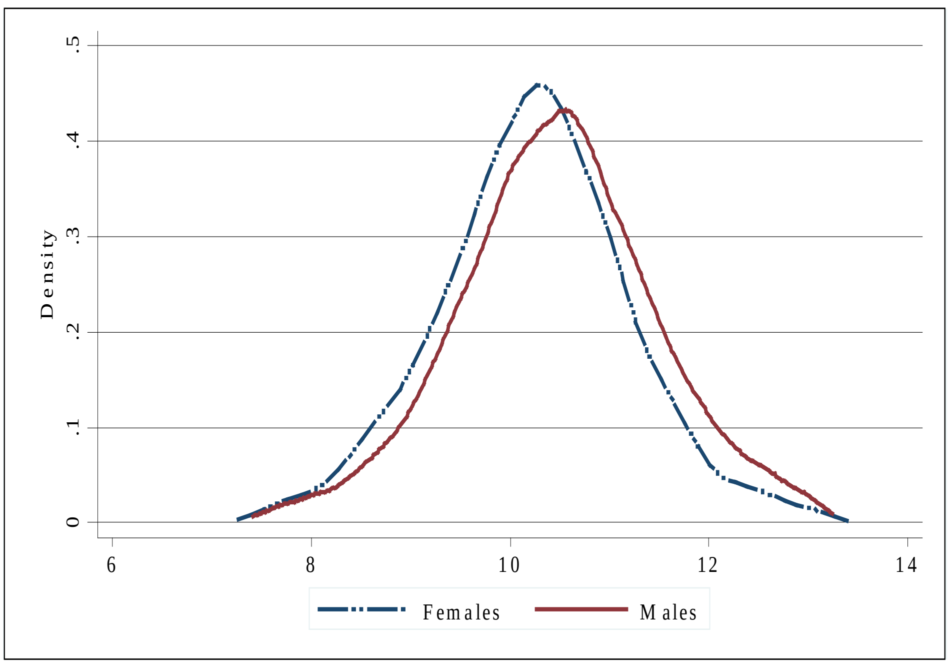
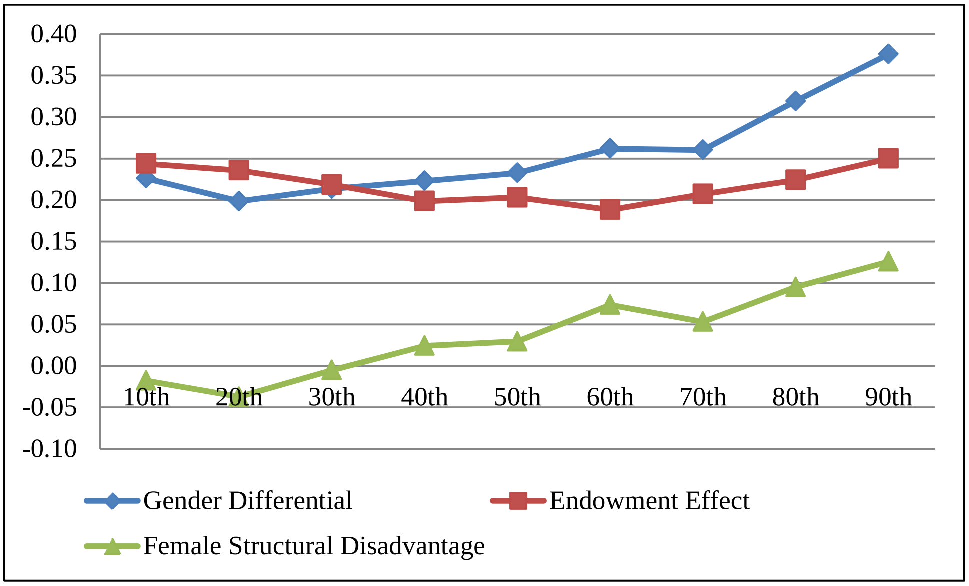


Figure 3: Gender Gap, Endowment Effect and Female Structural Disadvantage Estimated Based on RIF Decomposition at Deciles of Agricultural Productivity Distribution



Figures 4A-4D: RIF Regression Coefficients for Key Explanatory Variables, Estimated Separately from Pooled, Male-Managed, and Female-Managed Plot Samples across Deciles of Agricultural Productivity Distribution