Can private food standards promote gender equality in the small farm sector?

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Abstract. Agricultural commercialization can lift subsistence farmers in developing countries out of poverty – but can have adverse effects on gender equality. Here, we explore whether sustainability standards could serve as a vehicle to promote gender equality in smallholder cash crop production. We focus on two standards that explicitly address gender issues, namely Fairtrade and UTZ. This is the first quantitative study to analyze gendered implications of sustainability standards in depth. Our analysis is based on cross-sectional, gender-disaggregated data from certified and non-certified smallholder coffee producers in Uganda. We employ entropy balancing to control for observed heterogeneity between certified and non-certified farmers. To reduce possible bias from unobserved heterogeneity, we use estimates on farmers' willingness to accept (WTA) sustainability standards as a conditioning variable in reweighting the data. We find that sustainability standards increase household assets – including women's assets. In male-headed households, standards also affect the distribution of wealth within households. While in non-certified households most assets are owned by the male household head alone, in certified households most assets are owned jointly by the male head and female spouse. Certified farmers also have better access to agricultural extension, irrespective of their gender. Yet, sustainability standards have no effect on women's access to financial services. We conclude that sustainability standards may not completely eliminate gender disparities, but can contribute towards this goal.

***Keywords**:* cash crops, certification, gender, sustainability standards, women's empowerment

1 Introduction

The United Nation's Sustainable Development Goals reinforce the importance of gender equality and women's empowerment for poverty reduction and food and nutrition security (UN, 2016). Yet, achieving gender equality remains a challenge, especially in rural areas of developing countries, where poverty is particularity persistent (FAO, 2011).

Agricultural commercialization is seen as an important strategy to lift subsistence farmers out of poverty (Maertens & Swinnen, 2009; Rao & Qaim, 2011). Yet, the evidence suggests that agricultural commercialization can have adverse effects on women's empowerment and gender equality. Women farmers may find it more difficult to participate in modern value chains, given gender disparities in terms of access to land and agricultural inputs and services (Maertens & Swinnen, 2012; Quisumbing et al., 2015). Such gender disparities are not specific to any particular region, but hamper agricultural productivity and women's access to high value markets across the developing world (FAO, 2011). Further, social norms and gender roles may limit women's engagement in cash crop production and marketing (Njuki et al., 2011; Handschuch & Wollni, 2015). Therefore, cash crops are sometimes labelled 'men's crops' (Orr et al., 2016). Several studies also show that women may lose control over agricultural income from food crops, when these become profitable (von Braun & Kennedy, 1994; Fischer & Qaim, 2012; Chege et al., 2015). This is not only problematic from a women's empowerment perspective, but also from a broader welfare perspective (Doss, 2013; Malapit & Quisumbing, 2015). For instance, the evidence shows that women are likely to make expenditure decisions that promote child nutrition and wellbeing (Hoddinott & Haddad, 1995).

Here, we explore if private food standards could serve to mitigate potentially negative effects of agricultural commercialization on gender equality. Private food standards are gaining in importance in global food chains – including for crops produced by smallholder farmers in developing countries (Maertens & Swinnen, 2009; Lee et al., 2012). Private food standards cover a wide range of issues, such as food safety and quality, welfare, labor conditions, and environmental stewardship. Here, we focus on two popular standards that are aimed at promoting sustainability, namely UTZ and Fairtrade. UTZ and Fairtrade, among other sustainability standards, include specific components to promote women's empowerment and gender equality (Fairtrade International, 2009; UTZ, 2015c). For instance, certified farmer organizations have to comply with non-discrimination policies.

Further, they are encouraged to organize workshops to raise awareness on gender equality; to implement special programs tailored to women farmers' needs; and to promote women farmers' participation in regular agricultural training sessions. However, not all sustainability standards include such gender components. Therefore, understanding whether such gender components prove effective in promoting gender equality could be useful.

A growing body of literature has analyzed welfare effects of sustainability standards on smallholder farm households, with mixed results (Bolwig et al., 2009; Jones & Gibbon, 2011; Kleemann et al., 2014; Chiputwa et al., 2015; Chiputwa & Qaim, 2016; Ibanez & Blackman, 2016; van Rijsbergen et al., 2016; Mitiku et al., 2017). However, these studies typically focus on the household as the unit of observation. Thus, issues of intra-household distribution of costs and benefits cannot be analyzed. Further, it remains unclear whether sustainability standards can serve to promote gender equality and women's empowerment (Terstappen et al., 2013). A few quantitative studies look at gender issues (Ruben & Fort, 2012; Chiputwa & Qaim, 2016), but without analyzing gendered implications in detail – or based on individual-level data. Further, some qualitative studies describe experiences of female workers in the certified agro-processing or handicraft sector (Hutchens, 2010; Bonnan-White et al., 2013). Some qualitative studies (Lyon, 2008; Lyon et al., 2010; Bacon, 2010; Loconto, 2015) also explore gender aspects of food standards in the small farm sector (see chapter 2).

To our knowledge, this is the first quantitative study to analyze gendered implications of sustainability standards in depth. Our objectives are to analyze (1) if sustainability standards benefit women and men in male-headed households, (2) if costs and benefits associated with the adoption of sustainability standards are equally distributed within male-headed households, and (3) if female-headed households benefit from sustainability standards. Thus, we analyze impacts on both female spouses and female household heads, which is seldom done. Our analysis is based on gender-disaggregated survey data from certified and non-certified smallholder coffee producers in Uganda. Some of the sample households are UTZ or Fairtrade certified; others are not certified. We analyze the effect of sustainability standards on various outcome variables, capturing different areas of empowerment within households and beyond. Outcome variables include gendered asset ownership, participation in trainings and farmer group meetings, access to financial services, and time allocation. For the econometric analysis, we use entropy balancing (Hainmueller, 2012), allowing us to control for observed heterogeneity. To reduce possible

bias from unobserved heterogeneity, we use estimates on farmers' willingness to accept (WTA) sustainability standards as a conditioning variable in reweighting the data.

2 Sustainability standards, gender components, and possible effects on gender equality

The following literature review motivates our empirical strategy. We hypothesize that sustainability standards can contribute to promoting gender equality, provided that gender issues are accounted for in the standard. In the following, we summarize how gender issues are addressed in the standards we focus on, namely Fairtrade and UTZ. Afterwards, we discuss how standards may affect different areas of empowerment, based on previous qualitative findings on gender and standards and related literature. We focus on the following areas of empowerment: economic empowerment, division of labor, social capital, and access to services. The importance of considering these areas is described below. We take up these areas of empowerment in our empirical strategy and in presenting our results.

2.1 Gender components of Fairtrade and UTZ

In this study, we analyze the gendered effect of Fairtrade[1] and UTZ standards. We take these two standards as examples of sustainability standards that include gender components. We do not disaggregate between Fairtrade and UTZ in our analysis, because these two standards are very comparable, especially regarding their gender approach. UTZ and Fairtrade highlight their commitment to promote gender equality on their homepages and in several reports (Fairtrade International, 2009, 2011; UTZ, 2015b, 2015c). Fairtrade has developed a gender strategy (Fairtrade International, 2009) which is aimed at mainstreaming gender along Fairtrade value chains – from standard setting to implementation. UTZ recommends the use of its 'gender check list' to promote gender equality. Further, UTZ is piloting gender-sensitive approaches to auditing, which includes the training of auditors on gender issues (UTZ, 2015c).

