WORKING PAPER / 2018.07

# Improving intrahousehold cooperation for efficient smallholder farming.

## A field experiment in central Uganda

Els **Lecoutere**

IOB
Institute of Development Policy
University of Antwerp

Working Papers are published under the responsibility of
the IOB Research Commission, without external review process.
This paper has been vetted by **Danny Cassimon**, chair of the Research Commission.

Comments on this Working Paper are invited.
Please contact the author at els.lecoutere@uantwerpen.be.

**Institute of Development Policy**

Postal address:
Prinsstraat 13
B-2000 Antwerpen
Belgium

Visiting address:
Lange Sint-Annastraat 7
B-2000 Antwerpen
Belgium

Tel: +32 (0)3 265 57 70
Fax: +32 (0)3 265 57 71
e-mail: iob@uantwerp.be
http://www.uantwerp.be/iob

**WORKING PAPER / 2018.07**

**ISSN 2294-8643**

# Improving intrahousehold cooperation for efficient smallholder farming.
## A field experiment in central Uganda

Els **Lecoutere***

July 2018

* Marie Skłodowska-Curie Postdoctoral Fellow, Institute of Development Policy (IOB), University of Antwerp, Prinsstraat 13, 2000 Antwerp, Belgium, els.lecoutere@uantwerpen.be, M+32494835205, Skype – eilecout

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Sklodowska-Curie grant agreement No 702964. The project received support from the Hanns R. Neumann Stiftung and from the International Institute of Tropical Agriculture, Uganda research station as well.

Data and code used in this article will be available on http://dx.doi.org/10.17632/ny738nc4ck.1 from October 1, 2019 onwards; before, these are available on request.

IOB
Institute of Development Policy
University of Antwerp

# Table of Contents

## Abstract

Food security and a structural transformation towards more commercial agriculture in developing contexts requires more efficient and sustainable smallholder farming. Agricultural households, however, miss out on efficiency gains because of a lack of cooperation and unequal intrahousehold bargaining power, which a randomly encouraged introduction of participatory intrahousehold decision-making – through an intensive and less intensive treatment – tries to amend. We investigate its impact on the efficiency of agriculture-related household outcomes in smallholder coffee farming households in Uganda.

The intensive, as compared to the less intensive treatment, has a positive impact on the joint management of the most important food and cash crops grown in the household farm - a direct measure of cooperation - and on joint ownership of food crop plots and maize plots.

The intensive versus less intensive treatment makes households opt for food crops with relatively certain harvests. Both the intensive and less intensive treatment versus no treatment stimulate the choice for consumable cash crops, instead of solely producing coffee for income. The intensive treatment has a positive impact on the adoption of sustainable agronomic intensification practices for coffee and food production. This is an indication that households go for more efficient and sustainable farming, while increasing the attention for food production as well.

Total household income earned from selling livestock went up as a result of the intensive treatment. While household income earned from coffee generally decreased over time, in intensively treated households it decreased less than in the less intensively treated. A higher total household income earned from coffee reported by wives in intensively treated couples most likely results from more intrahousehold transparency over coffee income, an evolution that is important for women's bargaining power and involvement in the strategic management of their households.

In terms of impact on households' economic wellbeing, both the intensive and less intensive treatment versus no treatment stimulated the acquisition of land, but not of other assets. The intensive treatment increased the confidence about their households' wellbeing and food security, particularly among women.

# 1. Introduction

Efficient and sustainable smallholder farming is essential to face the challenge of food security and for a structural transformation towards more commercial agriculture in developing contexts. While there are constraints to efficient smallholder agriculture at different institutional levels, it is increasingly acknowledged that important constraints at the household level hinder capitalizing on efficiency gains (Doss & Meinzen-Dick 2015). The lack of cooperation between spouses in dyadic agricultural households, especially in patriarchal societies, is linked to specific gender norms defining roles, responsibilities and control and to imbalanced intrahousehold bargaining power, with women having a weaker negotiation position (Doss & Meinzen-Dick 2015).

Improving cooperation within agricultural households is necessary to exploit efficiency gains and can, at the same time, improve gender equity within households, which, in turn, can contribute to efficiency by freeing the way for more (risky) household investments (Slootmaker 2013) and by keeping members motivated for sustained contributions to collective action (Ostrom 1990).

The evidence of inefficient - and inequitable - household farm systems is there; theory provides insights into the reasons for inefficiencies and how these could be turned back; evidence of effective solutions, however, is still limited. That is why this article investigates whether it is possible to induce changes within agricultural households that make them more cooperative; and whether that can result in more efficient household outcomes including more efficient agricultural production? More particularly, in this article, we will assess the impact on the efficiency of household outcomes of a randomly encouraged package of interventions aimed at improving cooperation and gender equity through stimulating a more participatory way of intrahousehold decision-making in smallholder coffee farming households in central Uganda.

We found that an intensive coaching package, as compared to less intensive couple seminars, and spillovers from intensively coached couples have a positive impact on agreed upon joint management of food and cash crops grown in the household farm, and on joint ownership of food crop plots and maize plots. The intensive coaching makes households opt for less risky food crops. As compared to no exposure to interventions introducing participatory intrahousehold decision-making, the intensive and less intensive treatment makes households more likely to opt for consumable cash crops, instead of solely coffee. The intensive coaching and its spillovers, versus couple seminars, increase the adoption intensity of sustainable agronomic intensification practices for coffee and but also for food production. Intensively coached households increased their total household income earned from selling livestock, and their income earned from coffee went up more over time. Women report a higher total household income earned from coffee as a result of the intensive coaching which reflects they became better informed about their households' coffee income. In terms of households' economic wellbeing, there is a positive impact on the acquisition of land, as result of the intensive and less intensive treatment versus no exposure, but no impact on the accumulation of other assets. The intensive coaching increased the confidence about their households' wellbeing and food security, particularly among women.

# 2. Literature review

## 2.1. Theories of the household

It has now been established that a unitary household model, which makes abstraction of individual preferences of household members and assumes the collective action problem of the household is solved, does not adequately explain how households decide upon production and resource allocation (Udry 1996; Doss & Meinzen-Dick 2015).

Cooperative bargaining models acknowledge that each household member has his/her own utility function with different preferences and different abilities to impact outcomes, which implies bargaining between household members (Alderman, Hoddinott, Haddad, & Udry 2003). It is assumed that the threat point of those involved in bargaining - i.e. their outcomes if they would not be part of the household - forces Pareto efficient household outcomes (Udry 1996; Doss & Meinzen-Dick 2015).[1] The outside options of those involved in bargaining therefore determine the intrahousehold resource allocation.

Non-cooperative (separate sphere) bargaining models do not assume that resources are necessarily pooled within the household but acknowledge that "each individual makes separate but interrelated production and consumption decisions based on his or her own preferences and interests and expectations of what others will do" (Doss & Meinzen-Dick 2015:172; Udry 1996). Outcomes will depend on individual control over resources within the marriage, and are not per se Pareto efficient (Lundberg & Pollak 1993: in Udry 1996). Neither does this imply the household is a sum of individuals. Some degree of collective action within the household is likely either for the sake of household public goods or out of altruism (Udry 1996). The presence of household public goods (and/or altruism) makes that each household member has a stake in the welfare of the other members, hence motivates him/her to contribute to the benefit of the others and not just him/herself.

Doss and Meinzen-Dick (2015) take the existence of household public goods and collective action within the household further. They do so by drawing parallels with common pool resources (CPR). They argue that households, and especially agricultural households, just like user groups of CPR, manage a set of common resources to provide in a livelihood and are mutually interdependent on the individual decisions of the other members about provision and appropriation of (the benefits of) those resources, which have implications for all users. The common resources of an agricultural household, such as land, time, capital, share the rival nature and difficulty to exclude others from their use with CPR. Hence, similar collective action problems arise. Doss and Meinzen-Dick (2015) suggest that findings ways to improve cooperation within agricultural households can benefit from looking into ways to overcome the provision and appropriation dilemmas that typically arise in CPR settings.[2]

## 2.2. Evidence of non-cooperative bargaining household models

Evidence supports non-cooperative bargaining models for (agricultural) households. There is ample evidence of the absence of Pareto efficient outcomes in agricultural households, of which we provide a non-exhaustive review.

[1] Pareto efficiency implies the household could not produce more by reallocating labour or other resources and could not make at least one better off without making anyone worse off by reallocating goods and services across household members (Doss & Meinzen-Dick 2015).

[2] The provision dilemma exists in the fact that individual users may underinvest in provisioning of the CPR because they would individually bear the costs but only (expect to) receive a share of the benefits. The appropriation dilemma emerges as individual users members may overconsume the CPR, and even deplete them, because they can individually benefit while bearing only a portion of the costs related to overuse (Ostrom 1990).

In Burkina Faso, plots controlled by women were found to have significantly lower yields than similar plots within the household planted with the same crop in the same year, but controlled by men. That yield differential could be attributed to significantly higher labour and fertilizer inputs per acre on plots controlled by men. While total household crop yields could have been increased by shifting fertilizer from men's fields to women's fields, this did not happen (not Pareto efficient) (Udry 1996).

Duflo and Udry (2004) took advantage of the fact that particular rainfall patterns affects crops that tend to be produced by women and by men differently, to study the effect on the allocation of expenditures to household public goods or private goods in Côte D'Ivoire. They argue that, controlled for total expenditures, in Pareto efficient households, such differential effects of rainfall shocks should not translate into any difference in the allocation of expenditures to public and private goods within the household. Yet, they find evidence of differences in allocation of expenditures (*cfr. infra*).

McPeak and Doss (2006: in Doss & Meinzen-Dick 2015) found that, while East African pastoralist women could market milk in town and contribute to the household income, male household heads opted to move the household farther from town to limit women's milk marketing, a decision that appears to go counter maximizing household benefits.

Heath and Tan (2016) showed that Indian woman's unearned income, which followed from women's improved ability to inherit property through the Hindu Succession Act, can increase her labour supply by strengthening her autonomy, thus raising her utility of working. That finding cannot reconciled with a cooperative bargaining model, but only with a non-cooperative bargaining model.

The recent evidence of significant gender productivity gaps based on plot level data in Ethiopia (Aguilar, Carranza, Goldstein, Kilic, & Oseni 2014), Uganda (Ayalew, Bowen, Deininger, & Duponchel 2015), and Malawi (Kilic, Palacios-Lopez, & Goldstein 2015), among others, also imply that households forego significant efficiency gains in agriculture by the lack of cooperation.

In addition, there is an increasingly large body of experimental evidence of the lack of cooperation– i.e. of inefficient outcomes - in (agricultural) households (see the review by Munro 2017; Fiala & He 2017).

## 2.3. Evidence of intrahousehold bargaining power affecting household outcomes

Non-cooperative bargaining models imply bargaining whereby each household member's negotiation position will influence the weight of decisions of each household member about resource allocation (Agarwal 1997; Doss 2013). One's intra-household negotiation position gains from a stronger fall-back position, i.e. one's individual control over resources. That fall-back position is determined by one's – de jure and de facto - access to private and common productive assets, income earning means, social and external support systems and by social perceptions and norms; which, in a context of patriarchy, are disfavouring women (Agarwal 1997). In parallel with CPR, the intrahousehold 'rules of the game' – i.e. operational rules about each member's responsibilities and rights, sanctioning rules, collective choice and constitutional rules about decision-making and who can contribute to decisions – are important for the success of collective action within households and the (equitability of) outcomes thereof (Doss & Meinzen-Dick 2015). As social norms can set limits to what can be negotiated and how this can be done, they are likely to influence such intrahousehold 'rules of the game', and make them

gender skewed in settings where patriarchy shapes norms (Agarwal 1997; Folbre 1994: in Doss & Meinzen-Dick 2015).

There is substantial evidence of the way household bargaining, and more particularly strengthened bargaining power of women, impacts household decision-making in different fields. We distinguish decision-making about household expenditures, consumption, labour supply and time allocation, investment and agricultural supply, as Fiala and He (2017) did in their review.

More equal intrahousehold bargaining power is found to result in greater involvement of women in decisions about expenditures (Hashemi et al. 1996: in Fiala & He 2017; Lecoutere & Wuyts 2017), about loan use and money management (Holvoet 2005), and increases women's autonomy in such decisions (Anderson & Eswaran 2009: in McCarthy & Kilic 2017; De Brauw et al. 2014). In African countries, it increases women's input into several farm and non-farm decision-making processes (Doss et al. 2014: in McCarthy & Kilic 2017). In the case of Uganda, there is weak evidence of increased women's involvement in agricultural decisions (Lecoutere & Wuyts 2017).

More equal bargaining power has a positive impact on the consumption of durable goods (De Brauw et al. 2014; Polato e Fava & Arends-Kuenning 2013: in Fiala & He 2017), and food (as a consequence of rain shocks favouring women's crops) (Duflo & Udry 2004). In Bangladesh, Ethiopia, Indonesia, and South Africa, expenditures on food and education went up (Maluccio & Quisumbing 2003). In Mexico, investments in children and small livestock increased (Rubalcava et al. 2009: in Fiala & He 2017).

Women were shown to gain control over their time allocation as a result of credit, but only in cases of group lending (Holvoet 2005). In India, women's labour supply increased as a result of women's bargaining power that was strengthened by a change in inheritance laws (Heath & Tan 2016). Unilateral divorce laws that strengthen women's bargaining power have been shown to have similar positive effects on women's labour supply in the United States (Stevenson 2008: in Fiala & He 2017), and in other countries (Iversen & Rosenbluth 2006: in Fiala & He 2017). Higher women's relative wages led to more leisure time and less household work in the United States (Friedberg & Webb 2005: in Fiala & He 2017) and in Australia (Bittman et al. 2003: in Fiala & He 2017).

When it comes to investment and agricultural supply, in Ethiopia, strengthened women's bargaining power reduced investments in cash crop production in case the husband controls the earnings but relies on women's labour (Lim et al. 2007: in Fiala & He 2017). Men's increased dependence on women's labour for the production of cocoa in Ghana prompted men to provide land to their wives as an incentive for them to tend the cocoa trees (which also corroborates that mutual dependence fosters cooperation in other areas (*cfr. infra*)) (Quisumbing & Otsuka 2001: in Doss & Meinzen-Dick 2015). Yilmazer and Lich (2015: in Fiala & He 2017), for the United States, link changes in the household portfolio asset allocation to changes in bargaining power as the household portfolio asset allocation follows the risk tolerance level of the spouse with more power bargaining.

## 2.4. Evidence of the impact of cooperation and/or women's relative bargaining power on household outcomes

McCarthy and Kilic (2017) point out that the non-cooperative (separate sphere) bargaining model allows for four different scenarios based on the level of cooperation between household members and on their relative bargaining power. The scenario with equal bargaining

power and cooperation is expected to lead to the best outcomes in terms of efficiency and equity. An non-exhaustive review of existing evidence of the impact of cooperation and/or women's relative bargaining power on household outcomes is presented here.

Duflo and Udry (2004) demonstrated that increased jointly controlled income (as a proxy for cooperation), for which rainfall patterns favouring crops that by norms should be used to the benefit of the household are used as a proxy, has a significant positive impact on all household public goods expenditures, including education as well as food, and significant negative impacts on adult goods. Increased women's income (as a proxy for her empowerment) has a positive impact on most food categories, but also on expenditures on adult goods.

In Malawi, cooperation in agricultural households, as measured by the proportion of total household income jointly controlled, is positively associated with total household income, consumption expenditures per capita, and the share of household consumption devoted to public goods. Stronger women's bargaining power, for which the share of female income in total disjoint income is used as a proxy, is also positively related to total household income, although to a lesser extent (McCarthy & Kilic 2017).

Experimentally measured intrahousehold decision-making that supports cooperation and equitable sharing between spouses is associated with greater household investment in the intensification of cash and food crop production, more equitable access and control over income within the household, and improved household food security among smallholder coffee farming households in Uganda (Lecoutere & Jassogne 2017).

Evidence of the impact of programs or interventions stimulating cooperation and/or equal intrahousehold bargaining power on the efficiency and equity of household outcomes is emerging but remains limited for now.

Kafle, Michelson, and Winter-Nelson (2016) quasi-experimentally studied the impact of a program implemented in Zambia, providing a livestock transfer to women in combination with training for women and their husbands aimed to improve upon intrahousehold decision-making by tackling topics like gender balance, accountability, shared responsibilities, sustainability and self-reliance, and social justice. As a result, decisions made jointly by men and women increased across all household activities, at the expense of decisions independently made by men. The observed increase of women's involvement in decision-making is driven by the increase in joint decision-making.

In Côte d'Ivoire, a quasi-experimental evaluation of a program facilitating intrahousehold and intracommunity communication about gender equity showed a positive impact both on the involvement of women in decision-making and on joint decision-making about domestic work, livestock, children, expenditures and health; however, the study showed no impact on decision-making about farming. The regularity of intrahousehold communication improved as well (Nordhagen, Bastardes Tort, Kes & Winograd 2017).

In a qualitative evaluation of the household level activities of the Gender Action Learning System (GALS) implemented among coffee farming households in Uganda, men and women report an increase of joint decision-making over household income and expenditures, of joint investments such as businesses, of joint land titles, of men taking up reproductive tasks, and a decrease of domestic violence (Farnworth et al. 2013). A quasi-experimental assessment of the GALS implemented in Karamoja in Uganda - a context of poverty, severe disempowerment of women and violence against women – showed no change in women's or joint decision-making power about women's freedom of movement and a negative impact on women's and

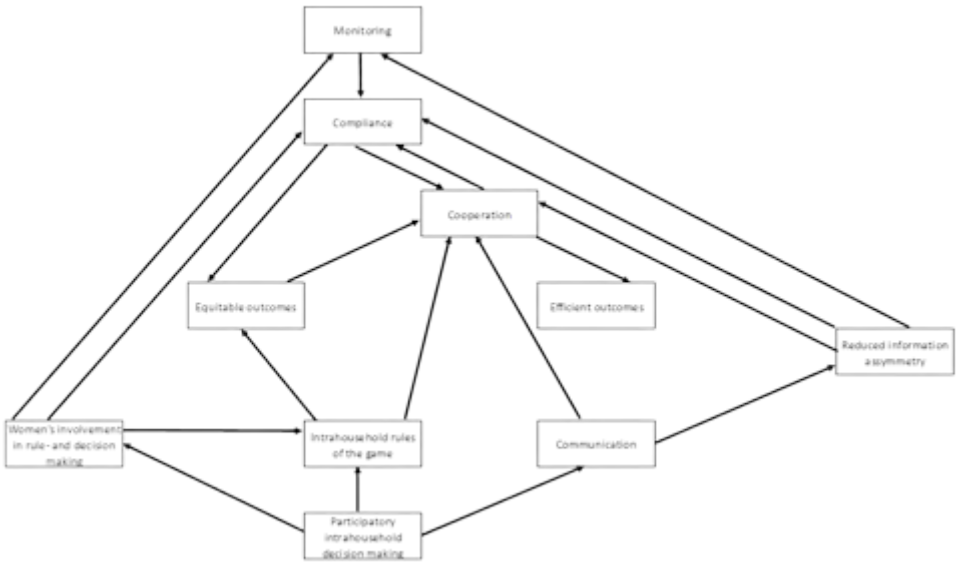
joint decision-making about household assets. However, the GALS did have a positive impact on some aspects of women's empowerment such as women's self-confidence and opinions about women's economic role, gender rights, and property rights (Lombardini & Yoshikawa 2015).

Lecoutere and Wuyts (2017) examined the impact of the introduction of a more participatory way of intrahousehold decision-making - by way of the same intervention as studied here - on women's empowerment (but not on the efficiency of household outcomes, which is the focus here). Introducing participatory intrahousehold decision-making was found to advance the involvement of women in decision-making about strategic household expenditures and business investments and to increase women's control over income earned from coffee produced in the household farm.

## 2.5. Pathways of change

Pointing to the existence of collective action challenges within households that resemble those in CPR settings, Doss and Meinzen-Dick (2015) call the importance of participation in decision-making for cooperation and rule compliance in CPR settings to mind and suggest it is worthwhile investigating the contribution of more participatory ways of intrahousehold decision-making on cooperation within agricultural households. The gains in efficiency through more participatory ways of intrahousehold decision-making can occur through increased cooperation and/or more equal intrahousehold bargaining power, the pathways through which are visualized in Figure 1.

**Figure 1** ***Pathways in which participatory intrahousehold decision-making can induce efficient outcomes***




Participation in rule- and decision-making in itself strengthens users' incentives to comply with rules in CPR settings (Bardhan 2000). Besides, in a patriarchal context, the promotion of participation in decision-making implies strengthening the voice of women in intrahousehold rule- and decision-making. Women's greater ability to include their claims in the rules reduces the likelihood of inequitable outcomes, as does increased compliance with sharing 'rules'

that spouses jointly devised (Agarwal 1997; Agarwal 2001; Doss & Meinzen-Dick 2015). Efficiency can benefit from reduced inequality in two ways. Inequality within households has been demonstrated to constrain choices for the most efficient options (Slootmaker 2013), and fairness in the allocation of benefits from common resources is conducive for sustained cooperation in CPR (Ostrom 1990; Baland & Platteau 1998).

Another important pathway through which the promotion of participatory intrahousehold decision-making can contribute to increased cooperation and efficiency, is through the reduction of information asymmetries between household members about each other's contributions to provision and each other's 'appropriation' of household resources. Theory and evidence on CPR management showed that reduced information asymmetry decreases the likelihood of opportunism and contributes to cooperation (Baland & Platteau 1998; Agarwal 2000). Experimental evidence in CPR and household settings has shown that communication in se is better for cooperative outcomes (Cardenas, Rodriguez, & Johnson 2011; Munro 2017), and especially in the case of continuing groups such as households (Carpenter and Seki 2011: in Munro 2017). In turn, as in CPR settings, the experience of less opportunistic provision and consumption is expected to strengthen incentives for cooperative behaviour (Ostrom 1990; Baland & Platteau 1996; Agrawal, 2003; Doss & Meinzen-Dick, 2015).

