

WORKING PAPER / 2018.11

Joint forces - The impact of intra-household cooperation on welfare in East African agricultural households

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WORKING PAPER / 2018.11

ISSN 2294-8643

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September 2018



This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 702964. The project received support from the Hanns R. Neumann Stiftung as well.

Data and code used in this article will be available on <http://dx.doi.org/10.17632/ywdr8kt26p.1> from October 1, 2019 onwards; before, these are available on request.

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ABSTRACT

In developing countries, a lack of intrahousehold cooperation among members of smallholder agricultural households may result in the inefficient allocation of productive resources. This article estimates the impact of intrahousehold cooperation on household welfare and household public goods provision, using the random encouragement for an intervention intended to stimulate cooperation as an instrument, among smallholder coffee farming households in Uganda and Tanzania. We demonstrate that improved cooperation has substantial positive effects on household income per capita and on the likelihood of household food security. The likelihood of investing in agricultural production, an important public good in these households, is greatly increased by improved cooperation as well. The downside is that, even with an intensive coaching package, the gains in cooperation are not spectacular. We conclude that stimulating intrahousehold cooperation is a promising path to stimulate efficiency, welfare and the provision of household public goods in agricultural households; but we warn against presenting the promotion of cooperation versus strengthening women's bargaining power as a strict policy choice as it may well be that women gain bargaining power in cooperation.

1. INTRODUCTION

Smallholder farming continues to be the most important way to sustain a livelihood for the majority of households in sub-Saharan Africa. To ensure food security of a growing and increasingly urbanized population with increasingly complex dietary demands, these smallholders will need to produce more, and on smaller plots. This will require a more commercially oriented approach, where modern inputs are procured and surplus production is marketed.

Recent research suggests that smallholder household farms produce well below capacity due to a lack of cooperation, and that unequal bargaining power between the main decision-makers in agricultural households leads to underprovisioning of household public goods and welfare losses (a.o. Udry 1996; McPeak and Doss 2006; in Doss & Meinzen-Dick 2015; Goldstein & Udry 2008; in Doss 2013; Iversen, Jackson, Kebede, Munro, & Verschoor 2011; Ayalew, Bowen, Deininger, & Duponchel 2015; Fiala & He 2017; Munro 2018). In the last decades, women's empowerment has received attention as way to level the bargaining power between the main decision-makers— as an intrinsic goal but also because it can be instrumental for household welfare. While the extent to which members of (agricultural) households cooperate has been studied extensively, less attention has been paid to the implications of improved intrahousehold cooperation for household welfare and household public goods provision. Yet, it is increasingly acknowledged that the lack of intrahousehold cooperation may be one of the key constraints for more efficient smallholder agriculture and enhanced welfare of agricultural households (Doss & Meinzen-Dick 2015).

2. LITERATURE

Numerous studies have tried to determine which household model best captures the mode of operation of agricultural households in developing contexts. While some households may function according to the predictions of *unitary household models* (Fiala & He 2017), it is widely acknowledged that this is not the prevailing mode of operation (Udry 1996). *Cooperative bargaining models* recognize that each household member has his/her own utility function with different preferences and different abilities to impact outcomes, which implies household level outcomes are the result of bargaining between household members (Alderman, Hoddinott, Haddad, & Udry 2003). In cooperative bargaining models, the outside options of those involved in bargaining constitute a threat point. The threat of the dissolution of the household for more optimal outside options force household outcomes to be Pareto efficient. The outside options of each member also determine the intrahousehold allocation of resources (Udry 1996; Doss & Meinzen-Dick 2015). However, there is ample observational and experimental evidence that households do not always reach Pareto efficient outcomes (a.o. Udry 1996; McPeak & Doss 2006; in Doss & Meinzen-Dick 2015; Iversen et al. 2011; Munro 2018). The *non-cooperative bargaining model* relaxes the assumption of Pareto efficient outcomes and recognizes that a household can persist in non-cooperation. If it is assumed wife's and husband's contributions to the provision of household public goods are perfect substitutes, the difference in bargaining power between spouses would not matter for consumption patterns; yet there is evidence that it does (Duflo & Udry 2004; McCarthy & Kilic 2017). The Lundberg and Pollak (1993) *separate spheres cooperative bargaining model* starts from the assumption that spouses' contributions to the provision of household public goods are imperfect substitutes. While thus allowing for bargaining power to influence the distribution of resources and consumption patterns, it also assumes efficiency can be achieved by using the non-cooperative outcome as a threat point. A *separate spheres non-cooperative bargaining model* acknowledges that household outcomes, particularly the provision