Fairtrade and UTZ standards also specify a range of mandatory and suggested measures on gender equality. The specific goal of these measures is to raise awareness on gender issues and to strengthen women's position within households, farmer organizations, and

[1] We refer to Fairtrade standards set by Fairtrade International (Fairtrade International (2011).

communities (Fairtrade International, 2009, 2011; UTZ, 2015b, 2015c). Measures can be broadly grouped into three categories. The first set of measures refers to non-discrimination policies. UTZ and Fairtrade farmer organizations have to respect the principle of non-discrimination in recruiting and paying staff. Further, women employees have the right to maternity leave. Sexual harassment must not be accepted (Fairtrade International, 2011; UTZ, 2015a, 2015c). UTZ additionally encourages farmer organizations to ensure equal representation of disadvantaged groups (incl. women) among their staff (e.g. extension officers or farmer organization leadership) (UTZ, 2015a, 2015c).

The second set of measures relates to special gender programs. The implementation is voluntary. Fairtrade and UTZ farmer organizations are encouraged to implement workshops or trainings on gender equality, targeting both women and men. Further, the introduction of special programs or trainings tailored to women farmers' needs is also encouraged (Fairtrade International, 2009, 2011; UTZ, 2015c). Fairtrade farmer organizations sometimes use parts of the Fairtrade premium[2] for such programs (Fairtrade International, 2011). The third set of measures is aimed at increasing women's participation in regular (agricultural) trainings, group meetings, and other activities implemented by certified farmer organizations. To promote this goal, UTZ farmer organizations have to take specific measures: women have to be informed about training sessions; trainings have to be held at times feasible for women; and attendance of women and men during trainings has to be documented using participant lists (UTZ, 2015a).

2.2 Possible effects on economic empowerment

Individual economic endowment (e.g. income, control over cash income, or asset ownership) is a key driver of women's empowerment (Kabeer, 1999; Doss, 2013; Johnson et al., 2016). Women who are employed (e.g. in the agro-processing sector) or who sell their own crops generate their own income, contributing to their economic empowerment (Maertens & Swinnen, 2012). However, women's role in cash crop production and marketing may be limited – and cash crops and the income generated from sales are often controlled by men (Njuki et al., 2011). Most certified crops produced by smallholder farmers are traditional cash crops. Drawing from previous studies, we hypothesize that

[2] The Fairtrade premium is payed to Fairtrade farmer organizations and is to be invested in development projects (Fairtrade International (2011).

sustainability standards may contribute to women's economic empowerment (1) by improving women's access to markets and income or (2) by increasing women's control over income from cash crop production.

Some studies suggest that standards and certification requirements can promote women's role in cash crop production and their access to markets and income. For instance, Lyon et al. (2010) found that, in Mesoamerica, Fairtrade-Organic standards promoted women's involvement in coffee production and marketing. Many women registered as farm operators and farmer group members. This development was attributable to high rates of men migration and certification requirements. Specifically, registered farm operators were required to be present during announced and unannounced certification audits, promoting women's role as registered farm operators. Kloos & Renaud (2014) found that access to certified markets increased women's involvement in cotton production in Benin. Cotton production and handling of chemical pesticides and synthetic fertilizers was locally perceived as a male task. Under Organic, the use of these inputs is prohibited, which increased social acceptance of women's Organic cotton production. Further, certified cotton was produced on the least fertile plots. Similarly, looking at West Africa, Bassett (2010) showed that women's role in cotton production increased due to the introduction of standards. Households aimed at accessing both certified and non-certified marketing channels. Male household heads continued to manage the largest share of the cotton area conventionally. Their spouses became members of the certified producer organization and produced certified cotton on a certain share of the area.

While standards and context-specific factors can increase women's access to markets and income, this does not always hold. Several studies suggest that women's role in marketing and supply chains does not change with the introduction of standards. Thus, some studies conclude that economic gains from standards and certification are captured by men (Lyon, 2008; Bolwig, 2012; Sen, 2014; Loconto, 2015). Chiputwa and Qaim (2016) also found that standards do not challenge men's role in coffee marketing. However, they showed that sustainability standards can nevertheless increase women's control over coffee revenues. They attributed this trend to non-discrimination policies and workshops on gender equality introduced by certified farmer organizations.

2.3 Possible effects on the division of labor and women's workload

Agricultural tasks and responsibilities are often gender-specific in the small farm sector. Therefore, agricultural interventions may affect women's and men's workload in different ways (Doss, 2001; Quisumbing et al., 2015). Women are often strongly involved in labor-intensive activities (e.g. weeding, harvesting, washing, and sorting in the case of coffee). Sustainability standards and related certification requirements on farming and post-harvest management tend to increase labor demand for these female activities (Lyon et al., 2010; Bolwig, 2012). Especially Organic standards, which prohibit the use of chemical pesticides, may increase women's workload (Bolwig 2012). However, whether women's workload increases as a result of standards and related certification requirements also depends on whether capital is reinvested in equipment that can reduce demand for manual labor (Lyon et al., 2010; Bolwig, 2012). It is also known that household members may renegotiate the division of agricultural tasks and responsibilities when circumstances change (Orr et al., 2016). Theoretically, standards could have the same effect. However, previous studies suggests that sustainability standards neither change the gendered division of labor nor decision making in agriculture (Bolwig, 2012; Ruben & Fort, 2012).

2.4 Possible effects on social capital

Social capital and collective action are key to linking women farmers to markets and for their empowerment (Fischer & Qaim, 2012; Handschuch & Wollni, 2015). In the small farm sector, farmer organizations are one important platform to enhance social capital. Yet, women farmers are often excluded from farmer organizations (Doss, 2001; Fischer & Qaim, 2012). Sustainability standards may increase women's participation in farmer organizations, especially if measures are taken to promote women's participation. Yet, the evidence on whether sustainability standards deliver on this goal is mixed. Some qualitative studies suggest that sustainability standards fail to increase women's representation in farmer organizations (Lyon, 2008; Sen, 2014). Figures provided by Fairtrade International support that men often dominate certified farmer organizations. About 20 percent of the registered members in Fairtrade certified farmer organizations are women (Fairtrade International, 2009). This may be problematic because being a registered member is often a precondition to influence decisions, e.g., on services to be provided by certified farmer organizations (Lyon, 2008). Even in organizations with a higher share of female members,

men often occupy leadership positions (Bacon, 2010) and may disapprove women's active participation and ideas (Lyon, 2008; Sen, 2014). Additionally, women's participation in meetings may be passive or low (Lyon, 2008; Sen, 2014). Other studies highlight advances in terms of women participation in farmer groups and decision making, due to standards (Elder et al., 2012). Further, women-led initiatives may emerge within certified farmer organizations (Bacon, 2010; Elder et al., 2012). There are also examples of women-only cooperatives, such as 'café feminino' (Lyon, 2008).

2.5 Possible effects on the access to services

Women farmers are often disadvantaged in terms of access to agricultural and financial services. Such gender disparities can explain low adoption of agricultural technologies, lower yields, and poor access to markets among women (Doss, 2001; FAO, 2011). Sustainability standards may improve women's access to such services. Certified farmer organizations usually offer agricultural trainings and other services to their members. Especially if specific measures are taken, women's participation in such trainings may increase. Women's access to information may also improve if female extension officers are employed by certified farmer organizations.

3 Research context and household survey

3.1 Survey and data

Our analysis builds on a household survey conducted in 2015 with small-scale coffee producers in Uganda. We employed a two-stage sampling strategy: Frist, we purposively selected two coffee farmer organizations, located in central Uganda. One of these organizations is Fairtrade certified, the other is UTZ certified. However, not all members of these farmer organizations are actually certified. For farm households, certification is a voluntary decision. Second, we randomly selected certified and non-certified households, based on complete membership lists provided by each farmer organization.

We collected data at the household and individual level.[3] In male-headed and female-headed households, we interviewed the male or female household head.[4] Additionally, in male-headed households we interviewed female spouses.[5] Interviews were conducted separately with male and female spouses. Table 1 provides an overview of the sample households by certification status. In total, we conducted interviews with 346 households. Among them 174 are certified and 172 are not certified. Within these households, we received individual responses from 548 individuals, including 233 male household heads, 244 female spouses, and 71 female household heads.[6] In Table 1 the number of respondents, from whom we received individual responses, is displayed in parentheses.