Effective monitoring and enforcement mechanisms are essential for efficient and sustainable management of CPR (Ostrom 1990; Baland & Platteau 1998). Equity, but also efficiency and sustainability, can be compromised if power imbalances limit the ability of the less powerful to enforce the rules (Agarwal 2000; Agrawal 2003; Lecoutere 2011; Lecoutere, D'Exelle, & Van Campenhout 2015). Thus, with greater participation of both spouses, including the wife, in rule-making and monitoring, each of the spouses is expected to be able to more effectively claim his/her share because the other spouse is aware about his/her contributions to investment in the household farm and because the resource allocation was mutually agreed upon.

## 3. Research hypotheses about the impact on the efficiency of outcomes in agricultural households

We have five research hypotheses about the impact participatory intrahousehold decision-making on the efficiency of outcomes in agricultural households (an overview of the outcome indicators and hypotheses can be found in Table 26 in Section 7 which summarizes results; descriptive statistics of the outcome indicators can be found in Table A in the Online Supplementary Materials 1).

Firstly, we expect a positive impact on the likelihood that husband and wife agree they ***jointly manage the production of the food crop and the cash crop*** that they consider to be most important source of food, respectively most important source of household income, as direct measures of cooperation between husband and wife. In line with Farnworth et al. (2013) and Lecoutere and Jassogne (2017), we expect a positive impact on ***joint ownership of land,*** as a formal acknowledgement of the households' productive land as a common resource and as a proxy for a greater level of cooperation.[3]

Secondly, in line with evidence of a positive impact of increased women's bargaining power and/or cooperation on the prioritisation of food needs (Maluccio & Quisumbing 2003;

[3] Ownership is largely undocumented in Uganda (Jacobs & Kes, 2015). Hence we measure perceived ownership and operationalized this by asking about who has the right and to what extent consent of the other spouse was needed in case of deciding upon selling, bequeathing, collateralizing, or renting out the land.

Jacobs and Kes (2015) caution, however, that joint land ownership in a Ugandan context should not be automatically associated with stronger land rights for women.

Duflo & Udry 2004; Njuki, Kaaria, Chamunorwa, & Chiuri 2011), we ***expect households to make choices that enhance certainty about food availability and that balance the household's food and income needs***. We will measure this by the likelihood (of switching from baseline to endline) of growing a food crop with a relatively certain harvest (including cassava, sweet potato) – as opposed to a food crop with a more risky harvest such as maize or rice. Our expectation of a greater emphasis on certain food crops as a result of women's bargaining power is informed by the fact that women tend to be highly concerned about their household's food security (Lecoutere & Wuyts 2017) and that households' investments tend to follow the risk tolerance of the spouse with more power bargaining (Yilmazer & Lich 2015: in Fiala & He 2017). For similar reasons as above, we expect a positive effect on households ***producing consumable cash crops*** such as maize or matooke banana, rather than coffee or banana for beer production. The choice for consumable cash crops, as well as a lower likelihood of coffee as the main cash crop, could also point to a ***positive effect on the adoption of diversification strategies*** to adapt to climatic, market and other risks; strategies which are generally associated with better food security as well (Waha, van Wijk, Fritz, See, Thornton, Wichern, & Herrero 2018).

Thirdly, more egalitarian, and more cooperative, households have been shown to be more likely to adopt (risky) technologies (Slootmaker 2013; Lecoutere & Jassogne 2017), hence we expect a positive impact of participatory intrahousehold decision-making on household's choices for efficient and sustainable farming. A ***higher intensity of adoption of sustainable agronomic intensification practices*** for coffee would point to such a choice. If there is indeed greater emphasis on food crop production, we anticipate the adoption intensity for the production of consumable cash crops such as maize, and food crops to increase as well.

Fourthly, in line with McCarthy and Kilic (2017), we ***expect a larger household (gross) income***, either as a result of greater cooperation, and/or more equal bargaining power that follows from participatory intrahousehold decision-making. We will measure the impact on the total income from selling coffee, other crops and livestock and on the (net) gain from base- to endline. The impact on the income from other crops and livestock would also point to a diversification of income sources in these coffee farming households (*cfr. supra*). Additionally, we anticipate that participatory intrahousehold decision-making will ***increase transparency*** - or reduce hiding - between spouses regarding income sources. This is informed by a general trend emerging from experimental studies that spouses mostly take the opportunity to hide resources and rarely invest all their resources in the most efficient (cooperative) option (a.o. Ashraf 2009; Mani 2011; Castilla & Walker 2013; Hoel 2015: in Munro 2017). Spouses hide resources to retain control over how they are spent (Iversen, Jackson, Kebede, Munro, & Verschoor 2011; Munro, 2017), or to safeguard the other spouse's contributions (van Staveren & Ode bode 2007). Women, however, regard transparency as a necessary complementary condition for their involvement in household decision-making, but deem it only feasible when their husband is cooperative (Lecoutere & Wuyts 2017).

Finally, increased cooperation and/or more equal bargaining power in the household through participatory intrahousehold decision-making is ***expected to contribute to the household's economic wellbeing,*** directly through efficiency gains, indirectly through reduced opportunism and its positive feedback loops (*cfr. supra*). We will look into three aspects of household's economic wellbeing: asset ownership, (the evolution of) household's relative wellbeing, and (the evolution of) the household's food security.[4]

[4] An analysis of the extent to which our study confirms an expected positive impact on investment in the education of children was challenged by delayed secondary school enrollment and data issues. The analysis has been

Overall, we expect an intensive coaching programme to have a stronger impact than a less intensive approach to introduce participatory intrahousehold decision-making (*cfr. infra*).

## 4. Context and intervention

This study concentrates on smallholder coffee farming households in sub-counties in Masaka and Kalungu districts and in Mubende district in central Uganda. Typically, these households produce food crops for household consumption, of which excess harvests are sold, and some cash crops - mostly coffee in this case - for marketing. The household farm system comprises of productive resources such as land, labour, financial and other assets, from which agricultural produce and income are derived.

The coffee farming households in this study are members of producer organisations (POs) linked to the Hanns R. Neumann Stiftung (HRNS), a non-profit foundation working with coffee farmers across the globe. HRNS stimulates sustainable livelihoods by supporting the coffee farming households with agronomic extension training promoting sustainable agronomic practices(mostly for coffee), diversification, and climate change adaptation and by encouraging joint marketing of coffee to increase competitiveness.

The HRNS intervention of interest for this study is the Gender Household Approach (GHA), through which a more participatory way of decision-making is promoted within their member coffee farming households. In a first stage, couple seminars are organised at the PO level, in which couples are guided through a self-assessment of the division of roles and responsibilities and control over resources in their household. Through enhanced awareness of the current gender division and imbalances, couples become motivated to introduce changes and one suggested way for change is a more participatory way of intrahousehold decision-making to better cooperate as a couple and share costs and benefits more equally.

The next stage is a package of activities intensively coaching couples on how to implement participatory intrahousehold decision-making. This is the intervention that has been randomly encouraged for this study among monogamous couples who participated in the couple seminars (*cfr. infra*). The activities in the intensive coaching program include a one-day workshop for couples focused on putting participatory planning and decision-making into practice by drafting a joint household farm plan and budget. The household farm plan and budget is an important communication tool where spouses together lists their planned investments, expected income and necessary expenditures for both their farm and household. After that, the couples receive a home visit by the HRNS gender officer to support the implementation of their farm plan and budget, to coach and follow up on the way spouses share decision-making. A third activity is a women leadership training. The fourth and final activity is a follow-up workshop in which couples share experiences and self-evaluate the coaching program. The couples in the intensive coaching program are stimulated to promote participatory intrahousehold decision-making and gender equity within their communities in order to create a positive spill over and widen the program's reach.[5]

moved to the Online Supplementary Materials 5.

[5] HRNS normally also organizes drama shows in the communities to widen the GHA's reach, but these have not taken place before endline data collection for this study.

# 5. Method

## 5.1. Data and samples

This impact assessment is based on data collected in sub-counties in Kalungu district and in Masaka district (labelled the Masaka-Kalungu sub-sample) and in Mubende district (labelled the Mubende sub-sample). Baseline data collected ran from end November 2015 till early July 2016 and endline data collection from February until April 2017 in the Masaka-Kalungu sub-sample. In the Mubende sub-sample, baseline data was collected from half November 2016 until March 2017, endline data from half January 2018 till half March 2018.

The final Masaka-Kalungu sub-sample, net of attrition, includes 366 households, the Mubende sub-sample 421 households, in which both husband and wife have been interviewed individually (Table 1).[6]

**Table 1 *Composition of sub-samples***

| Number of couples | Treatment | Non-compliers in Treatment | Control-A | Non-compliers in Control-A | Control-B | Control-C | Final sample | Attritors | Original sample |
|---|---|---|---|---|---|---|---|---|---|
| Masaka-Kalungu sub-sample | 166 | 6 | 159 | 9 | 0 | 41 | 366 | 8 | 374 |
| Mubende sub-sample | 180 | 4 | 104 | 4 | 82 | 55 | 421 | 37 | 458 |
| Total | 346 | 10 | 263 | 13 | 82 | 96 | 787 | 45 | 832 |

In the final Masaka-Kalungu sub-sample, 166 couples are part of the **Treatment group** (**T**). These couples were randomly selected out of the monogamous couples who participated in couple seminars (a selection of maximum six couples out of each of the 29 couple seminars that were conducted) and were encouraged to follow the intensive coaching treatment (Table 1). Out of those randomly encouraged couples, six couples did not comply with their assigned treatment. Out of the monogamous couples who participated in couple seminars, a random selection of 159 couples were not encouraged to take part in the intensive treatment (maximum six couples were selected per couple seminar). These couples form the **Control-A group** (**CA**). Nine couples are non-compliers and followed the intensive coaching despite non-encouragement. Control-A couples only received the couple seminars, but in the producer organization (PO) they are member of, some couples received the intensive coaching. Hence, spillovers are possible. The **Control-C group** (**CC**) includes 41 couples who were not exposed to any GHA intervention as they are members of POs in areas that were excluded for the GHA. All couples, regardless of treatment status, received standard agronomic and marketing trainings organised by HRNS.

In the final Mubende sub-sample, there are 180 couples in the **Treatment group**, randomly selected out of monogamous couples who participated in 42 couple seminars, of which four are non-compliers. There are 104 couples in the **Control-A group**, of which four are non-compliers, and 55 couples in the **Control-C group**. In the Mubende sub-sample, there is an additional **Control-B group** (**CB**), composed of a random selection of couples who participated in couple seminars and who were not encouraged to follow the intensive coaching. They differ

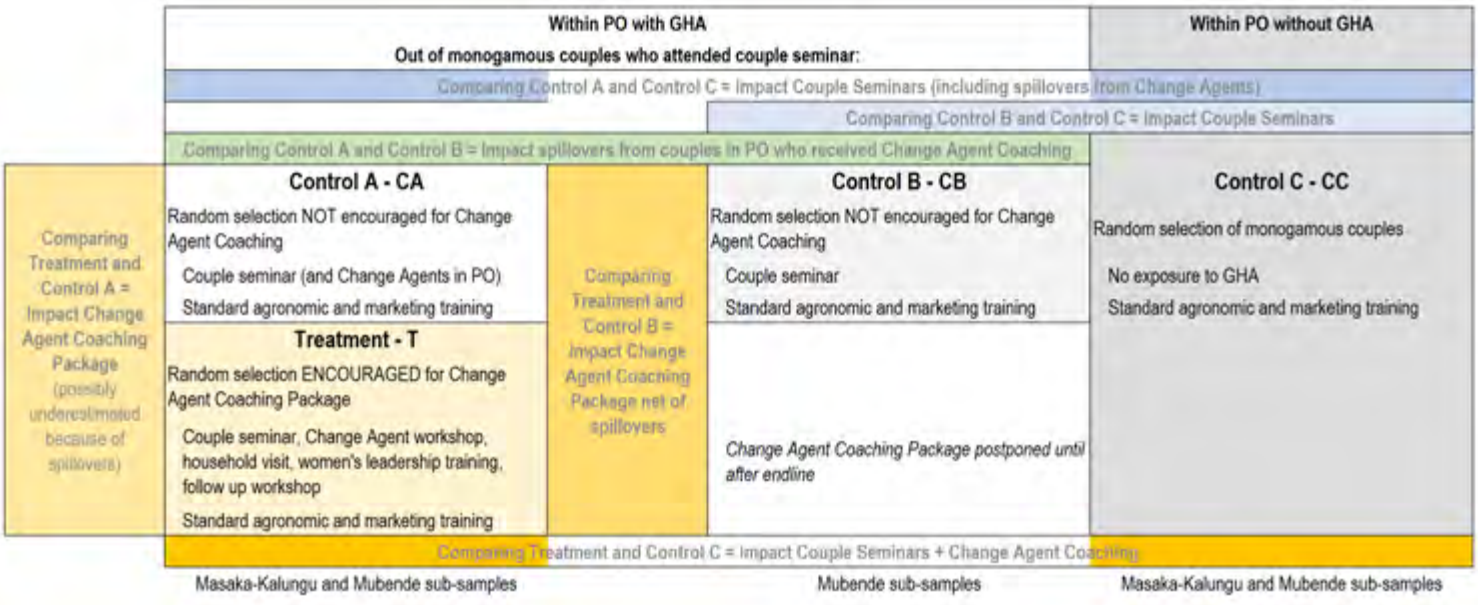
[6] There is random attrition of 8 couples in the Masaka-Kalungu sub-sample, of 37 couples in the Mubende sub-sample. The reasons for attrition in the Masaka-Kalungu sub-sample include no consent by either one of the spouses (82.6% of attrited households), divorce (8.7%) of death of the husband (8.7%). The reasons for attrition in the Mubende sub-sample include relocation (29.7%), divorce (18.9%), no consent by either one of the spouses (16.2%), death of the husband (13.5%), exclusion because the composition of the couple was not consistent across couple seminar, experiment and survey (10.8%), data issues (8.1%), and the imprisonment of the husband (2.7%). Attrition is unlikely to have introduced bias since there is balance in the distribution of selected baseline covariates.

from the Control-A group by not having couples who followed the intensive coaching program in their PO, hence, by the absence of spillovers. We avoided the presence of intensively coached couples by delaying that intervention until after endline data collection.[7]

## 5.2. A randomized encouragement design: Estimation of impact

The randomized encouragement design (visualized in Figure 2) allows estimating the **impact of the intensive coaching**, received after a couple seminar, **as compared to having only received a couple seminar**, **net of spillover effects** from couples who received intensive coaching by comparing Treatment and Control-B, only possible in the Mubende sub-sample. By comparing Treatment and Control-A, we can estimate the impact of the intensive coaching versus a couple seminar as well, yet it may be **underestimated because of the spillover effects**. This comparison can be made based on the combined Masaka-Kalungu and Mubende sub-samples.

**Figure 2** ***A randomized encouragement design***




To take into account possible non-compliance to the randomized encouragement status, we will use instrumental variable (IV) regression where the randomized encouragement status is used as an exogenous IV for the endogenous treatment status. In case of a comparison of Treatment and Control-A there can be non-compliance from two sides, in case of Treatment versus Control-B from one side since the intensive coaching package had not been organized yet in the POs which the Control-B couples are member of. It implies we will estimate local average treatment effects whereby the external validity is limited to compliers. In principle, controlling for possible selection bias would not be necessary because of the randomized encouragement.

[7] To avoid compromising the intervention logic of the intensive coaching following up on couple seminars within a maximum of six months, we pushed the couple seminars (ten out of the total of 42 couple seminars) and baseline data collection in this group to a later date. This could have introduced an underestimation of the impact of the couple seminars versus no GHA intervention and overestimate the impact of the intensive coaching program versus couples in the control-B group who received only couple seminars because the time for changes to realize before endline data collection (conducted from half July till half August 2017) was slightly shorter for the control-B group.

The balance check, however, pointed to some minor sources of imbalance (*cfr. infra*) which we control for in the IV regression model, once by matching using inverse probability of treatment weighting (IPTW) based on the propensity score, and once by including control variables in a regression model (presented in the Online Supplementary Materials 3). Note that both propensity score matching and regression analysis rely on assumptions that unobservable differences are absorbed by controlling for observable factors and do not bias results.

Next, we can estimate the **impact of the combination of a couple seminar and subsequent intensive coaching versus no exposure to the GHA** with a comparison of Treatment and Control-C, which can be done using the combined Masaka-Kalungu and Mubende sample. We will estimate the impact using IV regression to account for possible one-sided compliance (Control-C de facto always comply). The initial self-selection of the couples in the Treatment group into a couple seminar calls for controlling this possible selection bias, which will be done by matching using IPTW, and by including control variables in the regression as well.

Subsequently, comparing Control-B and Control-C gives us the **impact of the couple seminars versus no GHA exposure**, but can only be estimated based on the Mubende subsample. By comparing Control-A and Control-C, possible in the combined Masaka-Kalungu and Mubende samples, we can estimate the impact of couple seminars with possible spillovers from couples who received intensive Coaching versus no GHA exposure.

The couple seminars were not randomized, nor randomly encouraged. Therefore, we will use simple regression analysis to estimate its impact versus no GHA exposure, but will control for the self-selection into couple seminars of the couples in the Control-A, respectively Control-B, group, once by way of matching using IPTW, and once by way of control variables. While it is possible that a particular selection of couples in the Control-A group sneaked into the intensive coaching program, in this case, we are only interested in the effect of couple seminars. Therefore, we will ignore the couples who followed the intensive coaching as these had an additional treatment on top of the couple seminar.

Finally, the extent of **spillover effects** from couples who received intensive coaching and are member of the same PO of Control-A couples can be captured by a comparison of the Control-A and Control-B couples, but only in the Mubende sub-sample. In this case, even if the couple seminars were not randomized, we will take into account the possible endogenous non-compliance of Control-A to their randomised non-encouraged status by using IV regression (de facto Control-B always complied). Any additional selection bias will be dealt with by matching using IPTW, respectively the inclusion of control variables.

Even if Masaka and Kalungu districts and Mubende districts are all located in central Uganda and are quite similar, we will include a dummy variable taking the value one for Mubende in each model estimated based on the combined Masaka-Kalungu and Mubende samples to account for differences linked to area. The dummy variable may also capture difference that could be linked to the different timing of data collection in the two sub-samples.

## 5.3. Checking balance

The Treatment and Control-A, respectively Control-B, group are likely to be identical at baseline because of the random encouragement, while the Control-C is likely to differ from each of the other groups as they did not initially self-select into a couple seminar. We still checked whether there is balance across all treatment groups with regard to a number of categorical and continuous characteristics of the wife and/or husband in the couples measured at baseline in each of the sub-samples (Formal tests of balance are included Tables B and C in

Online Supplementary Materials 2).

The Treatment, Control-A, Control-B and Control-C groups are balanced for a number of observable baseline characteristics, which are therefore not used as control variables or covariates for matching.[8]

While the groups were balanced with regard to the age difference between husband and wife (*Age difference*); the husband's personal ownership of a bicycle (*Bicycle*) and the acreage of land owned (reported by husband) (*Acreage*), we included these as control variables or covariates for matching. And as mentioned before, we include a dummy variable for Mubende.

The test for balance showed imbalance across Treatment, Control-A, Control-B and/or Control-C groups for wife's age as a proxy for the duration of marriage (*Age wife*); being a polygamous household (reported by husband) (*Polygamous*)[9]; dummy indicating wife's highest level is secondary education or higher (*Wife sec edu*); dummy indicating husband's highest level is secondary education or higher (*Husband sec edu*); number of small livestock owned by the household (reported by husband) (*# small livestock*); housing built with fire-baked bricks (reported by wife) (*Fire-baked bricks*); and the likelihood of food security[10] (*Foodsecure*). These variables (of which the labels are between brackets) are finally included as control variables or covariates for matching (We summarized the nature and source of imbalance, and whether the covariate is used as a control in Table D in Online Supplementary Materials 2).

We observed imbalance with regard to the husband's age; wife's share in total household off-farm income; housing with a concrete or tiled floor (reported by the wife); wife's and husband's aspirations with regard to farming as well, but refrained to include these as control variables or covariates for matching (the reasons for which are listed in Table D in Online Supplementary Materials 2).

# 6. Results

## 6.1. The impact on cooperation

### 6.1.1. The impact on joint management of food crops and cash crops

Results in Table 2[11] show that the likelihood that husband and wife (agree they) jointly manage the main food crop and the main cash crop is positively affected by the intensive coaching (*positive ATE of 13 percentage points (pp) T vs CB for food crop (panel 2); respectively 13 pp for cash crop (panel 8)*) and the spillover effects of the change agents (*positive ATE of 15 pp CA vs CB for food crop (panel 6); respectively 18 pp for cash crop (panel 12)*) vis-à-vis exposure to couple seminars

[8] The characteristics for which there is balance include: the number of children from 6 up to 12 years old and the number of male household members older than 55 years currently residing with the household (reported by the wife); the total household off-farm income earned in the course of the last three months (i.e. sum of income earned by wife and by husband from off-farm activities and fishing); the total remittances received by the wife in the course of the last three months; the total number of cattle and total number of poultry owned by the household (reported by the husband); the value of tropical livestock units owned by the household (based on husbands' accounts); the personal ownership of a bicycle by the wife; and the likelihood that the house has an iron roof (reported by the wife).

[9] Dummy for polygamous not included when comparing with Control-B as none of the couples in that group is polygamous.

[10] We constructed a food security dummy indicator taking the value one when the household did not have to eat less preferred foods nor did it have reduce the number or size of meals.