Table 1: Overview of sample households and individuals by certification status

	Certified	Non-certified	Total
Total no. of households	174	172	346
Total no. of individuals	311 (278)	303 (270)	614 (548)
Male-headed households	137	131	268
Male household heads	137 (119)	131 (114)	268 (233)
Female spouses	137 (126)	131 (118)	268 (244)
Female-headed households	37	41	78
Female household heads	37 (33)	41 (38)	78 (71)

Numbers in parentheses refer to the individuals from whom we received individual responses

Interviews were conducted by local enumerators, who were trained and supervised by the researchers. The questionnaire covers farm, household, and contextual characteristics. We also collected detailed information on household assets and individual asset ownership. The questionnaire further encompasses detailed questions on time allocation and participation in training sessions and other group actives.

[3] When analyzing intra-household dynamics, two approaches are commonly used (Doss et al. (2014). Following the first, all adult household members are considered. Following, the second, only couples (household heads and their spouses) are considered. Here, we follow the second approach.

[4] In a few cases, the household head was not available for interviews. In such cases, we interviewed the female spouse.

[5] Some households in our sample (N=5) are polygamous, Muslim households, implying that there can be several (usually two) female spouses. In such cases, we asked the household head, who was interviewed first, to identify the female spouse with greater decision making power.

[6] Female household heads include widowed, single, divorced, or separated women. Married women who live alone (e.g. because their spouse migrated) are also considered female household heads.

3.2 Gender policies implemented by farmer organizations

As discussed, Fairtrade and UTZ standards specify a range of mandatory and voluntary measures to promote gender equality (see gender components of Fairtrade and UTZ). As the set of gender measures may thus vary by farmer organization, we briefly summarize the measures implemented by the sample farmer organizations. Both farmer organizations meet standards on non-discrimination. For instance, both women and men are hired as extension and certification officers as well as for administrative positions. Further, workshops are organized to raise awareness on gender equality. The specific purpose of these workshops is help spouses and other household members to work as a team and to appreciate the work done by other household members. Additionally, both farmer organizations provide agricultural services to their members, including credits and agricultural trainings. Theoretically, any farmer could join training sessions on gender equality or farming, irrespective of her certification status. However, certified farmers are particularly encouraged to participate. Training sessions and regular interactions between farmers and certification officers serve to ensure that certified farmers understand and comply with certification requirements. Compliance of certified members is pivotal, because otherwise the farmer organization may lose its certificate.

4 Empirical strategy

Our goal is to analyze how sustainability standards affect female household heads (in female-headed households) and female spouses and male household heads (in male-headed households). We consider different areas of empowerment, following the categories defined earlier (i.e. economic empowerment, division of labor and workload, social capital, and access to services). For each category, we selected different outcome variables. After describing each outcome variable, we explain our econometric approach.

4.1 Selection and measurement of outcome variables

We use asset ownership as an indicator for women's economic empowerment and bargaining power. Asset ownership is a suitable proxy for these outcomes, because it determines individuals' options and livelihood opportunities (Doss et al., 2014; Quisumbing et al., 2015; Johnson et al., 2016). For instance, assets serve a as collateral

when seeking credit. However, assets and related opportunities are often distributed unequally within households – and often favor men (Deere & Doss, 2006; Doss et al., 2014). Looking at individual asset ownership allows us to assess how wealth is distributed within households – and if standards change the distribution of wealth within households.[7] In this study, we look at the current market value of assets in 1000 Ugandan Shilling (UGX). Assets include durable consumption goods and productive assets, such as furniture, means of transportation, electronic devices, agricultural equipment, and livestock. We do not include assets such as land and housing, because these assets were probably acquired prior to certification.[8] Consequently, including these assets would not allow us to detect changes in empowerment – and thus to test causality between standards and empowerment.

One challenge in using asset ownership as an empowerment indicator is that assets can be held jointly or individually (Quisumbing et al., 2015). In male-headed households, male household heads often have more rights than their spouses over assets that are held jointly (e.g. when it comes to selling assets) (Johnson et al., 2016). We address this challenge by analyzing individual asset ownership and joint asset ownership separately. In male-headed households, we look at (1) the value of total household assets, (2) the value of assets owned by the male household head, (3) the value of assets owned by the female spouse, and (4) joint ownership. In addition to the absolute value, we also consider relative figures (e.g. individual ownership of the male head as a percentage of total household assets). For female-headed households, we focus on the value of assets owned by the female household head (in absolute terms and as a percentage of total household assets).

To analyze how standards may affect the workload of women and men, we follow Alkire et al. (2013) and use a 24 hour recall that captures all activities pursued during the last day. These data are based on individual-level responses. We aggregated hours each person spent on farm, off-farm, and domestic work. As proposed by Alkire et al. (2013) we also asked for peoples' satisfaction regarding their time available for leisure activities. This variable can take values from one (very unsatisfied) to five (very satisfied).

[7] Other studies have used control over income as a proxy for women's empowerment (e.g. Chiputwa & Qaim (2016). Using control over income, it is not possible to assess how wealth is distributed within households. Therefore, we prefer looking at asset ownership. Asset ownership also reflects longer term economic development and expenditure decisions.

[8] Both farmer organizations adopted UTZ/Fairtrade standards around the year 2007.

To proxy social capital, we asked respondents if they participated in farmer group meetings during the past twelve months. We also asked if they hold a leadership position in any group (e.g. famer, women's, religious group, etc.)

To analyze whether sustainability standards improve access to agricultural services, we asked respondents if they interacted with an extension officer; and if they participated in field days and agricultural trainings during the past twelve months. Agricultural trainings refer to sessions, demonstrations, and workshops on soil fertility, pest management, and coffee quality improvement. Regarding access to financial services, we asked respondents if they have a personal savings account, if they use mobile money, and if they are a member of a savings group.

4.2 Econometric approach

To assess the impact of sustainability standards on the outcomes described above, we compare certified against non-certified farmers. Specifically, we compare (1) male household heads in certified and non-certified households, (2) female spouses in certified and non-certified households, and (3) female household heads in certified and non-certified households. As we use observational data, we have to account for the fact that certified and non-certified farmers may differ in terms of observed and unobserved factors. If such factors are correlated with both the treatment (sustainability standards) and the outcomes (variables specified above), our estimation will be biased. To reduce such bias, we use entropy balancing (Hainmueller, 2012). Entropy balancing belongs to the family of weighting and matching approaches, such as propensity score matching (PSM) and inverse probability weighting (IPW). Weighting and matching approaches can be used to address imbalances in the distribution of covariates among the treatment and control group. The idea is that when such imbalances are eliminated, the treatment assignment becomes ignorable and the treatment effect can be calculated.

Entropy balancing is a novel approach to covariate balancing, but has been employed for impact evaluation in the field of unemployment and health (Marcus, 2013), policy interventions and development (Huang & Yeh, 2014; Neuenkirch & Neumeier, 2016), and education and earnings (Freier et al., 2015). Entropy balancing calculates weights for each untreated individual such that differences in the distribution of covariates between treatment and control group are eliminated. Technically speaking, this is a minimization

problem, subject to the balancing and non-negativity constraint. Entropy balancing has two advantages over more established methods, such as PSM. First, simultaneously balancing all covariates can prove challenging using PSM (Hainmueller, 2012). Low levels of covariate balancing are avoided using entropy balancing. Second, entropy balancing uses information from all observations, because no observation is given a weight of zero.

To obtain entropy weights, the researcher first has to select conditioning variables, i.e., variables that are accounted for in reweighting control group observations. All variables that may simultaneously affect the treatment assignment and the outcome should be included. We condition on a rich set of covariates, such as age, education, religion, and farm and contextual characteristics. In the second step, weights obtained through entropy balancing are used to calculate the mean difference in outcomes, or average treatment effect (ATT). Here, we use OLS regressions for continuous outcome variables (e.g. value of assets) and probit regressions for binary outcome variables (e.g. participation in trainings and access to financial services). In these regressions, we include the certification status as a binary treatment variable. As data are reweighted (i.e. balanced), control variables are not required in theses regressions.

The shortcoming of entropy balancing – and other weighting and matching approaches – is that it controls for observed heterogeneity only. In the presence of unobserved heterogeneity, treatment estimates will be biased. To reduce bias from unobserved confounders, we include estimates on farmers' willingness to accept (WTA) sustainability standards as a conditioning variable in reweighting the data. A similar approach was employed by Verhofstadt and Maertens (2014), using PSM. Estimates on farmers' WTA sustainability standards were obtained from a choice experiment carried out with the same farm households (Meemken et al., 2016). The choice experiment was used to analyze farmers' preferences for sustainability standards in general and for specific attributes of sustainability standards in particular. Attributes included in the choice experiment are (1) the price premium, (2) provision of agricultural extension, (3) gender policies, (4) requirements on coffee quality, (5) handling of chemical pesticides, and (6) record keeping. WTA estimates are obtained by dividing the coefficient of each attribute by the negative of the price coefficient. Aggregating WTA estimates of all attributes, we obtained farmers' overall WTA sustainability standards. Thus, our WTA variable is a good indicator for farmers' attitudes towards sustainability standards. This variable is useful for our analysis, because farmers' attitudes towards sustainability standards are likely correlated with a

range of factors that may simultaneously influence farmers' decision to enter certification and our outcome variables. Many of such factors are usually difficult to measure, for instance farmers' openness towards new farming practices, learning ability, or motivation. By including WTA estimates we have a suitable proxy variable for such unobserved confounders, thereby reducing bias due to unobserved heterogeneity.

As a robustness check, we also use inverse probability weighting (IPW) (Hirano et al., 2003; Wooldridge, 2007), instead of entropy weighting. The IPW estimator first calculates the treatment probability (i.e. the probability of entering certification in our case). Then, the inverse of the treatment probability is used as a weight in estimating the mean outcome of both the treatment and control group. Finally, the mean difference (i.e. treatment effect) is calculated, using the reweighted data. As IPW uses the inverse of the treatment probability, it assigns more weight to observations that receive an unlikely treatment. For instance, larger weights are given to those observations that are among the treated – although their treatment probability is low. The idea of IPW is to better account for all possible outcomes. Pirracchio et al. (2012) show that IPW yields unbiased treatment estimates, even when the sample size is as small as 40. However, similar to other matching and weighting methods, treatment estimates will only be unbiased when all confounders are included as conditioning variables (i.e. in estimating the treatment probability). We use the same conditioning variables as for entropy balancing, including our WTA estimates.

5 Results

We start the analysis by looking at the factors influencing the probability of adopting sustainability standards. Afterwards, we look at the effect of sustainability standards on economic empowerment. Then, we focus on the impact on the division of labor, social capital, and access to services. In each table we show descriptive statistics and average treatment effects (ATT).

5.1 Treatment probability

In table 2 we look at the factors affecting the probability of adopting sustainability standards. We estimated separate models for male-headed households (column 1) and

female-headed households (column 2). We also calculated treatment probabilities at the individual level (i.e. for male household heads, female spouses, and female household heads). This table can be found in the appendix (table A1). We find that various farm, household, and contextual characteristics influence the likelihood of adopting standards. For instance, households with older and better educated heads are more likely to adopt standards (table 2). Further, Muslim households are less likely to adopt sustainability standards. Location-specific factors (e.g. altitude or remoteness) also affect the treatment probability. These factors may not only affect the treatment probability, but also outcomes. As explained (see econometric approach), we use entropy balancing to address such imbalances in the distribution of covariates.

Table 2: Treatment probabilities (household level)

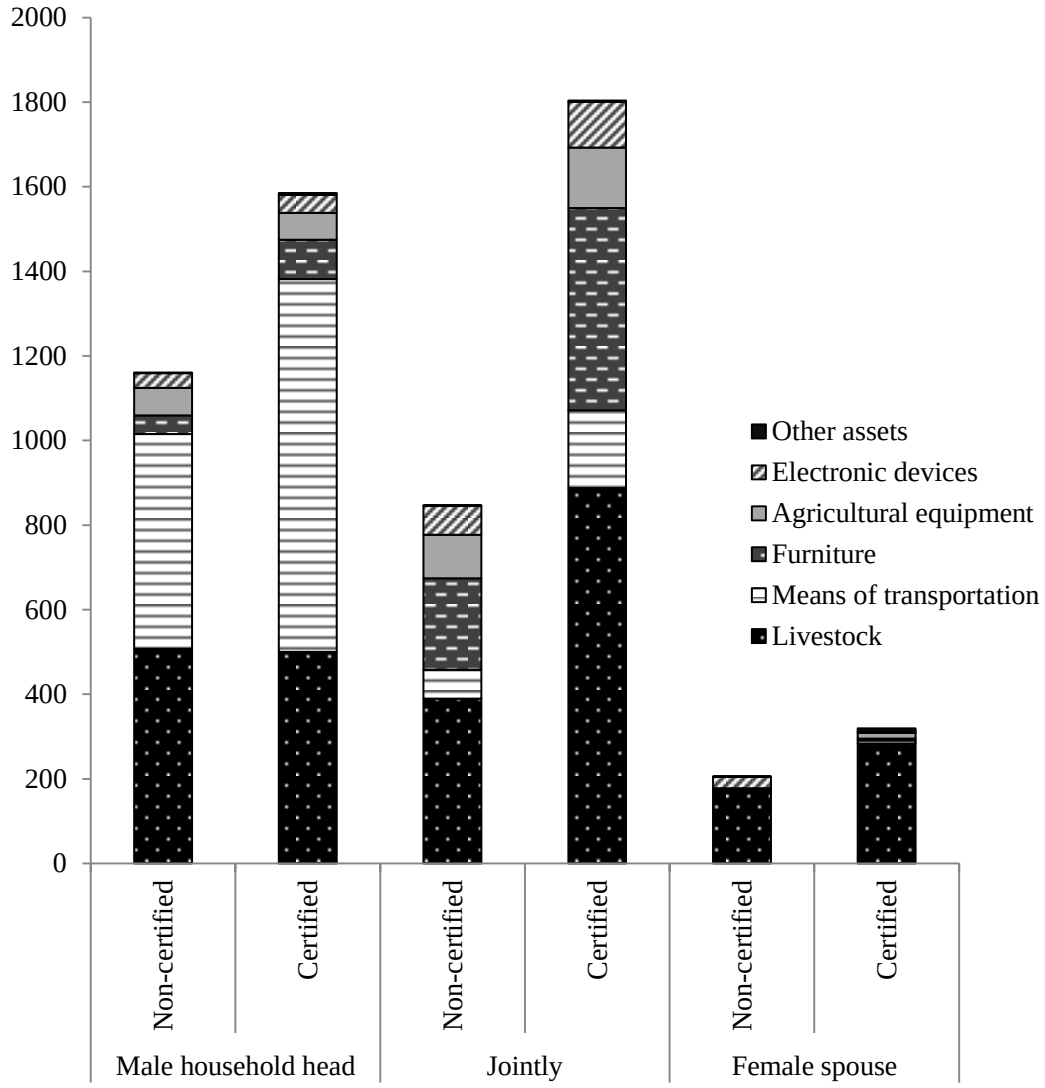
	(1) Male-headed households	(2) Female-headed households
Household size	0.02	-0.02
	(0.01)	(0.02)
Household head Muslim (1/0)	-0.18*	-0.65**
	(0.10)	(0.30)
Age household head (yrs.)	0.02***	0.01
	(0.00)	(0.01)
Age gap (age head - age spouse)	-0.01**	
	(0.00)	
Schooling household head (yrs.)	0.05***	0.03*
	(0.01)	(0.02)
Education gap (schooling head- schooling spouse)	-0.03***	
	(0.01)	
Yrs. growing coffee	-0.00	0.00
	(0.00)	(0.01)
Altitude (m)	0.00***	0.00***
	(0.00)	(0.00)
Distance to input market (km)	-0.01**	0.01
	(0.01)	(0.01)
Distance to output market (km)	-0.01	-0.03
	(0.01)	(0.02)
Wealthy ancestors (1/0)	-0.15*	0.10
	(0.08)	(0.17)
WTA sustainability standards	0.00	0.06***
	(0.01)	(0.02)
Observations	268	78
Pseudo R^2	0.21	0.25
LR chi^2	76.74***	27.32***