[11] The tables included here report results based on models with propensity score matching using Inverse Probability of Treatment Weighting. We report the magnitude of the effect based on these models in the text. The Online Supplementary Materials 3 presents the tables with the results of the models with covariates included as controls in the (IV) regression models.

We refer to Table A in the Online Supplementary Materials 1 for descriptive statistics of the outcome indicators.

only (Regression control models in Tables E and F in Online Supplementary Materials 3).[12] There are indications that as compared to no exposure to the Gender Household Approach (GHA), the intensive coaching and couple seminars with spillovers had positive effects on joint management of cash crops (*positive ATE of 7 pp T vs CC significant (sig) at 13% (panel 9); positive ATE of 8 pp CA vs CC sig at 11% (panel 10)*).

[12] These spillovers explain why we do not observe a difference between couples who followed the intensive coaching and couples who followed couple seminars but were exposed to spillovers through interaction with intensive coached couples in their POs (*insignificant ATE T vs CA (panel 1 and 7)*).

## Table 2 *Estimated impact on the likelihood of agreed upon joint management of the most important food and cash crop* [1]

| Outcome | Joint management of 1st food crop (A) | | | | | | Joint management of 1st cash crop (A) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | T vs CA | T vs CB | T vs CC | CA vs CC | CB vs CC | CA vs CB | T vs CA | T vs CB | T vs CC | CA vs CC | CB vs CC | CA vs CB |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| ATE | -0.041 | 0.126* | 0.042 | 0.066 | -0.017 | 0.148* | -0.009 | 0.132* | 0.073 | 0.083 | -0.084 | 0.183** |
| | (0.044) | (0.069) | (0.068) | (0.075) | (0.091) | (0.084) | (0.036) | (0.068) | (0.048) | (0.051) | (0.090) | (0.083) |
| | 0.347 | 0.068 | 0.535 | 0.381 | 0.848 | 0.078 | 0.803 | 0.051 | 0.129 | 0.106 | 0.349 | 0.026 |
| Cons | 0.352*** | 0.316*** | 0.328*** | 0.325*** | 0.337*** | 0.316*** | 0.095*** | 0.267*** | 0.039 | 0.038 | 0.346*** | 0.263*** |
| | (0.035) | (0.055) | (0.081) | (0.087) | (0.072) | (0.053) | (0.024) | (0.054) | (0.034) | (0.046) | (0.072) | (0.052) |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.258 | 0.412 | 0.000 | 0.000 |
| Mubende | 0.112*** | | 0.001 | 0.000 | | | 0.349*** | | 0.285*** | 0.294*** | | |
| | (0.041) | | (0.067) | (0.072) | | | (0.035) | | (0.045) | (0.052) | | |
| | 0.006 | | 0.991 | 0.996 | | | 0.000 | | 0.000 | 0.000 | | |
| N | 609 | 242 | 442 | 346 | 134 | 161 | 609 | 242 | 442 | 346 | 134 | 161 |
| $R^2$ | 0.011 | 0.020 | 0.004 | 0.005 | 0.000 | 0.015 | 0.160 | 0.019 | 0.124 | 0.135 | 0.008 | 0.039 |
| Fdf2 | 606.00 | 240.00 | 439.00 | . | . | 159.00 | 606.00 | 240.00 | 439.00 | . | . | 159.00 |
| F-stat | 3.96 | 3.31 | 0.21 | 0.49 | 0.04 | 3.06 | 51.90 | 3.76 | 28.25 | 16.90 | 0.88 | 4.87 |
| Adj $R^2$ | 0.01 | 0.02 | -0.00 | -0.00 | -0.01 | 0.01 | 0.16 | 0.01 | 0.12 | 0.13 | 0.00 | 0.03 |
| KPrkLM | 483.57 | 193.15 | 198.28 | | | 132.20 | 483.57 | 193.15 | 198.28 | | | 132.20 |
| KlPrkWF | 3 | 10 | 11 | | | 1 | 3 | 10 | 11 | | | 1 |
| Hansen J | 222.52 | 958.13 | 473.42 | | | 348.01 | 222.52 | 958.13 | 473.42 | | | 348.01 |

Models with Inverse Probability of Treatment Weighting (IPTW), Instrumental Variable (IV) regression for comparisons of T vs CA, CB, and CC, and CA vs CB, else linear regression.

Significance ***99%, **95%, *90%. Coefficient in 1st, robust Standard Errors (S.E.) in 2nd, p-value in 3rd row. Fdf2=Degrees of freedom; KPrkLM= Kleibergen-Paap rk LM statistic (under-identification test); KPrkWF=Kleibergen-Paap rk Wald F statistic (weak identification test); Hansen J=Hansen J statistic (overidentifying restrictions test). A=Agreed upon by wife and husband

[1] The most important food crop is the staple food crop that is considered the most important source of food for the household grown in the household farm, the most important cash crops is the crop that is considered to generate most income.

Digging a little deeper into the type of main cash crops that are more likely to be jointly managed, we observe indications of a positive effect of the intensive coaching itself for coffee (*indications of positive ATE of 5 pp T vs CB sig at 15% (panel 2); but indications of a negative effect of couple seminars without spillovers of -9 pp CB vs CC sig. at 11% (panel 5)*) (Table 3) (Regression control models in Tables G and H in Online Supplementary Materials 3). These effect are only present in the Mubende subsample. For maize, there are positive effects of the intensive coaching, and of the couple seminars with spillovers, vis-à-vis no GHA exposure (*positive ATE of 6 pp T vs CC, but only in the IPTW model (panel 9); positive ATE of 6 pp CA vs CC (panel 10)*).

## Table 3 *Estimated impact on the likelihood of agreed upon joint management of coffee, respectively maize*

| **Outcome** | **Joint management of coffee (A)** | | | | | | **Joint management of maize (A)** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | T vs CA | T vs CB | T vs CC | CA vs CC | CB vs CC | CA vs CB | T vs CA | T vs CB | T vs CC | CA vs CC | CB vs CC | CA vs CB |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| **ATE** | 0.023 | 0.053 | -0.011 | -0.022 | -0.094 | 0.051 | -0.007 | 0.047 | 0.061* | 0.057* | -0.002 | 0.035 |
| | (0.024) | (0.037) | (0.038) | (0.040) | (0.059) | (0.045) | (0.028) | (0.060) | (0.033) | (0.031) | (0.077) | (0.070) |
| | 0.341 | 0.148 | 0.779 | 0.584 | 0.110 | 0.257 | 0.803 | 0.431 | 0.063 | 0.066 | 0.982 | 0.622 |
| **Cons** | 0.050*** | 0.053** | 0.065** | 0.069 | 0.145*** | 0.051** | 0.018 | 0.189*** | -0.026 | -0.019 | 0.188*** | 0.185*** |
| | (0.016) | (0.026) | (0.031) | (0.042) | (0.053) | (0.025) | (0.016) | (0.048) | (0.016) | (0.016) | (0.060) | (0.047) |
| | 0.002 | 0.044 | 0.035 | 0.102 | 0.007 | 0.041 | 0.266 | 0.000 | 0.100 | 0.250 | 0.002 | 0.000 |
| **Mubende** | 0.036 | | 0.064* | 0.051 | | | 0.248*** | | 0.201*** | 0.191*** | | |
| | (0.023) | | (0.036) | (0.039) | | | (0.028) | | (0.030) | (0.033) | | |
| | 0.117 | | 0.074 | 0.196 | | | 0.000 | | 0.000 | 0.000 | | |
| **N** | 609 | 242 | 442 | 346 | 134 | 161 | 609 | 242 | 442 | 346 | 134 | 161 |
| **$R^2$** | 0.006 | 0.006 | 0.013 | 0.010 | 0.025 | 0.003 | 0.135 | 0.004 | 0.114 | 0.110 | 0.000 | 0.004 |
| **Fdf2** | 606.00 | 240.00 | 439.00 | . | . | 159.00 | 606.00 | 240.00 | 439.00 | . | . | 159.00 |
| **F-stat** | 2.26 | 2.07 | 1.65 | 1.17 | 2.58 | 1.27 | 40.27 | 0.62 | 33.26 | 20.09 | 0.00 | 0.24 |
| **Adj $R^2$** | 0.00 | 0.00 | 0.01 | 0.00 | 0.02 | -0.00 | 0.13 | 0.00 | 0.11 | 0.10 | -0.01 | -0.00 |
| **KPrkLM** | 483.57 | 193.15 | 198.28 | | | 132.20 | 483.57 | 193.15 | 198.28 | | | 132.20 |
| **KlPrkWF** | 3 | 10 | 11 | | | 1 | 3 | 10 | 11 | | | 1 |
| **Hansen J** | 222.52 | 958.13 | 473.42 | | | 348.01 | 222.52 | 958.13 | 473.42 | | | 348.01 |

Models with IPTW, IV regression for comparisons of T vs CA, CB, and CC, and CA vs CB, else linear regression.
Significance ***99%, **95%, *90%. Coefficient in 1st, robust S.E. in 2nd, p-value in 3rd row. Fdf2=Degrees of freedom; KPrkLM= Kleibergen-Paap rk LM statistic (under-identification test); KPrkWF=Kleibergen-Paap rk Wald F statistic (weak identification test); Hansen J=Hansen J statistic (overidentifying restrictions test). A=Agreed upon by wife and husband

### 6.1.2. The impact on joint ownership of food crops and cash crops plots

When it comes to (agreed upon) joint ownership of the plot on which the main cash crop is grown, there are no treatment effects, except an indication of a positive spillover effect of intensively coached couples among couples who received a couple seminar (*positive ATE of 8 pp CA vs CB sig at 10% (panel 12*)) (Table 4). Coffee is the main cash crop of many households, hence, we do not see treatment effects on joint ownership of plots on which coffee is grown either (Panel 1-6 Table 5) (Regression control models in Tables I, J, K, and L in Online Supplementary Materials 3).

## Table 4 *Estimated impact on the likelihood of agreed upon wjoint ownership of the plot(s) on which the most important food and cash crop is grown*

| **Outcome** | **Joint ownership of 1st food crop plot (A)** | | | | | | **Joint ownership of 1st cash crop plot (A)** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | T vs CA | T vs CB | T vs CC | CA vs CC | CB vs CC | CA vs CB | T vs CA | T vs CB | T vs CC | CA vs CC | CB vs CC | CA vs CB |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| **ATE** | 0.000 | 0.058** | 0.010 | 0.017 | -0.069* | 0.086** | -0.024 | 0.031 | -0.011 | 0.017 | -0.076 | 0.080 |
| | (0.019) | (0.023) | (0.022) | (0.022) | (0.040) | (0.037) | (0.020) | (0.034) | (0.028) | (0.026) | (0.059) | (0.049) |
| | 1.000 | 0.011 | 0.640 | 0.438 | 0.086 | 0.022 | 0.237 | 0.361 | 0.704 | 0.514 | 0.199 | 0.104 |
| **Cons** | 0.025* | 0.009 | 0.008 | 0.007 | 0.082** | 0.010 | 0.028** | 0.050** | 0.014 | 0.004 | 0.126** | 0.052** |
| | (0.013) | (0.009) | (0.011) | (0.011) | (0.037) | (0.010) | (0.013) | (0.025) | (0.014) | (0.013) | (0.054) | (0.026) |
| | 0.051 | 0.316 | 0.442 | 0.553 | 0.030 | 0.315 | 0.029 | 0.044 | 0.306 | 0.769 | 0.021 | 0.042 |
| **Mubende** | 0.043** | | 0.055*** | 0.059** | | | 0.075*** | | 0.080*** | 0.092*** | | |
| | (0.018) | | (0.020) | (0.024) | | | (0.020) | | (0.026) | (0.027) | | |
| | 0.021 | | 0.006 | 0.012 | | | 0.000 | | 0.002 | 0.001 | | |
| **N** | 609 | 242 | 442 | 346 | 134 | 161 | 609 | 242 | 442 | 346 | 134 | 161 |
| **$R^2$** | 0.011 | 0.024 | 0.020 | 0.023 | 0.026 | 0.039 | 0.029 | 0.004 | 0.033 | 0.042 | 0.018 | 0.011 |
| **Fdf2** | 606.00 | 240.00 | 439.00 | . | . | 159.00 | 606.00 | 240.00 | 439.00 | . | . | 159.00 |
| **F-stat** | 2.88 | 6.42 | 5.74 | 4.45 | 2.99 | 5.17 | 7.14 | 0.83 | 7.57 | 7.41 | 1.67 | 2.60 |
| **Adj $R^2$** | 0.01 | 0.02 | 0.02 | 0.02 | 0.02 | 0.03 | 0.03 | 0.00 | 0.03 | 0.04 | 0.01 | 0.00 |
| **KPrkLM** | 483.57 | 193.15 | 198.28 | | | 132.20 | 483.57 | 193.15 | 198.28 | | | 132.20 |
| **KlPrkWF** | 3 | 10 | 11 | | | 1 | 3 | 10 | 11 | | | 1 |
| **Hansen J** | 222.52 | 958.13 | 473.42 | | | 348.01 | 222.52 | 958.13 | 473.42 | | | 348.01 |

Models with IPTW, IV regression for comparisons of T vs CA, CB, and CC, and CA vs CB, else linear regression.

Significance ***99%, **95%, *90%. Coefficient in 1st, robust S.E. in 2nd, p-value in 3rd row. Fdf2=Degrees of freedom; KPrkLM= Kleibergen-Paap rk LM statistic (under-identification test); KPrkWF=Kleibergen-Paap rk Wald F statistic (weak identification test); Hansen J=Hansen J statistic (overidentifying restrictions test). A=Agreed upon by wife and husband

## Table 5 *Estimated impact on the likelihood of agreed upon joint ownership of the plot(s) on which coffee, respectively maize, is grown*

| **Outcome** | **Joint ownership of coffee plot (A)** | | | | | | **Joint ownership of maize plot (A)** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | T vs CA | T vs CB | T vs CC | CA vs CC | CB vs CC | CA vs CB | T vs CA | T vs CB | T vs CC | CA vs CC | CB vs CC | CA vs CB |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| **ATE** | -0.001 | 0.013 | -0.009 | -0.001 | -0.035 | 0.015 | -0.026* | 0.020* | -0.005 | 0.019 | -0.053 | 0.083** |
| | (0.015) | (0.024) | (0.025) | (0.020) | (0.038) | (0.030) | (0.013) | (0.012) | (0.013) | (0.015) | (0.043) | (0.033) |
| | 0.936 | 0.600 | 0.727 | 0.954 | 0.359 | 0.619 | 0.058 | 0.082 | 0.674 | 0.210 | 0.216 | 0.013 |
| **Cons** | 0.017 | 0.026 | 0.013 | 0.013 | 0.059* | 0.025 | 0.013* | 0.000 | 0.003 | -0.010 | 0.053 | 0.000 |
| | (0.011) | (0.018) | (0.012) | (0.010) | (0.034) | (0.018) | (0.007) | (0.000) | (0.006) | (0.008) | (0.043) | (0.000) |
| | 0.120 | 0.155 | 0.279 | 0.201 | 0.083 | 0.152 | 0.059 | . | 0.674 | 0.219 | 0.216 | . |
| **Mubende** | 0.020 | | 0.044* | 0.031 | | | 0.042*** | | 0.023** | 0.049*** | | |
| | (0.014) | | (0.023) | (0.021) | | | (0.013) | | (0.011) | (0.017) | | |
| | 0.148 | | 0.052 | 0.136 | | | 0.002 | | 0.044 | 0.003 | | |
| **N** | 609 | 242 | 442 | 346 | 134 | 161 | 609 | 242 | 442 | 346 | 134 | 161 |
| **$R^2$** | 0.004 | 0.001 | 0.016 | 0.009 | 0.008 | -0.003 | 0.030 | 0.010 | 0.011 | 0.031 | 0.027 | 0.045 |
| **Fdf2** | 606.00 | 240.00 | 439.00 | . | . | 159.00 | 606.00 | 240.00 | 439.00 | . | . | 159.00 |
| **F-stat** | 1.06 | 0.27 | 3.39 | 1.96 | 0.85 | 0.24 | 5.11 | 2.99 | 2.36 | 4.51 | e(F) | 6.10 |
| **Adj $R^2$** | 0.00 | -0.00 | 0.01 | 0.00 | 0.00 | -0.01 | 0.03 | 0.01 | 0.01 | 0.03 | 0.02 | 0.04 |
| **KPrkLM** | 483.57 | 193.15 | 198.28 | | | 132.20 | 483.57 | 193.15 | 198.28 | | | 132.20 |
| **KlPrkWF** | 3 | 10 | 11 | | | 1 | 3 | 10 | 11 | | | 1 |
| **Hansen J** | 222.52 | 958.13 | 473.42 | | | 348.01 | 222.52 | 958.13 | 473.42 | | | 348.01 |

Models with IPTW, IV regression for comparisons of T vs CA, CB, and CC, and CA vs CB, else linear regression.
Significance ***99%, **95%, *90%. Coefficient in 1st, robust S.E. in 2nd, p-value in 3rd row. Fdf2=Degrees of freedom; KPrkLM= Kleibergen-Paap rk LM statistic (under-identification test); KPrkWF=Kleibergen-Paap rk Wald F statistic (weak identification test); Hansen J=Hansen J statistic (overidentifying restrictions test). A=Agreed upon by wife and husband

The likelihood that the plot on which the main food crop is grown is jointly owned, on the other hand, is positively affected by the intensive coaching package (*positive ATE of 6 pp T vs CB (panel2)*) and the spillover effects of the intensively coached couples (*positive ATE of 9 pp CA vs CB but only in the PSM model (panel 6)*) vis-à-vis exposure to couple seminars (without spillovers), which have a negative effect (*negative ATE of -7 pp CB vs CC (panel 5)*) (Table 4).

The positive treatment effects of the intensive coaching and its spillovers are present for the joint ownership of plots on which maize is grown, which is a consumable cash crop (*positive ATE of 2 pp T vs CB (panel 8), and 8 pp CA vs CB (panel 12)*) (Table 5). Surprisingly, there is a negative treatment effect when comparing the groups with intensive coaching and couple seminars with spillovers (*negative ATE of 8 pp T vs CA (panel 7)*).

Note that any positive impact on joint ownership of plots only realized in the Mubende subsample.

## 6.2. The impact on the farm system

### 6.2.1. The impact on the choice of food crops

In line with expectations, the intensive coaching package made couples switch from food crops with uncertain harvests, such as maize or rice, at baseline, to a food crop with a more certain harvest, such as cassava, yams, or sweet potato, at endline, vis-à-vis couples who only followed the less intensive couple seminars with spillovers (*positive ATE of 6 pp for T vs CA (panel 1)*) (Table 6) (Regression control models in Tables M and N in Online Supplementary Materials 3). The latter, in fact, may have had a negative effect on switching to a more certain food crop (*negative ATE of 11% for CA vs CC sig at 11% in the IPTW model (panel 4)*). This is also reflected in the negative effect on the likelihood of growing a food crop with uncertain harvest of the intensive coaching package versus couple seminars, regardless of whether there are potential spillover effects from the intensively coached couples in their PO (*negative ATE of -10 pp T vs CA (panel 7)*) or no spillovers (*negative ATE of -11 pp T vs CB sig at 12% in the IPTW model (panel 8)*).

## Table 6 *Estimated impact on the likelihood of growing food crops with uncertain harvests, and on the likelihood of switching to food crops with more certain harvests*[2]

| **Outcome** | **Switched from food crops with uncertain to certain harvest (A)** | | | | | | **Food crops with uncertain harvests (A)** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | T vs CA | T vs CB | T vs CC | CA vs CC | CB vs CC | CA vs CB | T vs CA | T vs CB | T vs CC | CA vs CC | CB vs CC | CA vs CB |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| **ATE** | 0.063* | -0.028 | -0.036 | -0.107 | 0.048 | -0.057 | -0.101** | -0.112 | -0.026 | 0.088 | 0.038 | 0.002 |
| | (0.036) | (0.058) | (0.061) | (0.067) | (0.072) | (0.066) | (0.045) | (0.072) | (0.069) | (0.076) | (0.095) | (0.087) |
| | 0.079 | 0.628 | 0.553 | 0.111 | 0.505 | 0.386 | 0.024 | 0.119 | 0.706 | 0.245 | 0.689 | 0.985 |
| **Cons** | 0.178*** | 0.212*** | 0.345*** | 0.328*** | 0.169*** | 0.211*** | 0.535*** | 0.462*** | 0.439*** | 0.446*** | 0.408*** | 0.462*** |
| | (0.028) | (0.048) | (0.078) | (0.083) | (0.053) | (0.047) | (0.036) | (0.059) | (0.079) | (0.087) | (0.075) | (0.057) |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| **Mubende** | -0.030 | | -0.149** | -0.122* | | | -0.090** | | -0.073 | -0.092 | | |
| | (0.033) | | (0.061) | (0.063) | | | (0.041) | | (0.068) | (0.073) | | |
| | 0.356 | | 0.015 | 0.054 | | | 0.030 | | 0.283 | 0.207 | | |
| **N** | 609 | 242 | 442 | 346 | 134 | 161 | 609 | 242 | 442 | 346 | 134 | 161 |
| **$R^2$** | 0.005 | 0.001 | 0.032 | 0.038 | 0.004 | 0.001 | 0.018 | 0.009 | 0.006 | 0.017 | 0.001 | 0.000 |
| **Fdf2** | 606.00 | 240.00 | 439.00 | . | . | 159.00 | 606.00 | 240.00 | 439.00 | . | . | 159.00 |
| **F-stat** | 1.81 | 0.23 | 3.21 | 2.03 | 0.45 | 0.74 | 5.68 | 2.41 | 0.58 | 2.39 | 0.16 | 0.00 |
| **Adj $R^2$** | 0.00 | -0.00 | 0.03 | 0.03 | -0.00 | -0.01 | 0.01 | 0.01 | 0.00 | 0.01 | -0.01 | -0.01 |
| **KPrkLM** | 483.57 | 193.15 | 198.28 | | | 132.20 | 483.57 | 193.15 | 198.28 | | | 132.20 |
| **KlPrkWF** | 3 | 10 | 11 | | | 1 | 3 | 10 | 11 | | | 1 |
| **Hansen J** | 222.52 | 958.13 | 473.42 | | | 348.01 | 222.52 | 958.13 | 473.42 | | | 348.01 |

Models with IPTW, IV regression for comparisons of T vs CA, CB, and CC, and CA vs CB, else linear regression.