Probit estimates, marginal effects are shown
Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

5.2 Economic empowerment

Figure 1 provides an overview of the distribution of wealth within male-headed households. Differentiating by certification status, we show the average value of assets (in 1000 UGX) owned by male heads, female spouses, or jointly. Generally, female spouses own few assets. Most assets are owned jointly or by male heads. Women's most valuable assets are livestock. Men's most valuable assets are means of transportation and livestock. Figure 1 also suggests that certified households own more assets than non-certified households. Further, the distribution of wealth seems to differ in certified and non-certified households. While in non-certified households the largest share of assets is owned by male heads alone, the largest share of assets in certified households is owned jointly by female spouses and male heads. Using entropy balancing, we assess if these differences are attributable to the adoption of standards.

Figure 1: Asset ownership (in 1000 UGX) in male-headed households by category and certification status



Regression results confirm descriptive statistics (see table 3). In male-headed households, sustainability standards increase household assets by 1162,940 UGX or by about 46 percent (column 4). The largest increase (912,630 UGX) is found for joint asset ownership. Yet, standards also have a significant and economically relevant effect on female spouses' assets (i.e. an increase of 146,780 UGX). The coefficient for male household heads' assets is positive but not significant (column 4). Despite this absolute increase, standards reduce the

share of household assets owned by male heads alone. Consequently, standards increase the share of assets owned jointly.

Table 3: Asset ownership (in 1000 UGX)

	Descriptive statistics			Entropy balancing
	(1) Certified Mean [a]	(2) Non-cert. Mean [a]	(3) Mean Diff. [b]	(4) ATT [c]
Male-headed households	(N=137)	(N=131)	(N=268)	(N=268)
Value household assets	3684.52	2299.45	1385.07***	1162.94***
	(2896.86)	(2358.02)	(0.00)	(376.62)
Asset ownership male head				
Value	1434.89	1160.90	273.99	229.14
	(1842.77)	(1697.26)	(0.21)	(250.40)
Percent of total household assets	37.80	46.71	-8.91**	-9.04*
	(32.67)	(31.08)	(0.02)	(5.46)
Asset ownership female spouse				
Value	322.90	205.95	116.95	146.78**
	(782.05)	(417.41)	(0.13)	(74.08)
Percent of total household assets	9.80	11.69	-1.88	-1.16
	(18.93)	(19.39)	(0.42)	(2.81)
Joint asset ownership				
Value	1842.12	846.99	995.12***	912.63***
	(2089.72)	(1348.84)	(0.00)	(261.63)
Percent of total household assets	50.32	38.48	11.83***	13.18**
	(32.27)	(29.71)	(0.00)	(5.62)
Female-headed households	(N=37)	(N=41)	(N=78)	(N=78)
Value household assets	2899.39	1106.97	1792.42***	2137.64***
	(3371.77)	(1873.99)	(0.00)	(617.88)
Asset ownership female head				
Value	2430.50	922.45	1508.05***	1741.91***
	(3272.33)	(1529.37)	(0.01)	(601.53)
Percent of total household assets	77.67	78.67	-1.00	-0.94
	(29.61)	(30.61)	(0.88)	(12.83)

[a] Standard deviations in parentheses
[b] p-values in parentheses
[c] Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

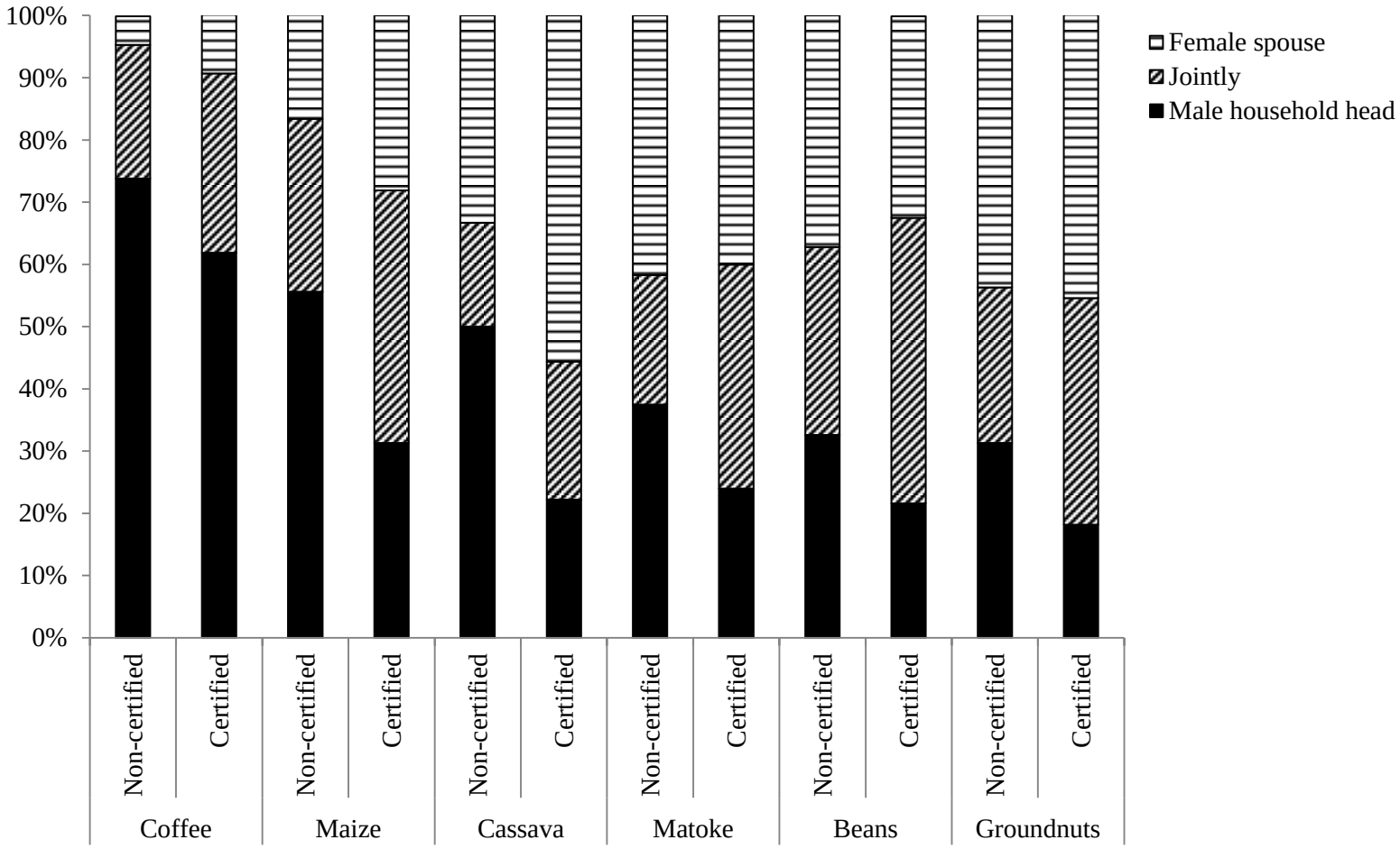
In the lower part of table 3, we focus on female-headed households. Sustainability standards increase the value of total household assets by 2137,640 or 280 percent (column 4). The largest share of household assets (over 70 percent) is owned by female heads. Thus, in female-headed households, sustainability standards increase overall household assets and women's individual assets almost to the same extent.

As coffee is the main income generating activity for most sample households, the increase in household wealth among certified households is likely related to higher coffee revenues. Coffee revenues are predominantly controlled by household heads. This holds for both male-headed and female-headed households. Specifically, in 92 percent of female-headed and in 67 percent of male-headed households, coffee revenues are controlled by the household head alone. The redistribution of wealth in certified, male-headed households may be attributable to female spouses' improved control over coffee incomes. To explore this possible pathway, we examine who controls coffee and other crop revenues in male-headed households.[9] Figure 2 provides an overview of the crops that are commonly produced and sold by sample households. Differentiating by crop and by certification status, figure 2 shows whether revenues are controlled by male household heads, female spouses, or jointly. We find that coffee revenues – irrespective of the certification status – are controlled by male household heads in most male-headed households. Revenues from most other crops are controlled jointly or by female spouses alone. This is not surprising because most of these crops are food crops.

Figure 2 also suggests that, among certified households, revenues are less likely controlled by the male household head alone. Consequently, female spouses in certified households have greater control over crop revenues than their counterparts in non-certified households. This applies not only for coffee, as previously shown by Chiputwa & Qaim (2016), but for all crops.

[9] We focus on male-headed households for this overview, because female heads in female-headed households usually control coffee revenues anyways.

Figure 2: Who controls crop revenues in male-headed households? (Percent of households)

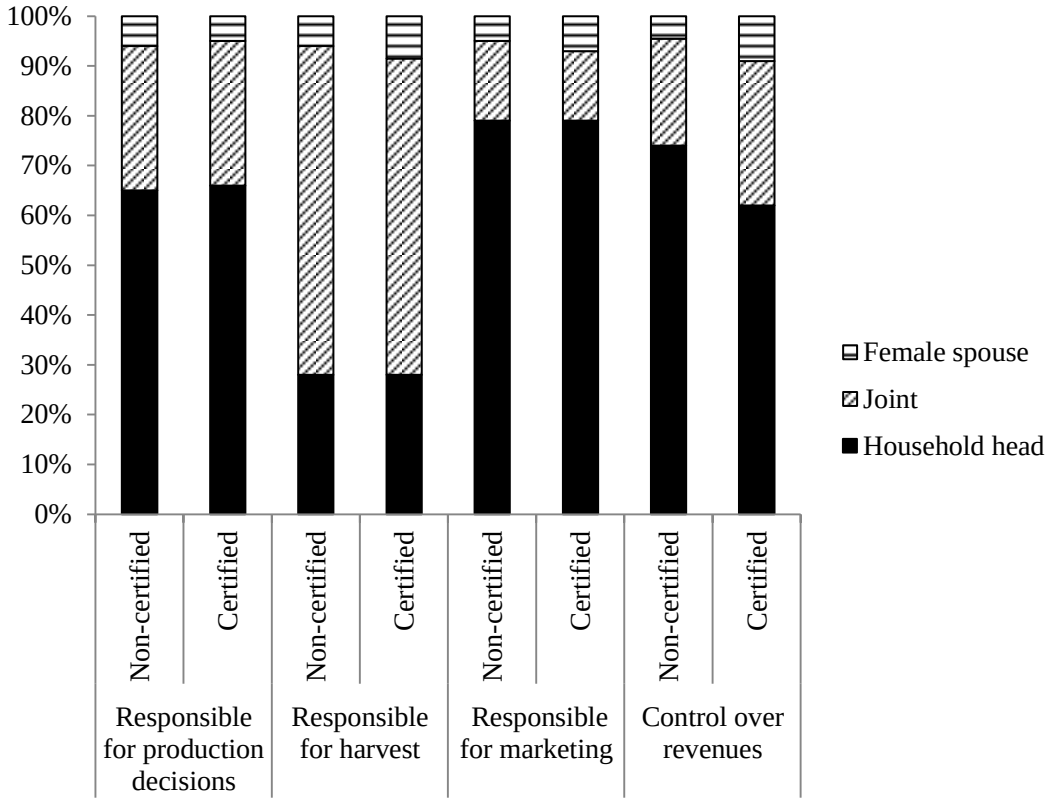


Note: Includes only male-headed households that produce and sell these crops (coffee: 346 households, maize: 134 households, cassava: 21 households, matoke: 72 households, beans: 79 households, groundnuts: 27 households).

5.3 Division of labor within households and workload

Figure 3 displays tasks in coffee production in male-headed households by certification status. We find that men control production decisions and marketing in most households – irrespective of the certification status. Further, in both certified and non-certified households, harvesting is a joint activity, undertaken by spouses and other household members. The only difference between certified and non-certified households is observed with respect to control over coffee revenues, as discussed above (see economic empowerment).

Figure 3: Tasks in coffee production in male-headed households by certification status (percent of households)



In table 4, we focus on women's and men's workload. Female spouses work on average about 10 hours per day – and about 90 minutes more than their husbands (column 1-2). Further, women in certified (male-headed and female-headed) households spend more time on farm, off-farm, and domestic work than their non-certified counterparts. However, these differences are small and neither significant before entropy balancing (column 3) nor after entropy balancing (column 4). Table 4 also suggests that female spouses are more satisfied with their

time available for leisure activities than their husbands, despite a higher workload (column 1-2). Yet, sustainability standards have no effect on the level of satisfaction in male-headed households (column 4).

Table 4: Workload and social capital

	Descriptive statistics			Entropy balancing
	(1) Certified Mean [a]	(2) Non-cert. Mean [a]	(3) Mean Diff. [b]	(4) ATT [c, d]
Workload and satisfaction				
Farm, off-farm, and domestic work (hrs./day)				
Male heads	8.57	8.48	0.09	0.11
	(3.28)	(3.69)	(0.85)	(0.64)
Female spouses	10.32	9.95	0.38	0.41
	(2.66)	(2.68)	(0.27)	(0.59)
Female heads	8.93	8.20	0.73	1.04
	(3.09)	(3.82)	(0.39)	(1.27)
Satisfaction leisure time (1-5) [e]				
Male heads	2.12	2.30	-0.18	0.04
	(1.10)	(1.17)	(0.23)	(0.20)
Female spouses	2.49	2.42	0.07	0.06
	(1.14)	(1.14)	(0.64)	(0.26)
Female heads	2.30	2.37	-0.07	-0.93*
	(1.31)	(1.32)	(0.84)	(0.51)
Social capital				
Participation in farmer meetings (1/0) [f]				
Male heads	0.85	0.84	0.01	-0.05
	(0.36)	(0.37)	(0.89)	(0.05)
Female spouses	0.64	0.58	0.07	0.12
	(0.48)	(0.50)	(0.29)	(0.10)
Female heads	0.64	0.58	0.06	0.00
	(0.49)	(0.50)	(0.63)	(0.19)
Administrative / leadership position (1/0) [g]				
Male heads	0.67	0.47	0.20***	0.15
	(0.47)	(0.50)	(0.00)	(0.10)
Female spouses	0.48	0.24	0.25***	0.10
	(0.50)	(0.43)	(0.00)	(0.10)
Female heads	0.48	0.34	0.14	-0.06
	(0.51)	(0.48)	(0.23)	(0.19)

[a] Standard deviations in parentheses
[b] p-values in parentheses
[c] Standard errors in parentheses
[d] Probit regressions for social capital variables. Marginal effects are shown.
[e] The variable can take 5 values. One represents the lowest level (low satisfaction); five the highest level (high satisfaction).
[f] During the past 12 months
[g] Includes leadership positions in farmer, religious, women's, governmental, help, and trade groups
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

5.4 Social capital

In the lower part of table 4 we look at social capital. Male household heads are more likely to attend farmer group meetings than female spouses and female household heads (column 1-2). Sustainability standards do not change this pattern: they do not increase the probability that individuals participate in farmer group meetings (column 4). Table 4 also suggests that certified farmers are actively involved in group activities. Specifically, 48 percent of women and 67 percent of men in certified households hold administrative or leadership positions (column 1). Yet, differences between certified and non-certified individuals are insignificant after entropy balancing (column 4).