[2] Food crops with uncertain harvests (A) is an indicator taking the value one if husband and wife agree that their most and second most important food crop is maize or rice, crops which, in this context, have relatively more unreliable harvests than cassava, sweet potato, yams and other staple food crops. Switched from food crops with uncertain to certain harvest (A) indicates that while at baseline the most or second most important food crop was maize or rice, at endline it is not (and can be cassava, sweet potato, yams and other staple food crops) (agreed upon by husband and wife).

### 6.2.2. The impact on the choice of cash crops

There is a positive effect of both the intensive coaching (*positive ATE of 7 pp T vs CC (panel 9)*) and a positive effect of the couple seminars with spillovers (*positive ATE of 7 pp CA vs CC (panel 10)*), vis-à-vis no GHA exposure on the likelihood of growing only consumable cash crops (Table 7) (Regression control models in Tables O and P in Online Supplementary Materials 3). In fact, the couple seminars vis-à-vis no exposure to the GHA had a negative effect on the likelihood that coffee is the main cash crop (*negative ATE of -20 pp T vs CC (panel 3), and of -23 pp CA vs CC (panel 4)*).[13]

[13] In the IPTW model the positive treatment effect on the likelihood that coffee is the main cash crop of 13 pp is insignificant for CB vs CC (Panel 5 Table 7) but is significant in the regression control model.

## Table 7 *Estimated impact on the likelihood of coffee being the most important cash crop and the likelihood of the most important cash crop being consumable*[3]

| Outcome | Coffee as the most important cash crop (HB-W) | | | | | | Consumable cash crop as (second) most important cash crop (HB-W) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | T vs CA | T vs CB | T vs CC | CA vs CC | CB vs CC | CA vs CB | T vs CA | T vs CB | T vs CC | CA vs CC | CB vs CC | CA vs CB |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| **ATE** | 0.032 | -0.024 | -0.203*** | -0.227*** | -0.131 | -0.020 | 0.008 | 0.035 | 0.073** | 0.065** | 0.009 | 0.039 |
| | (0.043) | (0.071) | (0.054) | (0.054) | (0.095) | (0.085) | (0.029) | (0.056) | (0.031) | (0.029) | (0.075) | (0.068) |
| | 0.458 | 0.736 | 0.000 | 0.000 | 0.171 | 0.818 | 0.788 | 0.531 | 0.017 | 0.025 | 0.903 | 0.563 |
| **Cons** | 0.648*** | 0.426*** | 0.857*** | 0.862*** | 0.572*** | 0.424*** | 0.041** | 0.167*** | 0.006 | -0.015 | 0.156** | 0.174*** |
| | (0.035) | (0.058) | (0.046) | (0.046) | (0.076) | (0.057) | (0.017) | (0.043) | (0.017) | (0.017) | (0.062) | (0.044) |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.013 | 0.000 | 0.726 | 0.378 | 0.013 | 0.000 |
| **Mubende** | -0.273*** | | -0.228*** | -0.222*** | | | 0.162*** | | 0.105*** | 0.149*** | | |
| | (0.040) | | (0.052) | (0.055) | | | (0.028) | | (0.028) | (0.031) | | |
| | 0.000 | | 0.000 | 0.000 | | | 0.000 | | 0.000 | 0.000 | | |
| **N** | 609 | 242 | 442 | 346 | 134 | 161 | 609 | 242 | 442 | 346 | 134 | 161 |
| **$R^2$** | 0.075 | 0.001 | 0.104 | 0.106 | 0.017 | 0.002 | 0.062 | 0.002 | 0.046 | 0.081 | 0.000 | 0.005 |
| **Fdf2** | 606.00 | 240.00 | 439.00 | . | . | 159.00 | 606.00 | 240.00 | 439.00 | . | . | 159.00 |
| **F-stat** | 22.79 | 0.11 | 21.38 | 18.73 | 1.89 | 0.05 | 19.52 | 0.39 | 15.03 | 13.75 | 0.02 | 0.33 |
| **Adj $R^2$** | 0.07 | -0.00 | 0.10 | 0.10 | 0.01 | -0.00 | 0.06 | -0.00 | 0.04 | 0.08 | -0.01 | -0.00 |
| **KPrkLM** | 483.57 | 193.15 | 198.28 | | | 132.20 | 483.57 | 193.15 | 198.28 | | | 132.20 |
| **KlPrkWF** | 3 | 10 | 11 | | | 1 | 3 | 10 | 11 | | | 1 |
| **Hansen J** | 222.52 | 958.13 | 473.42 | | | 348.01 | 222.52 | 958.13 | 473.42 | | | 348.01 |

Models with IPTW, IV regression for comparisons of T vs CA, CB, and CC, and CA vs CB, else linear regression.

Significance ***99%, **95%, *90%. Coefficient in 1st, robust S.E. in 2nd, p-value in 3rd row. Fdf2=Degrees of freedom; KPrkLM= Kleibergen-Paap rk LM statistic (under-identification test); KPrkWF=Kleibergen-Paap rk Wald F statistic (weak identification test); Hansen J=Hansen J statistic (overidentifying restrictions test). HB-W=as reported by either wife or husband.

[3] Coffee as the most important cash crop (HB-W) is an indicator taking the value one if either the husband or wife reported coffee as the most important cash crop. Consumable cash crop as (second) most important cash crop (HB-W) is an indicator taking the value one if neither the most important nor the second most important cash crop, reported by either the wife or husband, is coffee or banana for beer brewing (all other possible cash crops are consumable and most commonly reported are maize, matooke banana, rice, beans).

## 6.3. The impact on investment in sustainable intensification of cash and food crop production

### 6.3.1. The impact on adoption of sustainable agronomic intensification practices for coffee production

The adoption intensity for coffee is stimulated by the intensive coaching and by its spillovers as compared having only been exposed to couple seminars (*positive ATE of 0.83 practices T vs CB (panel 2), and of 0.57 practices CA vs CB (panel 6*)) (Table 8) (Regression control models in Table Q in Online Supplementary Materials 3). The positive effect of the intensive coaching also emerges in the regression control model, but not in the IPTW model, when comparing to couples who had no GHA exposure (*positive ATE of 0.31 practices T vs CC but not sig in the IPTW model*). Couple seminars in themselves have a negative effect on the adoption intensity for coffee (*negative ATE of -0.58 practices CB vs CC (panel 5*)).

## Table 8 *Estimated impact on adoption intensity for coffee production*[4]

| **Outcome** | **Adoption intensity for coffee production (HB)** | | | | | |
|---|---|---|---|---|---|---|
| | T vs CA | T vs CB | T vs CC | CA vs CC | CB vs CC | CA vs CB |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| **ATE** | 0.059 | 0.825*** | 0.212 | 0.096 | -0.582** | 0.574** |
| | (0.136) | (0.210) | (0.155) | (0.162) | (0.256) | (0.266) |
| | 0.664 | 0.000 | 0.173 | 0.551 | 0.024 | 0.031 |
| **Cons** | 3.144*** | 2.032*** | 2.959*** | 3.042*** | 2.722*** | 2.065*** |
| | (0.098) | (0.170) | (0.154) | (0.159) | (0.181) | (0.168) |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| **Mubende** | -0.642*** | | -0.308** | -0.459*** | | |
| | (0.128) | | (0.151) | (0.161) | | |
| | 0.000 | | 0.042 | 0.005 | | |
| **N** | 590 | 235 | 428 | 335 | 130 | 156 |
| **$R^2$** | 0.046 | 0.071 | 0.019 | 0.031 | 0.044 | 0.012 |
| **Fdf2** | 587.00 | 233.00 | 425.00 | . | . | 154.00 |
| **F-stat** | 12.70 | 15.29 | 3.09 | 4.91 | 5.19 | 4.61 |
| **Adj $R^2$** | 0.04 | 0.07 | 0.01 | 0.03 | 0.04 | 0.01 |
| **KPrkLM** | 467.75 | 187.49 | 196.49 | | | 127.99 |
| **KlPrkWF** | 3 | 14 | 12 | | | 1 |
| **Hansen J** | 100.33 | 199.14 | 905.61 | | | 284.68 |

Models with IPTW, IV regression for comparisons of T vs CA, CB, and CC, and CA vs CB, else linear regression.

Significance ***99%, **95%, *90%. Coefficient in 1st, robust S.E. in 2nd, p-value in 3rd row. Fdf2=Degrees of freedom; KPrkLM= Kleibergen-Paap rk LM statistic (under-identification test); KPrkWF=Kleibergen-Paap rk Wald F statistic (weak identification test); Hansen J=Hansen J statistic (overidentifying restrictions test). HB=as reported by the husband

[4] We gathered data about the following eight recommended sustainable intensification practices for coffee and go by the husband's reporting of it: Trenches or grassbands, intercropping, the use of mulch, the use of manure or compost, the use of inorganic fertilizer, proper weeding practices, pruning and desuckering. We consider the practice adopted if it reported to be applied on the whole or a substantial part of the coffee plantation. The adoption intensity indicator is the sum of the number of practices adopted and can take a maximum value of seven.

### 6.3.2. The impact on adoption of sustainable agronomic intensification practices for food production

As with coffee, the adoption intensity for maize is positively affected by the intensive coaching and by its spillovers vis-a-vis couple seminars only (*positive ATE of 0.35 practices T vs CB (panel 2), and of 0.27 practices CA vs CB (panel 6*)) (Table 9) (Regression control models in Tables R in Online Supplementary Materials 3). The positive effect of the intensive coaching and its spillovers is also present in comparison to a situation without GHA exposure (*positive ATE of 0.27 practices T vs CC (panel 3), and of 0.26 practices CA vs CC sig at 10% (panel 4)*).

## Table 9 *Estimated impact on adoption intensity for maize production*[5]

| **Outcome** | **Adoption intensity for maize production (HB)** | | | | | |
|---|---|---|---|---|---|---|
| | T vs CA | T vs CB | T vs CC | CA vs CC | CB vs CC | CA vs CB |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| **ATE** | 0.020 | 0.347*** | 0.274** | 0.256 | -0.164 | 0.274** |
| | (0.089) | (0.089) | (0.134) | (0.156) | (0.125) | (0.116) |
| | 0.821 | 0.000 | 0.040 | 0.101 | 0.192 | 0.019 |
| **Cons** | 1.566*** | 0.339*** | 1.255*** | 1.312*** | 0.541*** | 0.353*** |
| | (0.083) | (0.062) | (0.171) | (0.195) | (0.106) | (0.063) |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| **Mubende** | -0.936*** | | -0.828*** | -0.962*** | | |
| | (0.080) | | (0.134) | (0.145) | | |
| | 0.000 | | 0.000 | 0.000 | | |
| **N** | 609 | 242 | 442 | 346 | 134 | 161 |
| **$R^2$** | 0.179 | 0.060 | 0.167 | 0.208 | 0.017 | 0.014 |
| **Fdf2** | 606.00 | 240.00 | 439.00 | . | . | 159.00 |
| **F-stat** | 67.89 | 15.03 | 34.93 | 45.20 | 1.72 | 5.47 |
| **Adj $R^2$** | 0.18 | 0.06 | 0.16 | 0.20 | 0.01 | 0.01 |
| **KPrkLM** | 483.57 | 193.15 | 198.28 | | | 132.20 |
| **KlPrkWF** | 3 | 10 | 11 | | | 1 |
| **Hansen J** | 222.52 | 958.13 | 473.42 | 0 | 0 | 348.01 |

Models with IPTW, IV regression for comparisons of T vs CA, CB, and CC, and CA vs CB, else linear regression.

Significance ***99%, **95%, *90%. Coefficient in 1st, robust S.E. in 2nd, p-value in 3rd row. Fdf2=Degrees of freedom; KPrkLM= Kleibergen-Paap rk LM statistic (under-identification test); KPrkWF=Kleibergen-Paap rk Wald F statistic (weak identification test); Hansen J=Hansen J statistic (overidentifying restrictions test). HB=as reported by the husband

[5] We gathered data about the following six recommended sustainable intensification practices for crops other than coffee and go by the husband's reporting of it: Trenches or grass-bands, intercropping, the use of mulch, the use of compost or manure, inorganic fertilizer and improved seeds. We consider the practice adopted if it reported to be applied on the whole or a substantial part of the plot(s) on which the crop is grown. The adoption intensity indicator is the sum of the number of practices adopted and can take a maximum value of six.

While the adoption intensity for cassava and/or sweet potato is generally low, there is still a positive effect of the intensive coaching vis-à-vis couple seminars without spillover and vis-à-vis no GHA exposure (*positive ATE of 0.06 practices T vs CB sig at 10% (panel 2); positive ATE of 0.06 practices T vs CC (panel 3*)) (Table 10) (Regression control models in Tables S and T in Online Supplementary Materials 3). There is an indication of positive spillovers from intensively coached couples (*positive ATE of 0.07 practices CA vs CB sig at 13% (panel 6*)). The adoption intensity for matooke banana is commonly very low as well, yet we observe a positive effect of the intensive coaching and the couple seminars with spillovers on the adoption intensity vis-à-vis no GHA exposure (*positive ATE of 0.08 practices T vs CC (panel 9), and of 0.13 practices CA vs CC (panel 10*)).

## Table 10 *Estimated impact on adoption intensity for cassava and/or sweet potato, respectively matooke banana, production*

| Outcome | Adoption intensity for cassava and/or sweet potato production (HB) | | | | | | Adoption intensity for matooke banana production (HB) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | T vs CA | T vs CB | T vs CC | CA vs CC | CB vs CC | CA vs CB | T vs CA | T vs CB | T vs CC | CA vs CC | CB vs CC | CA vs CB |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| **ATE** | 0.034 | 0.056 | 0.064* | 0.051 | -0.050 | 0.075 | -0.052 | 0.017 | 0.079* | 0.129** | 0.036 | 0.031 |
| | (0.035) | (0.034) | (0.034) | (0.032) | (0.055) | (0.049) | (0.044) | (0.033) | (0.046) | (0.053) | (0.027) | (0.045) |
| | 0.334 | 0.102 | 0.062 | 0.108 | 0.363 | 0.125 | 0.242 | 0.597 | 0.085 | 0.015 | 0.193 | 0.490 |
| **Cons** | 0.170*** | 0.045** | 0.115*** | 0.082*** | 0.094* | 0.048** | 0.324*** | 0.050** | 0.172*** | 0.183*** | 0.015 | 0.055** |
| | (0.028) | (0.023) | (0.035) | (0.028) | (0.050) | (0.024) | (0.046) | (0.023) | (0.059) | (0.058) | (0.015) | (0.024) |
| | 0.000 | 0.048 | 0.001 | 0.004 | 0.062 | 0.045 | 0.000 | 0.026 | 0.003 | 0.002 | 0.321 | 0.024 |
| **Mubende** | -0.099*** | | -0.072** | -0.033 | | | -0.229*** | | -0.169*** | -0.204*** | | |
| | (0.032) | | (0.034) | (0.031) | | | (0.039) | | (0.046) | (0.049) | | |
| | 0.002 | | 0.036 | 0.288 | | | 0.000 | | 0.000 | 0.000 | | |
| **N** | 609 | 242 | 442 | 346 | 134 | 161 | 609 | 242 | 442 | 346 | 134 | 161 |
| **$R^2$** | 0.020 | 0.012 | 0.021 | 0.010 | 0.010 | 0.004 | 0.054 | 0.001 | 0.050 | 0.063 | 0.010 | 0.005 |
| **Fdf2** | 606.00 | 240.00 | 439.00 | . | . | 159.00 | 606.00 | 240.00 | 439.00 | . | . | 159.00 |
| **F-stat** | 4.81 | 2.65 | 3.85 | 1.93 | 0.83 | 2.32 | 17.39 | 0.28 | 15.29 | 15.34 | 1.71 | 0.47 |
| **Adj $R^2$** | 0.02 | 0.01 | 0.02 | 0.00 | 0.00 | -0.00 | 0.05 | -0.00 | 0.05 | 0.06 | 0.00 | -0.00 |
| **KPrkLM** | 483.57 | 193.15 | 198.28 | | | 132.20 | 483.57 | 193.15 | 198.28 | | | 132.20 |
| **KlPrkWF** | 3 | 10 | 11 | | | 1 | 3 | 10 | 11 | | | 1 |
| **Hansen J** | 222.52 | 958.13 | 473.42 | 0 | 0 | 348.01 | 222.52 | 958.13 | 473.42 | 0 | 0 | 348.01 |

Models with IPTW, IV regression for comparisons of T vs CA, CB, and CC, and CA vs CB, else linear regression.

Significance ***99%, **95%, *90%. Coefficient in 1st, robust S.E. in 2nd, p-value in 3rd row. Fdf2=Degrees of freedom; KPrkLM= Kleibergen-Paap rk LM statistic (under-identification test); KPrkWF=Kleibergen-Paap rk Wald F statistic (weak identification test); Hansen J=Hansen J statistic (overidentifying restrictions test). HB=as reported by the husband

## 6.4. The impact on efficiency

### 6.4.1. The impact on total household income from coffee

While generally the total income earned from coffee went down in the period from base- to endline data collection, the intensive coaching program resulted in a smaller (net) decrease in income earned from coffee, reported by the husband (in the Mubende subsample) as compared to couple seminars (*positive ATE of 533,700 UGX T vs CB (panel 8 Table 11) and net of 455,704 UGX (panel 8 Table 12)*). Yet the total coffee income reported by the husband is not affected by treatment (*insignificant ATE effects of T, CA, or CB*) (Table 13) (Regression control models in Tables U to Z in Online Supplementary Materials 3).

## Table 11 *Estimated impact on the evolution in total seasonal coffee income from base- to endline (in Ugandan Shilling UGX)* [6] [7]

| **Outcome** | **Evolution in total seasonal coffee income (W)** | | | | | | **Evolution in total seasonal coffee income (HB)** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | T vs CA | T vs CB | T vs CC | CA vs CC | CB vs CC | CA vs CB | T vs CA | T vs CB | T vs CC | CA vs CC | CB vs CC | CA vs CB |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| **ATE** | 186,991.656** | 107,517.883 | 254,683.547 | 19,102.393 | 307,754.125 | -366,031.406 | 89,016.031 | 533,700.500** | 212,796.938 | 135,581.016 | 25,998.369 | 40,998.230 |
| | (88,340.531) | (196,401.578) | (165,483.125) | (136,491.813) | (285,191.375) | (268,777.031) | (121,370.977) | (221,871.313) | (167,560.375) | (142,550.563) | (290,326.813) | (281,734.938) |
| | 0.034 | 0.584 | 0.124 | 0.889 | 0.284 | 0.173 | 0.463 | 0.016 | 0.204 | 0.343 | 0.929 | 0.884 |
| **Cons** | -50,738.000 | -43,349.055 | -70,398.242 | 41,526.313 | -312,374.563 | -58,316.566 | 6,901.274 | -473,002.406** | -126,251.711 | -17,863.137 | -445,413.719** | -462,261.281** |
| | (68,063.000) | (173,919.500) | (111,602.930) | (102,524.563) | (228,991.969) | (177,170.594) | (86,559.586) | (186,627.375) | (102,654.578) | (97,635.758) | (212,182.359) | (193,739.734) |
| | 0.456 | 0.803 | 0.528 | 0.686 | 0.176 | 0.742 | 0.936 | 0.011 | 0.219 | 0.855 | 0.039 | 0.017 |
| **Mubende** | -147,576.844* | | -199,819.828 | -355,996.594** | | | -133,640.031 | | -175,484.297 | -356,395.938** | | |
| | (81,592.125) | | (157,937.547) | (146,804.844) | | | (111,171.969) | | (162,906.703) | (148,427.359) | | |
| | 0.070 | | 0.206 | 0.016 | | | 0.229 | | 0.281 | 0.017 | | |
| **N** | 382 | 156 | 282 | 214 | 85 | 102 | 395 | 159 | 293 | 240 | 92 | 106 |
| **$R^2$** | 0.015 | 0.004 | 0.029 | 0.037 | 0.015 | 0.011 | 0.002 | 0.041 | 0.009 | 0.034 | 0.000 | -0.001 |
| **Fdf2** | 379.00 | 154.00 | 279.00 | . | . | 100.00 | 392.00 | 157.00 | 290.00 | . | . | 104.00 |
| **F-stat** | 3.10 | 0.30 | 1.24 | 3.22 | 1.16 | 1.82 | 0.81 | 5.71 | 0.87 | 3.09 | 0.01 | 0.02 |
| **Adj $R^2$** | 0.01 | -0.00 | 0.02 | 0.03 | 0.00 | 0.00 | -0.00 | 0.03 | 0.00 | 0.03 | -0.01 | -0.01 |
| **KPrkLM** | 279.37 | 119.19 | 128.42 | | | 80.80 | 304.51 | 118.18 | 164.78 | | | 85.29 |
| **KlPrkWF** | 1 | 6 | 6 | | | 513.96 | 1 | 15 | 8 | | | 819.02 |
| **Hansen J** | 420.08 | 644.27 | 676.43 | | | 0 | 760.81 | 977.41 | 166.85 | | | 0 |

Models with IPTW, IV regression for comparisons of T vs CA, CB, and CC, and CA vs CB, else linear regression.