5.5 Access to extension and financial services

In table 5, we focus on agricultural services. About 48-76 percent of male household heads in certified households interact with extension officers and participate in field days (column 1). Had these men not entered certification, they would be 29-42 percentage points less likely to access such services (column 4). Certified female household heads are also likely to access agricultural information. Indeed, sustainability standards increase the likelihood that female household heads interact with extension offers or participate in training sessions by 54-59 percentage points. In contrast, sustainability standards have a smaller effect on female spouses' access to agricultural information. Standards increase the likelihood that female spouses interact with extension officers (by 31 percentage points), participate in field days (by 17 percentage points), and attend training sessions on coffee quality (by 21 percentage points). Yet, certified female spouses are as unlikely to attend training sessions on soil fertility and pest management as their non-certified counterparts (column 4).

Regarding financial services (lower part of table 5), we find that such services are especially accessed by male household heads. Sustainability standards further improve access to financial services among men (column 4), but have no effect on women's access to financial services.

Table 5: Access to extension and financial services

	Descriptive statistics			Entropy balancing
	(1) Certified Mean [a]	(2) Non-cert. Mean [a]	(3) Mean Diff. [b]	(4) ATT [c,d]
Interaction extension officer (1/0) [e]				
Male heads	0.72	0.35	0.37***	0.31***
	(0.45)	(0.48)	(0.00)	(0.10)
Female spouses	0.53	0.21	0.32***	0.31***
	(0.50)	(0.41)	(0.00)	(0.10)
Female heads	0.64	0.24	0.40***	0.58***
	(0.49)	(0.43)	(0.00)	(0.13)
Participation in field days (1/0) [e]				
Male heads	0.48	0.11	0.36***	0.39***
	(0.50)	(0.32)	(0.00)	(0.07)
Female spouses	0.23	0.10	0.13***	0.17***
	(0.42)	(0.30)	(0.01)	(0.04)
Female heads	0.27	0.11	0.17*	0.19*
	(0.45)	(0.31)	(0.07)	(0.10)
Training on soil fertility (1/0) [e]				
Male heads	0.76	0.40	0.35***	0.29***
	(0.43)	(0.49)	(0.00)	(0.10)
Female spouses	0.48	0.25	0.23***	0.09
	(0.50)	(0.43)	(0.00)	(0.10)
Female heads	0.73	0.26	0.46***	0.54***
	(0.45)	(0.45)	(0.00)	(0.17)
Training pest management (1/0) [e]				
Male heads	0.76	0.31	0.46***	0.42***
	(0.43)	(0.46)	(0.00)	(0.10)
Female spouses	0.49	0.19	0.31***	0.16
	(0.50)	(0.39)	(0.00)	(0.10)
Female heads	0.70	0.21	0.49***	0.59***
	(0.47)	(0.41)	(0.00)	(0.16)
Training on coffee quality (1/0) [e]				
Male heads	0.76	0.43	0.33***	0.32***
	(0.43)	(0.50)	(0.00)	(0.10)
Female spouses	0.48	0.23	0.25***	0.21**
	(0.50)	(0.42)	(0.00)	(0.10)
Female heads	0.73	0.26	0.46***	0.59***
	(0.45)	(0.45)	(0.00)	(0.17)
Financial services (1/0) [f]				
Male heads	0.85	0.64	0.21***	0.22**
	(0.36)	(0.48)	(0.00)	(0.09)
Female spouses	0.64	0.48	0.16**	-0.02
	(0.48)	(0.50)	(0.01)	(0.09)
Female heads	0.76	0.58	0.18	0.05
	(0.44)	(0.50)	(0.12)	(0.15)

[a] Standard deviations in parentheses
[b] p-values in parentheses
[c] Standard errors in parentheses
[d] Probit regressions. Marginal effects are shown.
[e] Within the past 12 months
[f] Access to financial services through credit/savings groups, mobile money services, or savings account
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

5.6 Robustness checks

As a robustness check, we estimate treatment effects for all outcomes using IPW. Results are displayed in the appendix (table A2-A4). Overall, these robustness checks support our findings, especially regarding the sign of the effects. However, in some cases, IPW estimates are significant at a higher level than estimates obtained through entropy balancing. Given these differences, we prefer using the more conservative estimates, obtained through entropy balancing. In many instances, the magnitude of the treatment effect is similar using entropy balancing and IPW. For instance, we find that standards increase the value of female spouses' assets by 146,780 UGX (using entropy balancing) or 147,650 UGX (using IPW) (see table 3 and table A2). However, in other cases, IPW and entropy balancing estimates are dissimilar, especially for groups with few observations (e.g. female-headed households). The exact magnitude of treatment effects should hence be interpreted with caution.

6 Discussion and conclusion

Achieving gender equality remains a challenge, especially in rural areas of developing countries, where poverty is particularly persistent. The literature suggests that agricultural commercialization may further increase gender disparities. Here, we have analyzed whether sustainability standards can contribute to mitigating such adverse effects on gender equality. We have focused on two sustainability standards that specifically address gender issues in cash crop production, namely Fairtrade and UTZ. Based on a household survey and gender-disaggregated data, we have analyzed the effect of sustainability standards on individuals in male-headed households (i.e. on male household heads and female spouses) and in female-headed households (i.e. on female household heads). Our results suggest that sustainability standards may not completely eliminate gender disparities, but can at least contribute towards this goal.

Our results regarding economic empowerment are promising and challenge earlier conclusions that economic benefits from sustainability standards are captured by men (Bolwig, 2012; Sen, 2014; Loconto, 2015). Our results suggest that a differentiation between male-headed and female-headed households is useful, given heterogeneous effects. We hypothesized that sustainability standards may contribute to women's economic empowerment (1) by improving women's access to markets and income or (2) by increasing women's control over income from cash crop production. We find that the fist holds for female household heads; and the latter for female spouses. In female-headed households, sustainability standards increase total household assets and women's individual assets almost to the same extent. This is because most assets in female-headed households are owned by

female heads. The positive welfare effect possibly stems from higher coffee revenues among certified households. Female household heads are usually responsible for coffee production and marketing, so that they directly benefit from the access to high value markets and higher incomes. More generally, these findings support that cash crops are seldom produced only by men – and that the label 'men's crop' may not be applicable (Doss, 2002; Orr et al., 2016).

In male-headed households, standards do not only increase household assets, they also affect the distribution of wealth within households. Specifically, standards increase the value of women's assets and jointly held assets significantly. Apart from this absolute increase, standards also increase the share of assets held jointly by male heads and female spouses. We also show that women in certified households have greater control over coffee and crop revenues than their non-certified counterparts. This may explain why women are able to increase their asset stock. Our results are promising because we find that women can benefit economically from standards – even if they are not directly involved in marketing. In fact, we find that standards to not challenge male heads' dominant role coffee production and marketing at all. Standard may affect the distribution of wealth within households through different channels. Our results suggest that standards increase overall household welfare (proxied here using the value of household assets). In wealthier households, wealth may be more equally distributed among household members. Further, standards may increase peoples' preferences for a more equal distribution of wealth – though workshops, policies, and rules on non-discrimination and gender equality, implemented by certified farmer organizations.

Our results also differ from previous, qualitative studies regarding women's workload. We find no evidence that sustainability standards increase women's workload. Our results may differ from previous results (Lyon et al., 2010; Bolwig, 2012), because our sample farmers are not Organic certified – and can thus use chemical pesticides. However, our data do not capture seasonal differences and may thus disguise how the burden of work is distributed throughout the year. For instance, UTZ and Fairtrade include requirements on coffee quality. Meeting these requirements presupposes careful and repeated picking of coffee cherries. Although harvesting is usually a joint activity (i.e. undertaken by all household members) the burden of work during the harvest seasons may be unequally distributed within households.

Results further indicate that sustainability standards improve farmers' access to agricultural information, irrespective of gender. However, male and female household heads benefit more from sustainability standards than female spouses in this regard. Female spouses are also less likely than their husbands to register as a farmer group member and to participate in farmer group meetings. As Lyon (2008) points out, being an active, registered member is a precondition to influence decisions on which services are provided by certified farmer

organizations. We also find that sustainability standards improve men's access to financial services – but not women's access to financial services. Thus, more could be done to improve especially female spouses' access to agricultural services and to encourage their registration as farmer organization members.

One may argue that sustainability standards fail to challenge traditional gender roles and inequalities, if men's dominance in cash crop marketing and farmer organizations persists (Sen, 2014; Loconto, 2015). However, expectations regarding the effect of sustainability standards or other development interventions should be realistic. Gender equality should be understood as a long-term process. Standards alone will not eliminate gender disparities. Thus, although we find that standards cannot address gender disparities in all respects, we consider the positive trend promising. It should however be emphasized that gender components of sustainability standards are usually suggestions to certified farmer organizations rather than mandatory certification requirements. As a result, it depends on the farmer organization and contextual factors whether or not gender issues are accounted for in implementing standards. In the two farmer organizations in Uganda, gender policies were implemented. Elsewhere this may not always be the case. Thus, we agree with previous qualitative studies (Lyon, 2008; Hutchens, 2010) that gender issues could be addressed more explicitly in standards – for instance in the form of mandatory certification requirements. Thereby, sustainability standards may promote gender equality in certified households more broadly.

We want to point at a number of shortcomings of our study to encourage future research into this direction. Although our findings indicate that standards can contribute to improving gender equality, the exact magnitude of our estimates should be interpreted with caution. This holds especially for subgroups for which the sample size is small (i.e. female-headed households). Moreover, we are not able to capture possible spill-over effect. Certified farmers are strongly encouraged to participate in trainings on gender equality and farming management. However, non-certified members of the certified farmer organizations are not explicitly excluded from such trainings. They may also be influenced by gender-sensitive rules and policies. As we do not account for possible spill-over effects in our analysis, we may underestimate the effect of sustainability standards on gender equality. Future research into this direction would be useful to obtain more precise treatment effects.

Further, we have used observational, cross-sectional data for our impact assessment. As a result, we cannot rule out possible selection bias. We have used entropy balancing to control for observed heterogeneity; and estimates on farmers' willingness to accept (WTA) sustainability standards to reduce possible bias from unobserved heterogeneity. Future studies

could employ research designs and methods that are better suited to deal with possible issues of selection bias.

To assess individual-level impacts, we have used data collected at the household level and at the individual level. We suggest there is a potential trade off in using either of these approaches, which has received little attention so far. Specifically, data obtained at the household level may suffer from bias, because households members may have different perceptions regarding their and other's decision making authority (Anderson et al., 2017) or asset ownership. In other words, interviewing only one household member (usually the household head) may not provide the full picture. In contrast, data obtained at the individual level may suffer from selection bias, because interviewing several household members in each household may not always be possible. For instance, in our case, we could not interview all spouses, as some persons were not available when we arrived to conduct the survey. Given these two potential sources of bias, it is not clear which approach is more accurate to assess individual-level impacts. Nevertheless, we emphasize that we have no reasons to believe that we only interviewed particularly empowered women, nor that we failed to interview particularly disempowered women.

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Appendix

Table A1: Treatment probabilities (individual level)

	(1) Male heads	(2) Female spouses	(3) Female heads
Household size	0.02	0.01	-0.03
	(0.01)	(0.01)	(0.03)
Muslim (1/0)	-0.20*	-0.18*	-0.64**
	(0.10)	(0.10)	(0.30)
Age (yrs.)	0.02***	0.02***	0.00
	(0.00)	(0.00)	(0.01)
Age gap (age head - age spouse)	-0.01**	0.01*	
	(0.00)	(0.00)	
Schooling (yrs.)	0.05***	0.06***	0.03
	(0.01)	(0.01)	(0.02)
Education gap (schooling head - spouse)	-0.03**	0.02	
	(0.01)	(0.01)	
Yrs. growing coffee	-0.00	0.00	0.00
	(0.00)	(0.00)	(0.01)
Altitude (m)	0.00**	0.00***	0.00***
	(0.00)	(0.00)	(0.00)
Distance to input market (km)	-0.01	-0.02**	0.01
	(0.01)	(0.01)	(0.01)
Distance to output market (km)	-0.00	-0.01	-0.03
	(0.01)	(0.01)	(0.02)
Wealthy ancestors (1/0)	-0.09	-0.16*	0.18
	(0.09)	(0.09)	(0.18)
WTA sustainability standards	0.00	0.00	0.05**
	(0.01)	(0.01)	(0.02)
Observations	233	244	71
Pseudo R^2	0.19	0.22	0.25
LR chi^2	61.63***	74.84***	24.90***

Probit estimates, marginal effects are shown
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A2: Asset ownership (in 1000 UGX)

	IPW	
	ATT	SE
Male-headed households		
Value household assets	1148.58***	(348.19)
Asset ownership male head		
Value	109.06	(254.95)
Percent of total household assets	-10.52**	(4.80)
Asset ownership female spouse		
Value	147.65**	(69.78)
Percent of total household assets	-0.55	(2.41)
Joint asset ownership		
Value	926.86***	(220.69)
Percent of total household assets	12.43***	(4.65)
Female-headed households		
Value household assets	1775.60***	(554.28)
Asset ownership female head		
Value	1409.25***	(530.30)
Percent of total household assets	-7.13	(6.31)

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A3: Workload and social capital

	IPW	
	ATT	SE
Workload and satisfaction		
Farm, off-farm, and domestic work (hrs./day)		
Male heads	-0.07	(0.50)
Female spouses	0.17	(0.59)
Female heads	0.19	(0.68)
Satisfaction leisure time (1-5)[e]		
Male heads	0.00	(0.17)
Female spouses	-0.01	(0.22)
Female heads	-0.60	(0.40)
Social capital		
Participation in farmer meetings (1/0)		
Male heads	-0.04	(0.05)
Female spouses	0.16*	(0.08)
Female heads	0.07	(0.16)
Administrative / leadership position (1/0)		
Male heads	0.17**	(0.08)
Female spouses	0.20***	(0.08)
Female heads	-0.03	(0.16)

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A4: Access to extension and financial services

	IPW	
	ATT	SE
Interaction extension officer (1/0)		
Male heads	0.35***	(0.08)
Female spouses	0.34***	(0.07)
Female heads	0.45***	(0.13)
Participation in field days (1/0)		
Male heads	0.39***	(0.05)
Female spouses	0.15***	(0.05)
Female heads	0.09	(0.12)
Training on soil fertility (1/0)		
Male heads	0.31***	(0.08)
Female spouses	0.19***	(0.07)
Female heads	0.43***	(0.13)
Training pest management (1/0)		
Male heads	0.44***	(0.07)
Female spouses	0.26***	(0.07)
Female heads	0.50***	(0.13)
Training on coffee quality (1/0)		
Male heads	0.32***	(0.08)
Female spouses	0.27***	(0.07)
Female heads	0.46***	(0.13)
Financial services (1/0)		
Male heads	0.22***	(0.07)
Female spouses	0.02	(0.07)
Female heads	0.07	(0.12)

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$