Significance ***99%, **95%, *90%. Coefficient in 1st, robust S.E. in 2nd, p-value in 3rd row. Fdf2=Degrees of freedom; KPrkLM= Kleibergen-Paap rk LM statistic (under-identification test); KPrkWF=Kleibergen-Paap rk Wald F statistic (weak identification test); Hansen J=Hansen J statistic (overidentifying restrictions test). W=as reported by wife, HB=as reported by husband.

[6] U.S. Dollar is equivalent to approximately 3650 Ugandan Shilling (in the period mid-March 2017-2018).

[7] We constructed two indicators for the evolution in coffee income measured at baseline and at endline. One indicator makes abstraction of increased or reduced size of the household's coffee plantation, hence differences in total coffee income may be due to either idiosyncratic productivity changes or changes in area or number of coffee trees (prices for coffee are determined by the market and are not idiosyncratic). The other indicator corrects for changes in the size of the coffee plantation and is a net difference in total coffee income if the size of the coffee plantation would have remained as at baseline. We calculated those indicators based on total coffee income as reported by the husband and as reported by the wife.

# Table 12 *Estimated impact on the net evolution in total seasonal coffee income (in UGX)*

| **Outcome** | **Net evolution in total seasonal coffee income (W)** | | | | | | **Net evolution in total seasonal coffee income (HB)** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | T vs CA | T vs CB | T vs CC | CA vs CC | CB vs CC | CA vs CB | T vs CA | T vs CB | T vs CC | CA vs CC | CB vs CC | CA vs CB |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| **ATE** | 178,741.359** | 104,850.977 | 225,221.469 | -14,204.725 | 316,760.406 | -357,481.750 | 53,598.035 | 455,704.438** | 197,195.859 | 135,814.250 | 58,682.387 | 30,674.783 |
| | (83,475.930) | (194,089.828) | (164,877.438) | (134,347.688) | (284,535.375) | (268,161.000) | (116,983.469) | (223,435.813) | (161,148.500) | (141,690.219) | (285,736.313) | (287,201.750) |
| | 0.032 | 0.589 | 0.172 | 0.916 | 0.269 | 0.183 | 0.647 | 0.041 | 0.221 | 0.339 | 0.838 | 0.915 |
| **Cons** | -104,481.555* | -58,835.539 | -84,871.836 | 28,962.924 | -337,779.906 | -74,358.609 | -77,003.414 | -486,512.500*** | -213,879.391** | -124,809.938 | -497,428.625** | -478,486.688** |
| | (62,998.406) | (173,092.266) | (112,595.070) | (102,821.023) | (228,364.172) | (176,494.172) | (81,841.063) | (188,498.906) | (102,222.563) | (99,776.906) | (206,788.484) | (194,769.063) |
| | 0.097 | 0.734 | 0.451 | 0.778 | 0.143 | 0.674 | 0.347 | 0.010 | 0.036 | 0.212 | 0.018 | 0.014 |
| **Mubende** | -114,554.852 | | -188,458.953 | -348,938.656** | | | -106,319.797 | | -151,214.016 | -296,017.531** | | |
| | (77,660.383) | | (157,408.172) | (144,609.797) | | | (107,926.836) | | (156,734.500) | (147,497.609) | | |
| | 0.140 | | 0.231 | 0.017 | | | 0.325 | | 0.335 | 0.046 | | |
| **N** | 385 | 156 | 283 | 216 | 85 | 102 | 396 | 159 | 294 | 240 | 92 | 106 |
| **$R^2$** | 0.011 | 0.003 | 0.025 | 0.037 | 0.016 | 0.009 | 0.001 | 0.030 | 0.007 | 0.026 | 0.000 | -0.001 |
| **Fdf2** | 382.00 | 154.00 | 280.00 | . | . | 100.00 | 393.00 | 157.00 | 291.00 | . | . | 104.00 |
| **F-stat** | 2.70 | 0.29 | 1.01 | 3.39 | 1.24 | 1.74 | 0.50 | 4.11 | 0.80 | 2.36 | 0.04 | 0.01 |
| **Adj $R^2$** | 0.01 | -0.00 | 0.02 | 0.03 | 0.00 | -0.00 | -0.00 | 0.02 | 0.00 | 0.02 | -0.01 | -0.01 |
| **KPrkLM** | 283.62 | 119.19 | 128.11 | | | 80.80 | 305.57 | 118.18 | 164.16 | | | 85.29 |
| **KlPrkWF** | 1 | 6 | 6 | | | 513.96 | 1 | 15 | 8 | | | 819.02 |
| **Hansen J** | 452.06 | 644.27 | 740.55 | | | 0 | 768.46 | 977.41 | 292.69 | | | 0 |

Models with IPTW, IV regression for comparisons of T vs CA, CB, and CC, and CA vs CB, else linear regression.

Significance ***99%, **95%, *90%. Coefficient in 1st, robust S.E. in 2nd, p-value in 3rd row. Fdf2=Degrees of freedom; KPrkLM= Kleibergen-Paap rk LM statistic (under-identification test); KPrkWF=Kleibergen-Paap rk Wald F statistic (weak identification test); Hansen J=Hansen J statistic (overidentifying restrictions test). W=as reported by wife, HB=as reported by husband.

## Table 13 *Estimated impact on total seasonal coffee income (in UGX)*

| Outcome | Total seasonal coffee income (W) | | | | | | Total seasonal coffee income (HB) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | T vs CA | T vs CB | T vs CC | CA vs CC | CB vs CC | CA vs CB | T vs CA | T vs CB | T vs CC | CA vs CC | CB vs CC | CA vs CB |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| **ATE** | 105,850.188* | 29,161.172 | -82,676.469 | -119,751.563 | -75,007.641 | -204,803.531* | -242,155.016 | 181,407.578 | -18,580.432 | 321,866.906 | -180,178.094 | -80,113.297 |
| | (62,100.535) | (134,003.578) | (132,316.297) | (117,156.875) | (176,992.406) | (123,559.234) | (348,361.250) | (176,640.906) | (136,026.547) | (389,486.594) | (217,888.578) | (174,657.063) |
| | 0.088 | 0.828 | 0.532 | 0.308 | 0.672 | 0.097 | 0.487 | 0.304 | 0.891 | 0.409 | 0.410 | 0.646 |
| **Cons** | 213,529.500*** | 448,529.156*** | 375,048.656** | 390,494.719*** | 583,587.188*** | 460,679.844*** | 1225293.625** | 646,832.188*** | 718,305.563*** | 945,740.813*** | 908,749.313*** | 672,885.750*** |
| | (54,362.160) | (96,939.023) | (172,449.563) | (137,384.078) | (135,342.000) | (99,946.211) | (499,341.500) | (124,234.094) | (133,287.234) | (235,332.656) | (166,471.719) | (130,074.719) |
| | 0.000 | 0.000 | 0.030 | 0.005 | 0.000 | 0.000 | 0.014 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| **Mubende** | 87,256.891 | | 137,917.344 | 49,267.277 | | | -425,334.750 | | 98,707.305 | -351,438.344 | | |
| | (56,377.980) | | (144,170.328) | (122,969.023) | | | (327,496.469) | | (134,943.047) | (367,265.406) | | |
| | 0.122 | | 0.339 | 0.689 | | | 0.194 | | 0.464 | 0.339 | | |
| **N** | 459 | 215 | 350 | 261 | 119 | 138 | 464 | 214 | 349 | 272 | 120 | 137 |
| **$R^2$** | 0.011 | 0.000 | 0.005 | 0.006 | 0.002 | 0.019 | 0.007 | 0.006 | 0.002 | 0.006 | 0.006 | 0.002 |
| **Fdf2** | 456.00 | 213.00 | 347.00 | . | . | 136.00 | 461.00 | 212.00 | 346.00 | . | . | 135.00 |
| **F-stat** | 1.86 | 0.05 | 1.00 | 0.70 | 0.18 | 2.71 | 1.50 | 1.04 | 0.28 | 0.47 | 0.68 | 0.21 |
| **Adj $R^2$** | 0.01 | -0.00 | -0.00 | -0.00 | -0.01 | 0.01 | 0.00 | 0.00 | -0.00 | -0.00 | -0.00 | -0.01 |
| **KPrkLM** | 344.62 | 164.91 | 180.62 | | | 111.08 | 350.85 | 164.89 | 187.09 | | | 109.40 |
| **KlPrkWF** | 2 | 12 | 10 | | | 985.96 | 2 | 12 | 9 | | | 935.41 |
| **Hansen J** | 103.15 | 309.15 | 13.64 | | | 0 | 70.95 | 189.55 | 868.49 | | | 0 |

Models with IPTW, IV regression for comparisons of T vs CA, CB, and CC, and CA vs CB, else linear regression.

Significance ***99%, **95%, *90%. Coefficient in 1st, robust S.E. in 2nd, p-value in 3rd row. Fdf2=Degrees of freedom; KPrkLM= Kleibergen-Paap rk LM statistic (under-identification test); KPrkWF=Kleibergen-Paap rk Wald F statistic (weak identification test); Hansen J=Hansen J statistic (overidentifying restrictions test). W=as reported by wife, HB=as reported by husband.

The total coffee income reported by the wife is positively affected by the intensive coaching, but the effect is only observed in the combined sample (*positive ATE of 105,850 UGX T vs CA (panel 1)*) (Table 13). There seem to be negative spillover effects among those who received couple seminars and are member of the same POs as the intensively coached couples (*negative ATE of -204,803 UGX CA vs CB (panel 6)*). The higher total coffee income reported by women in couples who received the intensive coaching translates into a smaller (net) decrease in wife reported coffee income at endline versus baseline vis-à-vis women in couples who participated in couple seminars and in couples without GHA exposure (*positive ATE of 186,992 UGX T vs CA (panel 1 Table 11) and net of 178,741 UGX (panel 1 Table 12); positive ATE of 254,684 UGX T vs CC (panel 3 Table 11) and net of 225,221 UGX (panel 3 Table 12*) although the latter are not significant in the IPTW models but are in the regression control models).

The increase in total coffee income earned by the household reported by women may not necessarily mean that the income went up but rather that the wife is better informed about the coffee sales of her household. In fact, this is reflected in the reduced transparency gap as a result of the intensive coaching (in the combined sample) as compared to couple seminars and to no GHA exposure (*negative ATE of -12 pp T vs CA (panel 1); negative ATE of -14 pp T vs CB sig at 13% (panel 2); negative ATE of -17 pp T vs CC (panel 3)*) (Table 14) (Regression control models in Table AA in Online Supplementary Materials 3).[14] There is no evidence of spillover effects from intensively coached couples on intrahousehold transparency about coffee income (*insignificant ATE CA vs CC (panel 4), and insignificant ATE CA vs CB (panel 6)*).

[14] In Lecoutere and Wuyts (2017), no treatment effects on transparency were observed. But that analysis was limited to the Masaka sample. We double-checked and can confirm that the treatment effects reported here are fully due to the changes among couples in the Mubende sample.

## Table 14 *Estimated impact on the transparency gap*[8]

| **Outcome** | **Transparency gap** | | | | | |
|---|---|---|---|---|---|---|
| | T vs CA | T vs CB | T vs CC | CA vs CC | CB vs CC | CA vs CB |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| **ATE** | -0.116* | -0.143 | -0.171* | -0.049 | -0.001 | 0.022 |
| | (0.062) | (0.093) | (0.087) | (0.096) | (0.113) | (0.114) |
| | 0.062 | 0.125 | 0.050 | 0.611 | 0.996 | 0.848 |
| **Cons** | 0.635*** | 0.417*** | 0.664*** | 0.618*** | 0.404*** | 0.408*** |
| | (0.048) | (0.078) | (0.105) | (0.114) | (0.083) | (0.077) |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| **Mubende** | -0.231*** | | -0.211** | -0.133 | | |
| | (0.056) | | (0.097) | (0.102) | | |
| | 0.000 | | 0.029 | 0.192 | | |
| **N** | 410 | 197 | 312 | 238 | 106 | 124 |
| **$R^2$** | 0.052 | 0.015 | 0.060 | 0.017 | 0.000 | 0.000 |
| **Fdf2** | 407.00 | 195.00 | 309.00 | . | . | 122.00 |
| **F-stat** | 12.47 | 2.33 | 3.75 | 0.86 | 0.00 | 0.04 |
| **Adj $R^2$** | 0.05 | 0.01 | 0.05 | 0.01 | -0.01 | -0.01 |
| **KPrkLM** | 303.68 | 137.31 | 173.85 | | | 98.59 |
| **KlPrkWF** | 1 | 11 | 8 | | | 860.61 |
| **Hansen J** | 758.01 | 109.93 | 701.33 | 0 | 0 | 0 |

Models with IPTW, IV regression for comparisons of T vs CA, CB, and CC, and CA vs CB, else linear regression.

Significance ***99%, **95%, *90%. Coefficient in 1st, robust S.E. in 2nd, p-value in 3rd row. Fdf2=Degrees of freedom; KPrkLM= Kleibergen-Paap rk LM statistic (under-identification test); KPrkWF=Kleibergen-Paap rk Wald F statistic (weak identification test); Hansen J=Hansen J statistic (overidentifying restrictions test).Models with IPTW, IV regression for comparisons of T vs CA, CB, and CC, and CA vs CB, else linear regression. Significance ***99%, **95%, *90%. Coeff. in 1st, robust S.E. in 2nd, p-value in 3rd row.

[8] As a measure of intrahousehold transparency about seasonal income earned from coffee we calculated a transparency gap indicator which is the difference between total seasonal coffee income as reported by the husband and the total seasonal coffee income as reported by the wife proportional to the total seasonal coffee income as reported by the husband. Assuming that a smaller difference in reported total coffee income points to more transparency, a smaller value of the transparency gap indicator points more transparency.

### 6.4.2. The impact on total household income from crops other than coffee and livestock

The total income earned from the one or two main cash crops other than coffee, as reported by the husband, is positively affected by the intensive coaching as compared to a situation of no GHA exposure and indications of similar effects of couple seminars, in combination with possible spillovers from intensively coached couples in the same PO (although formal evidence of spillovers is lacking) (*positive ATE of 221,114 UGX T vs CC (panel 3); positive ATE of 166,749 UGX CA vs CC sig at 14% (panel 4); insignificant ATE CA vs CB (panel 6)*) (Table 15) (Regression control models in Tables AB to AG in Online Supplementary Materials 3). These effects are not consistent across models and only emerge in the models where propensity score matching was used. The positive treatment effect on total income from cash crops other than coffee, reported by the husband, neither is reflected in a higher increase in income from base- to endline.[15] And surprisingly, the results suggest a negative spillover effect of intensively coached couples on the evolution in income from other cash crops among couple seminar couples, which does not have a ready explanation (*negative ATE of -316,930 UGX CA vs CB (panel 12)*).

[15] We did not correct the increase or reduction in income from baseline to endline from other cash crops or from livestock for increased or reduced total land area of the household farm (through buying, inheriting or renting land), as it is not possible to speculate if that increased/reduced area was used for those crops or livestock.

## Table 15 *Estimated impact on the total seasonal income earned from cash crops other than coffee, and its evolution from base- to endline, as reported by the husband (in UGX)* [9] [10]

| **Outcomes** | **Total seasonal income from cash crops other than coffee (HB)** | | | | | | **Evolution in total seasonal income from cash crops other than coffee (HB)** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | T vs CA | T vs CB | T vs CC | CA vs CC | CB vs CC | CA vs CB | T vs CA | T vs CB | T vs CC | CA vs CC | CB vs CC | CA vs CB |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| **ATE** | 61,409.348 | 138,717.953 | 221,114.375** | 166,749.156 | -14,182.146 | -60,551.797 | 90,974.672 | -35,688.211 | 85,149.969 | 8,046.827 | 19,037.947 | -316,929.563* |
| | (80,006.156) | (125,217.070) | (103,561.695) | (112,690.961) | (164,825.719) | (133,328.563) | (67,819.266) | (122,413.320) | (65,601.992) | (68,080.727) | (146,095.750) | (166,386.250) |
| | 0.443 | 0.268 | 0.033 | 0.141 | 0.932 | 0.650 | 0.180 | 0.771 | 0.194 | 0.906 | 0.897 | 0.057 |
| **Cons** | 526,391.438*** | 700,271.500*** | 354,050.438*** | 480,604.719*** | 727,856.000*** | 719,785.438*** | -122,967.508*** | 257,520.297*** | -175,661.719*** | -111,439.531** | 238,123.125** | 276,262.469*** |
| | (91,827.805) | (101,865.242) | (124,601.422) | (148,367.828) | (125,403.219) | (105,535.852) | (44,655.078) | (99,283.219) | (51,585.629) | (51,207.313) | (105,293.484) | (101,645.703) |
| | 0.000 | 0.000 | 0.004 | 0.001 | 0.000 | 0.000 | 0.006 | 0.009 | 0.001 | 0.030 | 0.025 | 0.007 |
| **Mubende** | 195,438.422** | | 226,628.016* | 55,638.750 | | | 237,437.953*** | | 337,731.469*** | 204,739.563*** | | |
| | (91,600.781) | | (119,134.773) | (138,778.109) | | | (64,600.070) | | (62,481.813) | (71,041.695) | | |
| | 0.033 | | 0.057 | 0.689 | | | 0.000 | | 0.000 | 0.004 | | |
| **N** | 336 | 211 | 265 | 188 | 122 | 141 | 609 | 242 | 442 | 346 | 134 | 161 |
| **$R^2$** | 0.017 | 0.007 | 0.043 | 0.016 | 0.000 | 0.000 | 0.026 | 0.000 | 0.069 | 0.025 | 0.000 | 0.010 |
| **Fdf2** | 333.00 | 209.00 | 262.00 | . | . | 139.00 | 606.00 | 240.00 | 439.00 | . | . | 159.00 |
| **F-stat** | 2.56 | 1.22 | 4.27 | 1.15 | 0.01 | 0.20 | 11.06 | 0.08 | 16.51 | 4.25 | 0.02 | 3.58 |
| **Adj $R^2$** | 0.01 | 0.00 | 0.04 | 0.01 | -0.01 | -0.01 | 0.02 | -0.00 | 0.06 | 0.02 | -0.01 | 0.00 |
| **KPrkLM** | 272.10 | 174.99 | 119.97 | | | 118.75 | 483.57 | 193.15 | 198.28 | | | 132.20 |
| **KlPrkWF** | 2 | 25 | 12 | | | 1 | 3 | 10 | 11 | | | 1 |
| **Hansen J** | 609.69 | 751.13 | 851.8 | | | 595.76 | 222.52 | 958.13 | 473.42 | | | 348.01 |

Models with IPTW, IV regression for comparisons of T vs CA, CB, and CC, and CA vs CB, else linear regression.

Significance ***99%, **95%, *90%. Coefficient in 1st, robust S.E. in 2nd, p-value in 3rd row. Fdf2=Degrees of freedom; KPrkLM= Kleibergen-Paap rk LM statistic (under-identification test); KPrkWF=Kleibergen-Paap rk Wald F statistic (weak identification test); Hansen J=Hansen J statistic (overidentifying restrictions test). HB=as reported by husband.

[9] Note that the cash crops that husband wife report as being the most and second most important can differ, as can the income they report to have earned from the sales.

[10] When calculating the evolution in total income earned from cash crops other than coffee from base- to endline, we did not correct for a change in acreage of land owned or rented because we were unable to speculate whether that land was used for those crops.

The total income earned through sales of the main cash crops other than coffee, as reported by the wife, is positively affected by the intensive coaching vis-à-vis the couple seminars net of spillovers (*positive ATE of 183,380 UGX T vs CB (panel 2)*) (Table 16). This translates into a higher increase in income from other crops at endline versus baseline among women in intensively coached couples vis-à-vis couple seminar couples (*positive ATE of 209,280 UGX T vs CB (panel 8), and indication of positive ATE 85,704 UGX T vs CA sig at 11% in the IPTW model (panel 7)*). We observed a similar effect in the case of the wife reported income earned from coffee. This observation could point to a real increase in income from other crops for women or reflect that women in change agent couples are better informed about the household income.

## Table 16 *Estimated impact on the total seasonal income earned from cash crops other than coffee, and its evolution from base-to endline, as reported by the wife (in UGX)*

| Outcomes | Total seasonal income from cash crops other than coffee (W) | | | | | | Evolution in total seasonal income from cash crops other than coffee (W) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | T vs CA | T vs CB | T vs CC | CA vs CC | CB vs CC | CA vs CB | T vs CA | T vs CB | T vs CC | CA vs CC | CB vs CC | CA vs CB |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| **ATE** | 68,294.453 | 183,380.484* | 135,974.172 | 10,861.322 | -64,448.988 | 35,888.254 | 85,704.953 | 209,280.453* | 93,582.523 | 14,977.225 | -175,254.344 | -49,676.855 |
| | (66,945.328) | (109,917.367) | (100,019.461) | (103,099.844) | (136,215.438) | (119,299.070) | (54,209.223) | (110,273.164) | (65,492.836) | (67,209.914) | (139,428.219) | (144,108.891) |
| | 0.308 | 0.095 | 0.174 | 0.916 | 0.637 | 0.764 | 0.114 | 0.058 | 0.153 | 0.824 | 0.211 | 0.730 |
| **Cons** | 253,769.578*** | 528,715.188*** | 259,738.172* | 388,701.938*** | 612,059.125*** | 540,622.313*** | -85,385.203** | 163,494.484* | -135,124.766** | -93,714.258 | 357,955.094*** | 175,853.656* |
| | (52,997.078) | (87,673.500) | (133,483.141) | (132,362.500) | (97,696.594) | (91,487.273) | (35,653.855) | (92,961.727) | (61,915.973) | (63,731.328) | (97,844.531) | (96,675.461) |
| | 0.000 | 0.000 | 0.052 | 0.004 | 0.000 | 0.000 | 0.017 | 0.079 | 0.029 | 0.142 | 0.000 | 0.069 |
| **Mubende** | 351,158.625*** | | 276,236.469** | 128,086.164 | | | 316,477.531*** | | 412,218.719*** | 317,523.250*** | | |
| | (57,310.172) | | (108,900.570) | (104,851.969) | | | (52,598.406) | | (62,084.504) | (68,105.367) | | |
| | 0.000 | | 0.011 | 0.223 | | | 0.000 | | 0.000 | 0.000 | | |
| **N** | 365 | 225 | 278 | 198 | 124 | 146 | 609 | 242 | 442 | 346 | 134 | 161 |
| **$R^2$** | 0.069 | 0.015 | 0.034 | 0.009 | 0.002 | 0.001 | 0.070 | 0.017 | 0.130 | 0.078 | 0.012 | -0.001 |
| **Fdf2** | 362.00 | 223.00 | 275.00 | . | . | 144.00 | 606.00 | 240.00 | 439.00 | . | . | 159.00 |
| **F-stat** | 19.13 | 2.76 | 3.30 | 0.80 | 0.22 | 0.09 | 22.75 | 3.57 | 22.16 | 11.10 | 1.58 | 0.12 |
| **Adj $R^2$** | 0.06 | 0.01 | 0.03 | -0.00 | -0.01 | -0.01 | 0.07 | 0.01 | 0.13 | 0.07 | 0.00 | -0.01 |
| **KPrkLM** | 291.47 | 177.29 | 117.32 | | | 120.47 | 483.57 | 193.15 | 198.28 | | | 132.20 |
| **KlPrkWF** | 2 | 9 | 8 | | | 1 | 3 | 10 | 11 | | | 1 |
| **Hansen J** | 414.32 | 613.67 | 112.79 | | | 326.41 | 222.52 | 958.13 | 473.42 | | | 348.01 |

Models with IPTW, IV regression for comparisons of T vs CA, CB, and CC, and CA vs CB, else linear regression.

Significance ***99%, **95%, *90%. Coefficient in 1st, robust S.E. in 2nd, p-value in 3rd row. Fdf2=Degrees of freedom; KPrkLM= Kleibergen-Paap rk LM statistic (under-identification test); KPrkWF=Kleibergen-Paap rk Wald F statistic (weak identification test); Hansen J=Hansen J statistic (overidentifying restrictions test). W=as reported by wife.

The total income earned from selling livestock, which is the sum of the income earned through livestock personally sold by the husband and livestock personally sold by the wife, is higher as a result of the intensive coaching as compared to no GHA exposure (*positive ATE of 79,084 UGX T vs CC (panel 3)*) (Table 17). In the Mubende subsample, it emerges as a positive effect of the intensive coaching vis-à-vis the couple seminars without spillovers (*positive ATE of 121,336 UGX T vs CB (panel 2)*). Even if there is no formal evidence of spillover effects from the intensively coached couples (*insignificant ATE CA vs CB (panel 6)*), there might have been some which would explain the absence of treatment effects when comparing intensively coached couples to couple seminar couples who are member of the same POs as the intensively coached couples (*insignificant ATE T vs CA (panel 1)*). The evolution in income earned from livestock does not significantly differ across treatments (*Panels 7-12*).

## Table 17 *Estimated impact on the total household income earned from selling livestock and its evolution from base-to endline (in UGX)*[11]

| **Outcomes** | **Total household income from selling livestock** | | | | | | **Evolution in total household income from selling livestock** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | T vs CA | T vs CB | T vs CC | CA vs CC | CB vs CC | CA vs CB | T vs CA | T vs CB | T vs CC | CA vs CC | CB vs CC | CA vs CB |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| **ATE** | 45,268.430 | 121,336.125*** | 79,084.242*** | 27,192.941 | -22,530.387 | 63,194.031 | -26,687.221 | 29,463.277 | -5,173.111 | 848.493 | 66,850.273 | 19,847.328 |
| | (34,462.039) | (44,497.430) | (28,706.027) | (29,091.762) | (53,388.023) | (67,931.227) | (47,243.672) | (54,572.301) | (50,180.852) | (44,499.070) | (65,980.367) | (78,608.617) |
| | 0.189 | 0.006 | 0.006 | 0.351 | 0.674 | 0.352 | 0.572 | 0.589 | 0.918 | 0.985 | 0.313 | 0.801 |
| **Cons** | 124,267.734*** | 94,627.734*** | 100,528.820*** | 97,447.453*** | 131,622.750*** | 99,798.641*** | -67,745.922** | 50,478.008* | -53,964.977 | -27,691.109 | 5,088.475 | 57,666.578** |
| | (25,204.609) | (20,131.186) | (24,079.656) | (23,351.527) | (46,804.020) | (21,631.975) | (34,066.156) | (29,969.990) | (39,273.570) | (36,093.199) | (58,914.836) | (28,967.412) |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.006 | 0.000 | 0.047 | 0.092 | 0.169 | 0.443 | 0.931 | 0.047 |
| **Mubende** | 14,335.057 | | -1,095.921 | 3,048.358 | | | 148,688.406*** | | 75,967.648 | 36,921.375 | | |
| | (31,986.533) | | (27,885.490) | (29,756.719) | | | (43,268.379) | | (48,952.781) | (45,333.551) | | |
| | 0.654 | | 0.969 | 0.918 | | | 0.001 | | 0.121 | 0.416 | | |
| **N** | 609 | 242 | 442 | 346 | 134 | 161 | 609 | 242 | 442 | 346 | 134 | 161 |
| **$R^2$** | 0.005 | 0.035 | 0.016 | 0.002 | 0.002 | 0.004 | 0.019 | 0.001 | 0.006 | 0.002 | 0.010 | -0.000 |
| **Fdf2** | 606.00 | 240.00 | 439.00 | . | . | 159.00 | 606.00 | 240.00 | 439.00 | . | . | 159.00 |
| **F-stat** | 1.25 | 7.37 | 3.77 | 0.44 | 0.18 | 0.85 | 6.06 | 0.29 | 1.28 | 0.34 | 1.03 | 0.06 |
| **Adj $R^2$** | 0.00 | 0.03 | 0.01 | -0.00 | -0.01 | -0.00 | 0.02 | -0.00 | 0.00 | -0.00 | 0.00 | -0.01 |
| **KPrkLM** | 483.57 | 193.15 | 198.28 | | | 132.20 | 483.57 | 193.15 | 198.28 | | | 132.20 |
| **KlPrkWF** | 3 | 10 | 11 | | | 1 | 3 | 10 | 11 | | | 1 |
| **Hansen J** | 222.52 | 958.13 | 473.42 | | | 348.01 | 222.52 | 958.13 | 473.42 | | | 348.01 |

[11] The total household income earned from selling livestock is the sum of the amount received by the husband personally selling livestock and the amount received by the wife personally selling livestock in course of three months prior to data collection.

## 6.5. The impact on household welfare

### 6.5.1. The impact on household asset ownership

We do not find evidence of treatment effects on asset ownership as measured by tropical livestock units or a bicycle owned by the household (reported by the husband), nor on the evolution in tropical livestock units owned by the household (and reported by the husband) from baseline to endline (Tables 18 and 19) (Regression control models in Tables AH, AI, and AJ in Online Supplementary Materials 3).

## Table 18 *Estimated impact on the tropical livestock units (TLU) owned by the household, as reported by the husband, and the evolution in TLU from base- to endline*[12]

| Outcome | Tropical livestock units owned by the household (HB) | | | | | | Evolution in tropical livestock units (HB) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | T vs CA | T vs CB | T vs CC | CA vs CC | CB vs CC | CA vs CB | T vs CA | T vs CB | T vs CC | CA vs CC | CB vs CC | CA vs CB |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| **ATE** | 0.075 | 0.117 | 0.104 | 0.053 | 0.047 | -0.001 | 0.056 | 0.217 | -0.074 | -0.152 | -0.038 | 0.144 |
| | (0.179) | (0.235) | (0.234) | (0.255) | (0.260) | (0.245) | (0.165) | (0.347) | (0.214) | (0.223) | (0.313) | (0.335) |
| | 0.676 | 0.618 | 0.657 | 0.834 | 0.858 | 0.995 | 0.733 | 0.532 | 0.728 | 0.497 | 0.903 | 0.667 |
| **Cons** | 1.906*** | 1.188*** | 1.802*** | 1.766*** | 1.247*** | 1.218*** | 0.273* | 0.112 | 0.395** | 0.263 | 0.231 | 0.121 |
| | (0.176) | (0.156) | (0.240) | (0.249) | (0.175) | (0.158) | (0.146) | (0.319) | (0.195) | (0.209) | (0.207) | (0.284) |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.062 | 0.725 | 0.043 | 0.209 | 0.268 | 0.670 |
| **Mubende** | -0.738*** | | -0.466** | -0.410 | | | -0.004 | | 0.109 | 0.341 | | |
| | (0.163) | | (0.230) | (0.249) | | | (0.151) | | (0.210) | (0.225) | | |
| | 0.000 | | 0.043 | 0.101 | | | 0.981 | | 0.603 | 0.130 | | |
| **N** | 598 | 239 | 434 | 341 | 133 | 159 | 562 | 233 | 414 | 321 | 132 | 156 |
| **$R^2$** | 0.032 | 0.001 | 0.015 | 0.011 | 0.000 | 0.000 | 0.001 | 0.003 | 0.001 | 0.014 | 0.000 | 0.001 |
| **Fdf2** | 595.00 | 237.00 | 431.00 | . | . | 157.00 | 559.00 | 231.00 | 411.00 | . | . | 154.00 |
| **F-stat** | 12.21 | 0.25 | 2.20 | 1.36 | 0.03 | 0.00 | 0.06 | 0.39 | 0.16 | 1.22 | 0.01 | 0.18 |
| **Adj $R^2$** | 0.03 | -0.00 | 0.01 | 0.01 | -0.01 | -0.01 | -0.00 | -0.00 | -0.00 | 0.01 | -0.01 | -0.01 |
| **KPrkLM** | 475.27 | 192.20 | 199.54 | | | 130.29 | 441.69 | 192.56 | 200.26 | | | 126.46 |
| **KlPrkWF** | 3 | 14 | 13 | | | 1 | 2 | 13 | 11 | | | 1 |
| **Hansen J** | 190.53 | 547.64 | 200.53 | | | 305.39 | 782.68 | 324.66 | 740.62 | | | 206.44 |

Models with IPTW, IV regression for comparisons of T vs CA, CB, and CC, and CA vs CB, else linear regression.

Significance ***99%, **95%, *90%. Coefficient in 1st, robust S.E. in 2nd, p-value in 3rd row. Fdf2=Degrees of freedom; KPrkLM= Kleibergen-Paap rk LM statistic (under-identification test); KPrkWF=Kleibergen-Paap rk Wald F statistic (weak identification test); Hansen J=Hansen J statistic (overidentifying restrictions test).Models with IPTW, IV regression for comparisons of T vs CA, CB, and CC, and CA vs CB, else linear regression. Significance ***99%, **95%, *90%. Coeff. in 1st, robust S.E. in 2nd, p-value in 3rd row. HB=as reported by the husband.

[12]Tropical livestock units are calculated by making a weighed sum of all livestock owned by the household. More specifically, the weights are: cattle = 0.70, sheep and goats = 0.10, pigs = 0.20, chicken = 0.01, turkey = 0.05, donkey = 0.50; pigeons = 0.005, ducks = 0.02 and rabbits = 0.02 (Jahnke & Jahnke 1982). Here we used 0.70 for cattle, 0.15 for small livestock (sheep, goats and pigs), and 0.015 for poultry.

## Table 19 *Estimated impact on bicycle ownership by the husband*

| **Outcome** | **Bicycle ownership (HB)** | | | | | |
|---|---|---|---|---|---|---|
| | T vs CA | T vs CB | T vs CC | CA vs CC | CB vs CC | CA vs CB |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| **ATE** | 0.048 | 0.067 | 0.083 | 0.050 | -0.044 | 0.024 |
| | (0.042) | (0.070) | (0.068) | (0.076) | (0.094) | (0.086) |
| | 0.256 | 0.337 | 0.223 | 0.513 | 0.640 | 0.779 |
| **Cons** | 0.713*** | 0.373*** | 0.676*** | 0.648*** | 0.421*** | 0.391*** |
| | (0.034) | (0.056) | (0.081) | (0.089) | (0.075) | (0.056) |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| **Mubende** | -0.350*** | | -0.337*** | -0.319*** | | |
| | (0.039) | | (0.068) | (0.073) | | |
| | 0.000 | | 0.000 | 0.000 | | |
| **N** | 598 | 239 | 434 | 341 | 133 | 159 |
| **$R^2$** | 0.127 | 0.006 | 0.120 | 0.105 | 0.002 | 0.000 |
| **Fdf2** | 595.00 | 237.00 | 431.00 | . | . | 157.00 |
| **F-stat** | 39.25 | 0.91 | 16.21 | 13.65 | 0.22 | 0.08 |
| **Adj $R^2$** | 0.12 | 0.00 | 0.12 | 0.10 | -0.01 | -0.01 |
| **KPrkLM** | 475.27 | 192.20 | 199.54 | | | 130.29 |
| **KlPrkWF** | 3 | 14 | 13 | | | 1 |
| **Hansen J** | 190.53 | 547.64 | 200.53 | 0 | 0 | 305.39 |

Models with IPTW, IV regression for comparisons of T vs CA, CB, and CC, and CA vs CB, else linear regression.

Significance ***99%, **95%, *90%. Coefficient in 1st, robust S.E. in 2nd, p-value in 3rd row. Fdf2=Degrees of freedom; KPrkLM= Kleibergen-Paap rk LM statistic (under-identification test); KPrkWF=Kleibergen-Paap rk Wald F statistic (weak identification test); Hansen J=Hansen J statistic (overidentifying restrictions test).Models with IPTW, IV regression for comparisons of T vs CA, CB, and CC, and CA vs CB, else linear regression. Significance ***99%, **95%, *90%. Coeff. in 1st, robust S.E. in 2nd, p-value in 3rd row. HB=as reported by the husband.

But there is evidence of a positive treatment effect of couple seminars, potentially in combination with (spillover effects from) the intensively coached couples (even if there is no formal evidence of such spillovers), vis-à-vis no GHA exposure on increasing household farm assets by buying (or inheriting) additional land (*based on husbands' accounts positive ATE of 5 pp T vs CC (panel 3), and of 7 pp CA vs CC (panel 4 Table 20); and based on wives' accounts positive ATE of 19 pp T vs CC (panel 3), and of 10 pp CA vs CC (panel 4 Table 21*) (Regression control models in Tables AK to AN in Online Supplementary Materials 3). Apparently, buying (or inheriting) is preferred over renting as a way to increase household farm land, as treatment effect on rented land are absent (*Panels 7-12 Tables 20 and 21*).

## Table 20 *Estimated impact on the likelihood that the household acquired additional land by buying (or inheriting), respectively renting, in the course of one year, as reported by the husband*

| **Outcome** | **Household bought (or inherited) land (HB)** | | | | | | **Household rented land (HB)** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | T vs CA | T vs CB | T vs CC | CA vs CC | CB vs CC | CA vs CB | T vs CA | T vs CB | T vs CC | CA vs CC | CB vs CC | CA vs CB |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| **ATE** | -0.016 | 0.028 | 0.047** | 0.071*** | 0.002 | 0.013 | -0.000 | -0.103 | -0.044 | -0.036 | -0.082 | -0.167 |
| | (0.023) | (0.030) | (0.020) | (0.022) | (0.033) | (0.037) | (0.045) | (0.142) | (0.087) | (0.089) | (0.220) | (0.140) |
| | 0.490 | 0.353 | 0.018 | 0.001 | 0.942 | 0.724 | 0.995 | 0.468 | 0.613 | 0.686 | 0.708 | 0.233 |
| **Cons** | 0.102*** | 0.039** | 0.017* | 0.020* | 0.036 | 0.042** | 0.194*** | 0.386*** | 0.197** | 0.216** | 0.424** | 0.362*** |
| | (0.021) | (0.020) | (0.010) | (0.011) | (0.027) | (0.021) | (0.046) | (0.136) | (0.081) | (0.084) | (0.185) | (0.123) |
| | 0.000 | 0.047 | 0.096 | 0.068 | 0.181 | 0.044 | 0.000 | 0.004 | 0.015 | 0.010 | 0.023 | 0.003 |
| **Mubende** | -0.042** | | 0.003 | -0.009 | | | 0.046 | | 0.122 | 0.060 | | |
| | (0.021) | | (0.019) | (0.022) | | | (0.041) | | (0.083) | (0.089) | | |
| | 0.050 | | 0.893 | 0.699 | | | 0.258 | | 0.143 | 0.500 | | |
| **N** | 598 | 239 | 434 | 341 | 133 | 159 | 598 | 239 | 434 | 341 | 133 | 159 |
| **$R^2$** | 0.009 | 0.004 | 0.008 | 0.026 | 0.000 | 0.002 | 0.002 | 0.004 | 0.010 | 0.002 | 0.001 | 0.006 |
| **Fdf2** | 595.00 | 237.00 | 431.00 | . | . | 157.00 | 595.00 | 237.00 | 431.00 | . | . | 157.00 |
| **F-stat** | 2.18 | 0.85 | 4.41 | 5.86 | 0.01 | 0.12 | 0.69 | 0.52 | 1.07 | 0.26 | 0.14 | 1.40 |
| **Adj $R^2$** | 0.01 | -0.00 | 0.00 | 0.02 | -0.01 | -0.00 | -0.00 | -0.00 | 0.01 | -0.00 | -0.01 | -0.00 |
| **KPrkLM** | 475.27 | 192.20 | 199.54 | | | 130.29 | 475.27 | 192.20 | 199.54 | | | 130.29 |
| **KlPrkWF** | 3 | 14 | 13 | | | 1 | 3 | 14 | 13 | | | 1 |
| **Hansen J** | 190.53 | 547.64 | 200.53 | | | 305.39 | 190.53 | 547.64 | 200.53 | | | 305.39 |

Models with IPTW, IV regression for comparisons of T vs CA, CB, and CC, and CA vs CB, else linear regression.

Significance ***99%, **95%, *90%. Coefficient in 1st, robust S.E. in 2nd, p-value in 3rd row. Fdf2=Degrees of freedom; KPrkLM= Kleibergen-Paap rk LM statistic (under-identification test); KPrkWF=Kleibergen-Paap rk Wald F statistic (weak identification test); Hansen J=Hansen J statistic (overidentifying restrictions test).Models with IPTW, IV regression for comparisons of T vs CA, CB, and CC, and CA vs CB, else linear regression. Significance ***99%, **95%, *90%. Coeff. in 1st, robust S.E. in 2nd, p-value in 3rd row. HB=as reported by the husband.

## Table 21 *Estimated impact on the likelihood that the household acquired additional land by buying (or inheriting), respectively renting, in the course of one year, as reported by the wife*

| **Outcome** | **Household bought (or inherited) land (W)** | | | | | | **Household rented land (W)** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | T vs CA | T vs CB | T vs CC | CA vs CC | CB vs CC | CA vs CB | T vs CA | T vs CB | T vs CC | CA vs CC | CB vs CC | CA vs CB |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| **ATE** | 0.103 | 0.077 | 0.190*** | 0.097* | 0.104 | -0.095 | -0.048 | -0.002 | -0.006 | 0.026 | -0.032 | -0.050 |
| | (0.081) | (0.109) | (0.066) | (0.054) | (0.090) | (0.092) | (0.057) | (0.063) | (0.063) | (0.077) | (0.082) | (0.071) |
| | 0.204 | 0.480 | 0.004 | 0.075 | 0.248 | 0.302 | 0.406 | 0.970 | 0.924 | 0.738 | 0.695 | 0.479 |
| **Cons** | 0.163** | 0.118 | 0.053 | 0.052* | 0.036 | 0.134 | 0.243*** | 0.257*** | 0.176** | 0.216*** | 0.266*** | 0.249*** |
| | (0.073) | (0.072) | (0.038) | (0.029) | (0.027) | (0.083) | (0.068) | (0.051) | (0.078) | (0.083) | (0.067) | (0.049) |
| | 0.025 | 0.101 | 0.167 | 0.070 | 0.181 | 0.108 | 0.000 | 0.000 | 0.023 | 0.010 | 0.000 | 0.000 |
| **Mubende** | -0.113 | | -0.048 | -0.059 | | | 0.012 | | 0.062 | -0.020 | | |
| | (0.073) | | (0.067) | (0.053) | | | (0.051) | | (0.063) | (0.074) | | |
| | 0.120 | | 0.474 | 0.267 | | | 0.811 | | 0.328 | 0.786 | | |
| **N** | 597 | 242 | 431 | 340 | 134 | 161 | 597 | 242 | 431 | 340 | 134 | 161 |
| **$R^2$** | 0.005 | 0.002 | 0.012 | 0.009 | 0.007 | 0.004 | 0.002 | 0.000 | 0.006 | 0.001 | 0.001 | -0.000 |
| **Fdf2** | 594.00 | 240.00 | 428.00 | . | . | 159.00 | 594.00 | 240.00 | 428.00 | . | . | 159.00 |
| **F-stat** | 2.18 | 0.49 | 4.17 | 1.89 | 1.35 | 1.05 | 0.69 | 0.00 | 0.59 | 0.11 | 0.15 | 0.49 |
| **Adj $R^2$** | 0.00 | -0.00 | 0.01 | 0.00 | -0.00 | -0.00 | -0.00 | -0.00 | 0.00 | -0.01 | -0.01 | -0.01 |
| **KPrkLM** | 475.54 | 193.15 | 194.53 | | | 132.20 | 475.54 | 193.15 | 194.53 | | | 132.20 |
| **KlPrkWF** | 3 | 10 | 10 | | | 1 | 3 | 10 | 10 | | | 1 |
| **Hansen J** | 239.03 | 958.13 | 811.29 | | | 348.01 | 239.03 | 958.13 | 811.29 | | | 348.01 |

Models with IPTW, IV regression for comparisons of T vs CA, CB, and CC, and CA vs CB, else linear regression.

Significance ***99%, **95%, *90%. Coefficient in 1st, robust S.E. in 2nd, p-value in 3rd row. Fdf2=Degrees of freedom; KPrkLM= Kleibergen-Paap rk LM statistic (under-identification test); KPrkWF=Kleibergen-Paap rk Wald F statistic (weak identification test); Hansen J=Hansen J statistic (overidentifying restrictions test).Models with IPTW, IV regression for comparisons of T vs CA, CB, and CC, and CA vs CB, else linear regression. Significance ***99%, **95%, *90%. Coeff. in 1st, robust S.E. in 2nd, p-value in 3rd row. W=as reported by the wife.

### 6.5.2. The impact on subjective household economic wellbeing

As a result of the intensive coaching vis-à-vis couple seminars, both wives and husbands think their household is better off than the average household in their community (*based on husbands' accounts positive ATE of 11 pp T vs CA (panel 7), and of 10 pp T vs CB (panel 8) although the latter is not significant in the IPTW model); based on wives' accounts positive ATE of 14 pp T vs CA (panel 1), and of 14 pp T vs CB (panel 2*)) (Table 22) (Regression control models in Tables AO and AP in Online Supplementary Materials 3). The couple seminar with spillovers as compared to no GHA exposure, however, made women more pessimistic about their households' wellbeing (*negative ATE of 21 pp CA vs CC (panel 4*)). Couple seminars without spillovers versus no GHA exposure, however, have a positive effect on husbands' belief their household is better off than the average household (in the Mubende subsample) (*positive ATE of 15 pp CB vs CC (panel 11*)).

## Table 22 *Estimated impact on the likelihood that the wife, respectively the husband, believes her/his household is (much) better off than the average households in the community*

| **Outcome** | **Household is (much) better off than the average household (W)** | | | | | | **Household is (much) better off than the average household (HB)** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | T vs CA | T vs CB | T vs CC | CA vs CC | CB vs CC | CA vs CB | T vs CA | T vs CB | T vs CC | CA vs CC | CB vs CC | CA vs CB |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| **ATE** | 0.143*** | 0.137** | -0.029 | -0.214** | -0.025 | -0.084 | 0.109*** | 0.098 | 0.078 | -0.040 | 0.146* | -0.052 |
| | (0.041) | (0.068) | (0.076) | (0.082) | (0.101) | (0.068) | (0.041) | (0.072) | (0.076) | (0.087) | (0.086) | (0.080) |
| | 0.001 | 0.046 | 0.701 | 0.010 | 0.803 | 0.222 | 0.008 | 0.171 | 0.305 | 0.643 | 0.092 | 0.510 |
| **Cons** | 0.197*** | 0.169*** | 0.467*** | 0.520*** | 0.229*** | 0.171*** | 0.198*** | 0.191*** | 0.310*** | 0.346*** | 0.096* | 0.203*** |
| | (0.035) | (0.053) | (0.099) | (0.104) | (0.078) | (0.053) | (0.034) | (0.058) | (0.105) | (0.112) | (0.049) | (0.059) |
| | 0.000 | 0.002 | 0.000 | 0.000 | 0.004 | 0.001 | 0.000 | 0.001 | 0.003 | 0.002 | 0.053 | 0.001 |
| **Mubende** | -0.070* | | -0.221*** | -0.279*** | | | -0.047 | | -0.169** | -0.206** | | |
| | (0.039) | | (0.077) | (0.079) | | | (0.039) | | (0.076) | (0.081) | | |
| | 0.072 | | 0.004 | 0.001 | | | 0.225 | | 0.025 | 0.012 | | |
| **N** | 469 | 188 | 341 | 253 | 95 | 114 | 479 | 181 | 344 | 255 | 87 | 110 |
| **$R^2$** | 0.023 | 0.023 | 0.055 | 0.144 | 0.001 | 0.008 | 0.011 | 0.010 | 0.042 | 0.062 | 0.039 | 0.000 |
| **Fdf2** | 466.00 | 186.00 | 338.00 | . | . | 112.00 | 476.00 | 179.00 | 341.00 | . | . | 108.00 |
| **F-stat** | 7.31 | 3.94 | 4.72 | 6.40 | 0.06 | 1.46 | 4.10 | 1.85 | 9.45 | 5.43 | 2.91 | 0.43 |
| **Adj $R^2$** | 0.02 | 0.02 | 0.05 | 0.14 | -0.01 | -0.00 | 0.01 | 0.00 | 0.04 | 0.05 | 0.03 | -0.01 |
| **KPrkLM** | 376.91 | 125.96 | 124.32 | | | 95.38 | 386.01 | 111.81 | 114.50 | | | 90.07 |
| **KlPrkWF** | 3 | 7 | 10 | | | 875.09 | 3 | 10 | 13 | | | 879.10 |
| **Hansen J** | 272.68 | 640.26 | 94.05 | | | 0 | 304.9 | 219.94 | 868.31 | | | 0 |

Models with IPTW, IV regression for comparisons of T vs CA, CB, and CC, and CA vs CB, else linear regression.

Significance ***99%, **95%, *90%. Coefficient in 1st, robust S.E. in 2nd, p-value in 3rd row. Fdf2=Degrees of freedom; KPrkLM= Kleibergen-Paap rk LM statistic (under-identification test); KPrkWF=Kleibergen-Paap rk Wald F statistic (weak identification test); Hansen J=Hansen J statistic (overidentifying restrictions test). W=as reported by wife, HB=as reported by husband.

According to women, the intensive coaching vis-à-vis couple seminars (with or without spillovers) made their household better off than the year before (*positive ATE of 10 pp T vs CA (panel 1), and of 11 pp T vs CB (panel 2)*); while the effect is less convincing according to men (*positive ATE of 7 pp T vs CA sig at 11% (panel 7); positive ATE of 8 pp T vs CB (panel 8) but the latter is not significant in the IPTW model and only significant at 13 % in regression control models*) (Tables 23) (Tables AQ and AR in Online Supplementary Materials 3).

## Table 23 *Estimated impact on the likelihood that the wife, respectively the husband, believes her/his household is (much) better off than one year ago*

| **Outcome** | **Household is (much) better off than one year ago (W)** | | | | | | **Household is (much) better off than one year ago (HB)** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | T vs CA | T vs CB | T vs CC | CA vs CC | CB vs CC | CA vs CB | T vs CA | T vs CB | T vs CC | CA vs CC | CB vs CC | CA vs CB |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| **ATE** | 0.102** | 0.108* | -0.002 | -0.094 | -0.102 | 0.017 | 0.065 | 0.083 | 0.020 | -0.032 | 0.022 | 0.010 |
| | (0.041) | (0.061) | (0.068) | (0.075) | (0.091) | (0.073) | (0.041) | (0.064) | (0.065) | (0.073) | (0.086) | (0.079) |
| | 0.013 | 0.075 | 0.972 | 0.213 | 0.263 | 0.820 | 0.114 | 0.191 | 0.763 | 0.664 | 0.802 | 0.898 |
| **Cons** | 0.310*** | 0.199*** | 0.435*** | 0.443*** | 0.332*** | 0.198*** | 0.304*** | 0.240*** | 0.386*** | 0.382*** | 0.256*** | 0.246*** |
| | (0.034) | (0.047) | (0.082) | (0.090) | (0.073) | (0.046) | (0.034) | (0.050) | (0.080) | (0.087) | (0.066) | (0.050) |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| **Mubende** | -0.113*** | | -0.151** | -0.163** | | | -0.069* | | -0.130** | -0.135* | | |
| | (0.038) | | (0.068) | (0.072) | | | (0.038) | | (0.065) | (0.070) | | |
| | 0.003 | | 0.026 | 0.024 | | | 0.070 | | 0.046 | 0.053 | | |
| **N** | 596 | 242 | 431 | 339 | 134 | 161 | 598 | 239 | 434 | 341 | 133 | 159 |
| **$R^2$** | 0.022 | 0.014 | 0.025 | 0.039 | 0.013 | 0.001 | 0.007 | 0.008 | 0.019 | 0.022 | 0.001 | 0.001 |
| **Fdf2** | 593.00 | 240.00 | 428.00 | . | . | 159.00 | 595.00 | 237.00 | 431.00 | . | . | 157.00 |
| **F-stat** | 6.97 | 3.14 | 2.74 | 2.60 | 1.26 | 0.05 | 2.63 | 1.70 | 2.60 | 2.10 | 0.06 | 0.02 |
| **Adj $R^2$** | 0.02 | 0.01 | 0.02 | 0.03 | 0.01 | -0.00 | 0.00 | 0.00 | 0.01 | 0.02 | -0.01 | -0.01 |
| **KPrkLM** | 474.65 | 193.15 | 194.53 | | | 132.20 | 475.27 | 192.20 | 199.54 | | | 130.29 |
| **KlPrkWF** | 3 | 10 | 10 | | | 1 | 3 | 14 | 13 | | | 1 |
| **Hansen J** | 229.14 | 958.13 | 811.29 | | | 348.01 | 190.53 | 547.64 | 200.53 | | | 305.39 |

Models with IPTW, IV regression for comparisons of T vs CA, CB, and CC, and CA vs CB, else linear regression.

Significance ***99%, **95%, *90%. Coefficient in 1st, robust S.E. in 2nd, p-value in 3rd row. Fdf2=Degrees of freedom; KPrkLM= Kleibergen-Paap rk LM statistic (under-identification test); KPrkWF=Kleibergen-Paap rk Wald F statistic (weak identification test); Hansen J=Hansen J statistic (overidentifying restrictions test). W=as reported by wife, HB=as reported by husband.

When respondents reported an improvement or a deterioration in their household's wellbeing, we probed for the main reason (which enumerators fitted into one of the ten possible categories) (Listed in Tables AW and AX in Online Supplementary Materials 4). The most commonly cited main reason by women for a positive evolution in their household's wellbeing include more cooperative household decision-making, especially among women who participated in the change agent coaching and in couple seminars with spillovers from change agents, but also among women without GHA exposure. More diversified income sources is another often cited reason, especially by women who had couple seminars without spillovers and those without GHA exposure. The most cited reason by men is cooperative household decision-making, regardless of treatment, more diversified income sources the second most cited reason. Men who participated in the change agent coaching and couple seminars with spillovers also mention capacity building on agriculture or other economic activities.

The most cited reasons mentioned by women and men, regardless of treatment, for their household's wellbeing having deteriorated since last year relate to problematic agricultural production and climate change or weather related challenges. Note that among women and men without GHA exposure health issues or old age are also important reasons.

### 6.5.3. The impact on household food security

The likelihood that the household is food secure, i.e. when the household did not have to eat less preferred foods nor did it have to reduce the number of meals or quantity of food per meal, is improved by the intensive coaching vis-à-vis couple seminars without spillovers in the Mubende subsample  and vis-à-vis no GHA exposure in the combined sample if we go by women's accounts (*positive ATE of 15 pp T vs CB (panel 2); positive ATE of 11 pp T vs CC (panel 3)*) (Table 24) (Regression control models in Tables AS and AT in Online Supplementary Materials 3). (Even if there is no formal evidence of spillover effects (*insignificant ATE CA vs CB (panel 6)*), they might have been present thereby obscuring a difference between change agent coaching and couple seminars with possible spillovers (*insignificant ATE T vs CA (panel 1)*). Going by husbands' accounts on food security, there are no treatment effects (*Panels 7-12*).

## Table 24 *Estimated impact on the likelihood of the household being food secure*

| **Outcome** | **Household is food secure (W)** | | | | | | **Household is food secure (HB)** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | T vs CA | T vs CB | T vs CC | CA vs CC | CB vs CC | CA vs CB | T vs CA | T vs CB | T vs CC | CA vs CC | CB vs CC | CA vs CB |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| **ATE** | 0.033 | 0.152** | 0.114** | 0.068 | -0.010 | 0.088 | 0.010 | 0.061 | 0.068 | 0.072 | 0.043 | 0.118 |
| | (0.040) | (0.070) | (0.053) | (0.050) | (0.092) | (0.085) | (0.040) | (0.071) | (0.056) | (0.053) | (0.095) | (0.085) |
| | 0.411 | 0.030 | 0.031 | 0.178 | 0.914 | 0.297 | 0.812 | 0.395 | 0.225 | 0.175 | 0.655 | 0.165 |
| **Cons** | 0.179*** | 0.351*** | 0.101** | 0.101*** | 0.366*** | 0.350*** | 0.177*** | 0.411*** | 0.109*** | 0.088** | 0.399*** | 0.411*** |
| | (0.031) | (0.056) | (0.040) | (0.039) | (0.073) | (0.054) | (0.030) | (0.057) | (0.039) | (0.036) | (0.075) | (0.056) |
| | 0.000 | 0.000 | 0.011 | 0.009 | 0.000 | 0.000 | 0.000 | 0.000 | 0.005 | 0.015 | 0.000 | 0.000 |
| **Mubende** | 0.245*** | | 0.266*** | 0.244*** | | | 0.290*** | | 0.316*** | 0.357*** | | |
| | (0.038) | | (0.050) | (0.052) | | | (0.038) | | (0.052) | (0.056) | | |
| | 0.000 | | 0.000 | 0.000 | | | 0.000 | | 0.000 | 0.000 | | |
| **N** | 609 | 242 | 442 | 346 | 134 | 161 | 609 | 242 | 442 | 346 | 134 | 161 |
| **$R^2$** | 0.073 | 0.023 | 0.102 | 0.084 | 0.000 | 0.006 | 0.097 | 0.003 | 0.122 | 0.159 | 0.002 | 0.019 |
| **Fdf2** | 606.00 | 240.00 | 439.00 | . | . | 159.00 | 606.00 | 240.00 | 439.00 | . | . | 159.00 |
| **F-stat** | 22.25 | 4.69 | 24.02 | 13.56 | 0.01 | 1.07 | 30.51 | 0.72 | 28.70 | 28.64 | 0.20 | 1.90 |
| **Adj $R^2$** | 0.07 | 0.02 | 0.10 | 0.08 | -0.01 | 0.00 | 0.09 | -0.00 | 0.12 | 0.15 | -0.01 | 0.01 |
| **KPrkLM** | 483.57 | 193.15 | 198.28 | | | 132.20 | 483.57 | 193.15 | 198.28 | | | 132.20 |
| **KlPrkWF** | 3 | 10 | 11 | | | 1 | 3 | 10 | 11 | | | 1 |
| **Hansen J** | 222.52 | 958.13 | 473.42 | | | 348.01 | 222.52 | 958.13 | 473.42 | | | 348.01 |

Models with IPTW, IV regression for comparisons of T vs CA, CB, and CC, and CA vs CB, else linear regression.

Significance ***99%, **95%, *90%. Coefficient in 1st, robust S.E. in 2nd, p-value in 3rd row. Fdf2=Degrees of freedom; KPrkLM= Kleibergen-Paap rk LM statistic (under-identification test); KPrkWF=Kleibergen-Paap rk Wald F statistic (weak identification test); Hansen J=Hansen J statistic (overidentifying restrictions test). W=as reported by wife, HB=as reported by husband.

The likelihood that women report an improvement in their household food security situation as compared to last year is increased by the intensive coaching vis-à-vis couple seminars without spillovers in the Mubende subsample (*positive ATE of 22 pp T vs CB (panel 2)*) and vis-à-vis no GHA exposure in the combined sample (*positive ATE of 14 pp T vs CC (panel 3)*) (Table 25) (Regression control models in Tables AU and AV in Online Supplementary Materials 3). In this case there is proof of positive spillover effects of intensively coached couples (*positive ATE of 22 pp CA vs CB (panel 6)*), which may also have contributed the positive effect of couple seminars with spillovers vis-à-vis no GHA exposure (*positive ATE of 15 pp CA vs CC (panel 4)*). Going by husband's accounts, there are similar treatment effects on the likelihood that they report an improvement in their household food security situation as compared to last year (*positive ATE of 18 pp T vs CB (panel 8); positive ATE of 17 pp T vs CC (panel 9); positive ATE of 15 pp CA vs CC (panel 10); positive ATE of 19 pp CA vs CB (panel 12)*). This is in contrast with the fact that there was no (convincing) evidence of treatment effects on the likelihood of household food security, as reported by the husband (*cfr. supra*).

## Table 25 *Estimated impact on the likelihood that the wife, respectively the husband, believes her/his household is (much) better off in terms of food security than one year ago*

| **Outcome** | **Household is (much) better off in terms of food security than one year ago (W)** | | | | | | **Household is (much) better off in terms of food security than one year ago (HB)** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | T vs CA | T vs CB | T vs CC | CA vs CC | CB vs CC | CA vs CB | T vs CA | T vs CB | T vs CC | CA vs CC | CB vs CC | CA vs CB |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| **ATE** | -0.005 | 0.215*** | 0.143*** | 0.150*** | -0.003 | 0.222*** | 0.010 | 0.184*** | 0.167*** | 0.146*** | 0.057 | 0.187*** |
| | (0.036) | (0.042) | (0.036) | (0.035) | (0.036) | (0.062) | (0.036) | (0.047) | (0.030) | (0.032) | (0.044) | (0.067) |
| | 0.890 | 0.000 | 0.000 | 0.000 | 0.923 | 0.000 | 0.779 | 0.000 | 0.000 | 0.000 | 0.202 | 0.005 |
| **Cons** | 0.165*** | 0.042** | 0.043 | 0.038 | 0.051* | 0.043** | 0.140*** | 0.085*** | 0.021 | 0.022 | 0.045** | 0.089*** |
| | (0.029) | (0.021) | (0.033) | (0.027) | (0.026) | (0.021) | (0.027) | (0.030) | (0.027) | (0.024) | (0.023) | (0.031) |
| | 0.000 | 0.045 | 0.192 | 0.161 | 0.054 | 0.043 | 0.000 | 0.005 | 0.442 | 0.371 | 0.050 | 0.004 |
| **Mubende** | 0.076** | | 0.050 | 0.040 | | | 0.117*** | | 0.054* | 0.056* | | |
| | (0.034) | | (0.035) | (0.036) | | | (0.034) | | (0.030) | (0.033) | | |
| | 0.023 | | 0.157 | 0.261 | | | 0.001 | | 0.066 | 0.088 | | |
| **N** | 597 | 242 | 431 | 340 | 134 | 161 | 598 | 239 | 434 | 341 | 133 | 159 |
| **$R^2$** | 0.009 | 0.093 | 0.051 | 0.051 | 0.000 | 0.101 | 0.022 | 0.060 | 0.070 | 0.056 | 0.012 | 0.051 |
| **Fdf2** | 594.00 | 240.00 | 428.00 | . | . | 159.00 | 595.00 | 237.00 | 431.00 | . | . | 157.00 |
| **F-stat** | 2.56 | 26.55 | 8.20 | 9.24 | 0.01 | 12.91 | 6.16 | 14.89 | 15.06 | 10.48 | 1.64 | 7.68 |
| **Adj $R^2$** | 0.01 | 0.09 | 0.05 | 0.05 | -0.01 | 0.10 | 0.02 | 0.06 | 0.07 | 0.05 | 0.00 | 0.05 |
| **KPrkLM** | 475.54 | 193.15 | 194.53 | | | 132.20 | 475.27 | 192.20 | 199.54 | | | 130.29 |
| **KlPrkWF** | 3 | 10 | 10 | | | 1 | 3 | 14 | 13 | | | 1 |
| **Hansen J** | 239.03 | 958.13 | 811.29 | | | 348.01 | 190.53 | 547.64 | 200.53 | | | 305.39 |

Models with IPTW, IV regression for comparisons of T vs CA, CB, and CC, and CA vs CB, else linear regression.

Significance ***99%, **95%, *90%. Coefficient in 1st, robust S.E. in 2nd, p-value in 3rd row. Fdf2=Degrees of freedom; KPrkLM= Kleibergen-Paap rk LM statistic (under-identification test); KPrkWF=Kleibergen-Paap rk Wald F statistic (weak identification test); Hansen J=Hansen J statistic (overidentifying restrictions test). W=as reported by wife, HB=as reported by husband.

Given the relatively small number who consider their household's food security situation to have improved since last year, we will concentrate on reasons mentioned by men and women in the combined Masaka and Mubende sample who received the change agent coaching or couple seminars with spillovers (Main reasons for improved or deteriorated food security are listed in Tables AY and AZ in Online Supplementary Materials 4). These are, in order of importance, cooperative household decision-making - more so for change agent than couple seminar men and women -, improved agricultural production and more diversified income sources.

Quite unanimously, for men and women and for each treatment, climate change or weather related challenges and problematic agricultural production are to blame for a deterioration of the household's food security situation.

## 7. Discussion

This article starts from the increasing awareness that part of the reasons for inefficiencies and inequities in smallholder farming in developing contexts are situated at the intrahousehold level. It investigates the possibility to induce changes in agricultural households that support cooperation and level the intrahousehold bargaining power, both of which are expected to increase efficiency, while at the same time improving upon equity. More particularly, it assesses the impact of a program, randomly encouraged among smallholder coffee farming households in central Uganda, introducing a more participatory way of intrahousehold decision-making on the efficiency of agriculture related household outcomes. The program entails an intensive intervention package that coaches couples to apply participatory intrahousehold decision-making, and less intensive half-day couple seminars problematizing the imbalance and strict division of resources and responsibilities within households.

The summary overview of the indicators, the research hypotheses and results presented in Table 26 will guide the discussion of the observed impact of the intensive coaching package and the couple seminars on different measures of efficiency of agriculture related household outcomes.

## Table 26 *Summary overview of the outcome indicators, hypotheses and results*

| | **Hypothesis about impact** | **Observed impact** (**) | | | | | |
|---|---|---|---|---|---|---|---|
| | | Masaka-Kalungu and Mubende sub-samples combined | | | Mubende sub-sample | | |
| **Outcome indicators (*)** | | T vs CA | T vs CC | CA vs CC | T vs CB | CB vs CC | CA vs CB |
| | | (1) | (2) | (3) | (4) | (5) | (6) |
| Management of food crops and cash crops | | | | | | | |
| - Likelihood of agreed upon joint management of food crops | + | | | | + | | + |
| - Likelihood of agreed upon joint management of cash crops | + | | (+) | (+) | + | | + |
| - Likelihood of agreed upon joint management of coffee | + | | | | (+) | (-) | |
| - Likelihood of agreed upon joint management of maize | + | | + | + | | | |
| Ownership of food crops and cash crops plots | | | | | | | |
| - Likelihood of agreed upon joint ownership of food crops | + | | | | + | - | + |
| - Likelihood of agreed upon joint ownership of cash crops | + | | | | | | (+) |
| - Likelihood of agreed upon joint ownership of coffee | + | | | | | | |
| - Likelihood of agreed upon joint ownership of maize | + | - | | | + | | + |
| Type of food crops | | | | | | | |
| - Likelihood of growing a food crop with uncertain harvest (agreed by HB and W) | - | - | | | (-) | | |
| - Likelihood of changing from a food crop with uncertain harvest at baseline to a certain food at endline (agreed by W and HB) | + | + | | (-) | | | |
| Type of cash crops | | | | | | | |
| - Likelihood that coffee is the main cash crop (W or HB) | + **or** – if diversification | | - | - | | | |
| - Likelihood only consumable cash crop (as 1st and 2nd cash) (1st and 2nd cash crop are other than coffee or banana for beer - reported by W or HB) | + | | + | + | | | |
| Adoption of agronomic practices for coffee | | | | | | | |
| - Adoption intensity for coffee (HB reported) | + | | **[+]** | | + | - | + |
| Adoption of agronomic practices for food crops | | | | | | | |
| - Adoption intensity for maize (HB reported) | + | | + | (+) | + | | + |
| - Adoption intensity for cassava, or sweet potato (HB reported) | + | | + **[/]** | (+) **[/]** | (+) | | (+) |
| - Adoption intensity for matooke banana (HB reported) | + | | + **[/]** | + | | | |
| Income from coffee | | | | | | | |
| - Evolution in income from coffee from base- to endline (W reported) | Larger increase | + | (+) | | | | |

| | Hypothesis about impact | Observed impact (**) | | | | | |
|---|---|---|---|---|---|---|---|
| | | Masaka-Kalungu and Mubende sub-samples combined | | | Mubende sub-sample | | |
| **Outcome indicators (*)** | | T vs CA | T vs CC | CA vs CC | T vs CB | CB vs CC | CA vs CB |
| | | (1) | (2) | (3) | (4) | (5) | (6) |
| - Evolution in income from coffee from base- to endline (HB reported) | Larger increase | | | | + | | |
| - Evolution in income from coffee from base- to endline corrected for larger/ smaller plantations (W reported) | Larger increase | + | **[+]** | | | | |
| - Evolution in income from coffee from base- to endline corrected for larger/ smaller plantations (HB reported) | Larger increase | | | | + | | |
| - Total income from coffee (W reported) | + | + | | | | | **[+]** |
| - Total income from coffee (HB reported) | + | | | | | | |
| - Transparency gap | - | - | - | | (-) | | |
| Income from other crops and livestock | | | | | | | |
| - Income from other crops mentioned as cash crops (HB reported) | + | | + **[/]** | (+) **[/]** | | | |
| - Evolution in income from other crops per household from base- to endline (HB reported) | Larger increase | | | | | | **[-]** |
| - Income from other crops mentioned as cash crops (W reported) | + | | | | + | | |
| - Evolution in income from other crops per household from base- to endline (W reported) | Larger increase | (+) | | | **[+]** | | |
| - Income from livestock sales | + | | + | | + | | |
| - Evolution in income livestock sales per household from base- to endline | Larger increase | | | | | | |
| Asset ownership | | | | | | | |
| - Tropical livestock units (HB reported) | + | | | | | | |
| - Evolution in tropical livestock units from base- to endline (HB reported) | Larger increase | | | | | | |
| - Bicycle (HB reported) | + | | | | | | |
| - Land bought/inherited in the last year (HB reported) | + | | + | + | | | |
| - Land rented in the last year (HB reported) | + | | | | | | |
| - Land bought/inherited in the last year (W reported) | + | | + | + | | | |
| - Land rented in the last year (W reported) | + | | | | | | |
| Household economic wellbeing | | | | | | | |
| - In comparison with others (W reported) | + | + | | - | + | | |
| - In comparison with others (HB reported) | + | + | **[+]** | | **[+]** | + | |
| - In comparison with one year ago (W reported) | + | + | | | + | | |
| - In comparison with one year ago (HB reported) | + | (+) | | | | | |
| - **Main reasons for improvements/deterioration** | **Improvements linked to coop** | | | | | | |
| Food security | | | | | | | |

| | **Hypothesis about impact** | **Observed impact** (**) | | | | | |
|---|---|---|---|---|---|---|---|
| | | Masaka-Kalungu and Mubende sub-samples combined | | | Mubende sub-sample | | |
| **Outcome indicators (*)** | | T vs CA | T vs CC | CA vs CC | T vs CB | CB vs CC | CA vs CB |
| | | (1) | (2) | (3) | (4) | (5) | (6) |
| - Food security indicator (W reported) | **+** | | + | | + | | |
| - Food security indicator (HB reported) | **+** | | | | | | |
| - In comparison with one year ago (W reported) | **+** | | + | + | + | | + |
| - In comparison with one year ago (HB reported) | **+** | | + | + | + | | + |
| - **Main reasons for improvements/deterioration** | **Improvements linked to coop** | | | | | | |

First, the intensive coaching package, as compared to couple seminars in the absence of spillovers from intensively coached couples (*T vs CB panel 4*), have a positive impact on the likelihood that spouses agree they jointly manage the most important food crops and most important cash crops, indicatively including coffee, grown in their household farm, which is generally taken as a direct measure of increased cooperation. It also makes it more likely that spouses agree they jointly own the plots on which the most important food crops are grown, including maize, which is also cash crop in this setting. Since the default in this patriarchal setting is that agricultural plots, and certainly those for cash crop production, are considered to be owned by the husband, the latter is an important achievement.

There are positive spillovers from intensively coached couples, who are encouraged to promote participatory intrahousehold decision-making in the producer organisations (POs) they are member of (*CA vs CB panel 6*), on the likelihood of agreed upon joint management of the most important food and cash crops and agreed upon joint ownership of food crop and maize plots.

As compared to couples who were not exposed to any of the Gender Household Approach (GHA) interventions promoting participatory intrahousehold decision-making, both the intensive coaching package (*T vs CC panel 2*) and the couple seminars with the help of spillovers (*CA vs CC panel 3*), increase the likelihood of agreeing upon joint management of maize production, indicatively coffee production as well.

Secondly, in line with the expectations that participatory intrahousehold decision-making will stimulate the choice for strategies that secure food availability and balance the household's food and income needs, we observe that the intensive coaching package versus couple seminars with spillovers (*T vs CA panel 1*) reduces the likelihood of growing a food crop with a relatively risky harvest, such as maize or rice, and makes it more likely that households switched to a food crop with a more certain harvest, cassava and sweet potato among others.

The choice for consumable cash crops, as well as a lower likelihood of coffee as the main cash crop, by the intensively coached couples (*T vs CC panel 2*) and by those who participated in a couple seminar and are possibly exposed to positive spillovers (*CA vs CC panel 3*) as compared to couples with GHA exposure, point to a positive effect on the adoption of diversification strategies.

Thirdly, the positive effect of the intensive coaching package versus the couple seminars without spillovers (*T vs CB panel 4*) on the adoption intensity of sustainable agronomic intensification practices for coffee production is an indication of households choosing for efficient and sustainable farming. There are positive spillovers from having intensively coached couples around in the PO as well (*CA vs CB panel 6*). Couple seminars without spillovers, however, reduce the adoption intensity for coffee production (*CB vs CC panel 5*), which does not have a ready explanation.

The increased choice for efficient and sustainable farming applies for food crop production as well, which can be seen as an important accomplishment in this setting with generally low intensity of adoption of sustainable agronomic intensification practices for food crops; and hints to greater attention for the production of food crops, typically more in women's domain. We observe positive effects for maize, and indicatively for cassava or sweet potato, as a result of the intensive coaching versus couple seminars without spillovers (*T vs CB panel 4*), and of the spillovers from the presence of intensively coached couples (*CA vs CB panel 6*). As compared to no exposure to the GHA, the intensive coaching (*T vs CC panel 2*), and the couple

seminars with the help from spillovers (*CA vs CC panel 3*), increase adoption intensity for maize, cassava or sweet potato, and matooke banana.

Fourthly, we expect a larger household (gross) income, be it as a result of greater cooperation and/or more equal bargaining power that follows from participatory intrahousehold decision-making. Based on husbands' accounts, households who received the intensive coaching versus couple seminars without spillovers (*T vs CB panel 4*) increased their household income earned from coffee more over time.

Wives' accounts reflect the positive effects of the intensive coaching versus the couple seminars without spillovers (*T vs CA panel 1*) on the evolution of the household coffee income, but show positive effects on current coffee income as well. At the same time, the transparency gap, measured by the difference in the total household coffee income reported by the husband and the wife, reduces. Thus, the positive impact on total household coffee income reported by women can be a true increase of the income or, more likely, be due to the fact that women are better informed about their households' income from coffee. In the eyes of women, the latter is crucially important for their involvement in the strategic management of their household (Lecoutere & Wuyts, 2017). Similarly, the positive impact on women's reported household income from selling crops other than coffee as a result of the intensive coaching versus couple seminars without spillovers (*T vs CB panel 4*) reflect either a higher income, or more intrahousehold transparency.

The increased total household income from selling livestock, which is the sum of sales by the husband and the wife, as a result of the intensive coaching versus couple seminars without spillovers (*T vs CB panel 4*) and versus no GHA exposure (*T vs CC panel 2*), is clearly an income effect.

Fifthly, does increased cooperation and/or more equal bargaining power in the household through participatory intrahousehold decision-making increase households' economic wellbeing? In terms of asset ownership, there is no evidence of accumulation of livestock, nor of increased ownership of bicycles. But households are more likely to buy (or inherit) additional land as a result of the intensive coaching and the couple seminars with spillovers versus no GHA exposure (*T vs CC panel 2, CA vs CC panel 3*).

Clearly, women in couples who went through the intensive coaching versus couple seminars (exposed to spillovers or not) (*T vs CA panel 1, T vs CB panel 4*) are optimistic about their households' wellbeing – they believe their household is better off than the average household in the community and improved its wellbeing in the course of the year. The intensive coaching versus couple seminars without spillovers (*T vs CB panel 4*), and versus no GHA exposure (*T vs CC panel 2*), made women feel their household is food secure, and improved this over time. Men are somewhat less optimistic, but still, as a result of the intensive coaching versus couple seminars without spillovers (*T vs CB panel 4*), they believe their household is better off than the average household; and as compared to no GHA exposure the intensive coaching (*T vs CC panel 3*) made them feel their households' food security improved over time. Both men and women believe their households' food security situation improved over time as a result of the couple seminars versus no GHA exposure (*CA vs CC panel 3*), which is probably linked to positive spillovers from the intensively coached couples in their POs (*CA vs CB panel 6*).

The conclusion of this articles is that it is indeed possible to increase efficiency by a program introducing participatory intrahousehold decision-making to stimulate cooperation and level the bargaining power of spouses. An intensive coaching package seems necessary, al-

though the presence of intensive coached couples in the POs who promote what they learned in terms of cooperation and participatory decision-making, in many cases, produces positive spill-overs. Women seem to have particularly benefitted in terms of being better informed about the household income – which will help for their intrahousehold bargaining power – and in terms of subjective wellbeing and household food security. There is still little evidence of positive impact on household income or asset accumulation, but it may have been too soon for such impact to realize. A follow up study after more than one year would permit capturing impact that takes longer to actualize. The positive impact on the adoption of sustainable intensification practices both for coffee and food production, in combination with strategies that balance households' cash and food needs, are important steps in the direction of more sustainable and efficient household farm systems, which in the end hopefully translate in sustained higher household incomes.

## References

Agarwal, B. (1997). ''Bargaining'' and gender relations: Within and beyond the household. *Feminist economics*, *3*(1), 1-51.

Agarwal, B. (2000). Conceptualising environmental collective action: why gender matters. *Cambridge journal of economics*, *24*(3), 283-310.

Agarwal, B. (2001). Participatory exclusions, community forestry, and gender: An analysis for South Asia and a conceptual framework. *World development*, *29*(10), 1623-1648.

Agrawal, A. (2003). Sustainable governance of common-pool resources: context, methods, and politics. *Annual review of anthropology*, *32*(1), 243-262.

Aguilar, A., Carranza, E., Goldstein, M.,Kilic, T., & Oseni, G. (2014). *Decomposition of gender differentials in agricultural productivity in Ethiopia* (Policy Research Working Paper WPS 6764). Washington D.C.: World Bank Group. Retrieved from the World Bank Group: https://elibrary.worldbank.org/doi/abs/10.1596/1813-9450-6764

Alderman, H., Hoddinott, J., Haddad, L., & Udry, C. R. (2003). Gender differentials in farm productivity: Implications for household efficiency and agricultural policy. In A. R. Quisumbing (Ed.), *Household decisions, gender, and development: A synthesis of recent research.* (pp. 61-66). Washington D.C.: International Food Policy Research Institute.

Ayalew, A. D., Bowen, F. H., Deininger, K.W., & Duponchel, M. F. (2015). *Investigating the gender gap in agricultural productivity: Evidence from Uganda.* (Policy Research Working Paper WPS 7262). Washington, D.C.: The World Bank. Retrieved from the World Bank: http://documents.worldbank.org/curated/en/172861468184777211/Investigating-the-gender-gap-in-agricultural-productivity-evidence-from-Uganda

Baland, J. M., & Platteau, J. P. (1996). *Halting degradation of natural resources: Is there a role for rural communities?*. New York, USA, Oxford, UK: Food and Agricultural Organization and Clarendon Press.

Baland, J. M., & Platteau, J. P. (1998). Wealth inequality and efficiency in the Commons, part II: the regulated case. *Oxford Economic Papers*, *50*(1), 1-22.

Bardhan, P. (2000). Irrigation and cooperation: An empirical analysis of 48 irrigation communities in South India. *Economic Development and cultural change*, *48*(4), 847-865.

Cardenas, J. C., Rodriguez, L. A., & Johnson, N. (2011). Collective action for watershed management: field experiments in Colombia and Kenya. *Environment and Development Economics*, *16*(3), 275-303.

De Brauw, A., Gilligan, D. O., Hoddinott, J., & Roy, S. (2014). The impact of Bolsa Família on women's decision-making power. *World Development*, *59*, 487-504.

Doss, C. (2013). Intrahousehold Bargaining and Resource Allocation in Developing Countries. *World Bank Research Observer, 28*(1), 52–78.

Doss, C. R., & Meinzen-Dick, R. (2015). Collective action within the household: Insights from natural resource management. *World Development*, *74*, 171-183.

Duflo, E., & Udry, C. (2004). Intrahousehold resource allocation in Cote d'Ivoire: Social norms, separate accounts and consumption choices (No. w10498). National Bureau of Economic Research.

Farnworth, C., Fones Sundell, M., Nzioki, A., Shivutse, V. & Davis, M. (2013). Household Methodologies. Chapter 5. In: Farnworth, C., Fones Sundell, M., Nzioki, A., Shivutse, V. & Davis, M. (Eds.) *Transforming Gender Relations in Agriculture in Sub-Saharan Africa*. Stockholm: Swedish International Agricultural Network Initiative (SIANI) Stockholm Environment Institute.

Fiala, N., & He, X. (2017). Unitary or noncooperative intrahousehold model? Evidence from couples in Uganda. *The World Bank Economic Review*, *30* (Supplement_1), S77-S85.

Heath, R. and Tan, X. (2016). *Intrahousehold bargaining, female autonomy, and labour supply: theory and evidence from India*. Washington D.C.: Department of Economics, University of Washington. Retrieved on May 31, 2018 from: https://economics.nd.edu/assets/227115/hsa_heathtan.pdf

Holvoet, N. (2005). The impact of microfinance on decision□making agency: evidence from South India. *Development and Change*, *36*(1), 75-102.

Iversen, V., Jackson, C., Kebede, B., Munro, A., & Verschoor, A. (2011). Do spouses realise cooperative gains? Experimental evidence from rural Uganda. *World Development*, *39*(4), 569-578.

Jacobs, K., & Kes, A. (2015). The ambiguity of joint asset ownership: cautionary tales from Uganda and South Africa. *Feminist Economics*, *21*(3), 23-55.

Jahnke, H. E., & Jahnke, H. E. (1982). *Livestock production systems and livestock development in tropical Africa* (Vol. 35). Kiel: Kieler Wissenschaftsverlag Vauk.

Kafle, K., Michelson, H., & Winter-Nelson, A. (2016). Does she have a say? The impact of livestock transfer and associated training on women's empowerment: Evidence from Zambia. In *2016 Annual Meeting, July 31-August 2, 2016, Boston, Massachusetts* (No. 236271). Agricultural and Applied Economics Association. Retrieved January 4, 2018 from: http://purl.umn.edu/236271

Kilic, T., Palacios-Lopez, A., & Goldstein, M. (2015). Caught in a productivity trap: a distributional perspective on gender differences in Malawian agriculture. *World Development*, *70*, 416-463.

Lecoutere, E., & Jassogne, L. (2017). Fairness and Efficiency in Smallholder Farming: The Relation with Intrahousehold Decision-Making. *The Journal of Development Studies*, 1-26.

Lecoutere, E. (2011). Institutions under construction: resolving resource conflicts in Tanzanian irrigation schemes. *Journal of Eastern African Studies*, *5*(2), 252-273.

Lecoutere, E., & Wuyts, E. (2017). *Confronting the wall of patriarchy: does participatory intrahousehold decision-making empower women in agricultural households? (IOB Working paper 2017.13)*. Antwerp: The Institute of Development Policy (IOB), University of Antwerp. Retrieved from the Institute of Development Policy: https://www.uantwerpen.be/en/research-groups/iob/publications/working-papers/wp-2017/wp-201713/

Lecoutere, E., d'Exelle, B., & Van Campenhout, B. (2015). Sharing common resources in patriarchal and status-based societies: evidence from Tanzania. *Feminist Economics*, *21*(3), 142-167.

Lombardini, S., & Yoshikawa, K. (2015). *Women's Empowerment in Uganda: Impact evaluation of piloting gender sensitive livelihoods in Karamoja*. (*Effectiveness Review Series 2014-15*). Oxford: Oxfam GB. Retrieved from Oxfam GB: https://policy-practice.oxfam.org.uk/publications/womens-

empowerment-in-uganda-impact-evaluation-of-the-project-piloting-gender-s-592575

Quisumbing, A. R., & Maluccio, J. A. (2003). Resources at marriage and intrahousehold allocation: Evidence from Bangladesh, Ethiopia, Indonesia, and South Africa. *Oxford Bulletin of Economics and Statistics*, 65(3), 283-327.

McCarthy, N., & Kilic, T. (2017). *Stronger Together: Intra-Household Cooperation and Household Welfare in Malawi.* (Policy Research Working Paper WPS 8043). Washington D.C.: The World Bank. Retrieved from the World Bank: http://documents.worldbank.org/curated/en/352721493213579147/Stronger-together-intra-household-cooperation-and-household-welfare-in-Malawi

Munro, A. (2018). Intra-Household Experiments: A Survey. *Journal of Economic Surveys*, 32(1), 134-175.

Njuki, J., Kaaria, S., Chamunorwa, A., & Chiuri, W. (2011). Linking smallholder farmers to markets, gender and intra-household dynamics: Does the choice of commodity matter?. *The European Journal of Development Research*, 23(3), 426-443.

Nordhagen S., Bastardes Tort C., Kes A., and Winograd L. (2017). *Nurturing Connections? Evaluating the Impact of a Women's Empowerment Curriculum in Cote d'Ivoire.* (ICRW Working Paper). Washington, DC: International Center for Research on Women ICRW. Retrieved from AgriLinks: https://www.agrilinks.org/post/nurturing-connections-more-gender-equitable-agricultural-communities

Ostrom, E. (1990). *Governing the Commons: The Evolution of Institutions for Collective Action*. New York: Cambridge University Press.

Slootmaker, C. (2013). Technology adoption, risk, and intrahousehold bargaining in subsistence agriculture. In *2014 American Economic Association Annual Meeting Allied Social Science Associations, January 3-5, 2014, Philadelphia, PA*. Retrieved May 4, 2018 from the American Economic Association website: https://www.aeaweb.org/aea/2014conference/program/retrieve.php?pdfid=68

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

Van Staveren, I., & Ode bode, O. (2007). Gender norms as asymmetric institutions: A case study of Yoruba women in Nigeria. *Journal of Economic Issues*, 41(4), 903-925.

Waha, K., van Wijk, M. T., Fritz, S., See, L., Thornton, P. K., Wichern, J., & Herrero, M. (2018). Agricultural diversification as an important strategy for achieving food security in Africa. *Global change biology*. 1–11.

IOB
Institute of Development Policy
University of Antwerp