of household public goods, can be inefficient (McCarthy & Kilic 2017). The relative bargaining power of the household members continues to play a crucial role in these models. The sources of one's bargaining power lie in one's – de jure and de facto – access to private and common productive assets, income earning means, and social and external support systems, and are defined by social perceptions and norms (Agarwal 1997). Because of gender skewed social perceptions resulting in a systematic undervaluation of women's contributions or needs, women's negotiation position may be reduced; or social norms can set limits to what can be negotiated by women and how this can be done (Agarwal 1997).

Intuitively, a situation with equal intrahousehold bargaining power and cooperation can be expected to result in the best household outcomes in terms of household public goods provision and resource allocation. Yet, evidence from developing contexts suggests unequal intrahousehold bargaining power and non-cooperation may prevail. McCarthy and Kilic (2017) are interested in determining whether the largest gains are to be made by promoting intrahousehold cooperation or by levelling intrahousehold bargaining power through the empowerment of women. The household model they propose allows to distinguish the gains on household outcomes, such as total household income, consumption and the provision of household public goods, from improving bargaining power versus increasing cooperation between spouses. In their model, the wife and husband both maximize their utility of a private good to consume and the wife also chooses the amount of labour to supply. Spouses' contributions to the provision of household public goods are imperfect substitutes (separate spheres) and additively separable (Anderson & Eswaran 2009: in McCarthy & Kilic 2017; Heath & Tan 2016). They make the wife's contribution of labour subject to wage and her opportunity cost of labour, but also to the disutility from having part of the income controlled by her husband. The latter enables capturing an increase in the wife's labour supply when her bargaining power increases. The husband's labour supply is assumed to be fixed. According to the model, household income and consumption outcomes are largely determined by the wife's labour supply decision. The model predicts an increase in the wife's labour supply by moving from unequal to more equal bargaining power (i.e. reduced husband's control over wife's income) and by moving from non-cooperation to cooperation (i.e. each spouse internalizes the other spouse's gain from the household public good in his/her utility maximization). The model states that a situation of cooperation and equal bargaining power leads to the best outcomes. But whether a situation of non-cooperation and equal bargaining power versus a situation of cooperation and unequal bargaining power leads to a greater labour supply by the wife depends on how much income the husband can control versus how highly he values the household public good.

McCarthy and Kilic (2017) test the relation between household outcomes and respectively cooperation and women's relative bargaining power for the context of rural Malawi using unit fixed effects regression analysis with the 2010 and 2013 rounds of the Malawi Integrated Household Panel Survey. They use the share of jointly controlled income in total gross income as a proxy for cooperation, in contrast to the share of income controlled by the wife over the total disjoint income as a proxy for the wife's bargaining power vis-à-vis the husband's. They find that, in Malawi, the proxy for cooperation is more strongly and positively related to total household income per capita, consumption expenditures per capita, and the share of household consumption devoted to public goods than the proxy for stronger bargaining power of the wife. They relate this to qualitative evidence that both men and women allot importance to household public goods and that there is limited scope for husbands to control their wives' income in this context.

The conceptualization of agricultural households as a group facing collective action problems similar to the ones arising in common pool resource (CPR) settings as proposed by Doss and Meinzen-Dick (2015) provides another backdrop to understand the potential benefits for household outcomes that can follow from cooperation and equal bargaining power. Cooperation means the absence of opportunism by the household members with regard to provision of the commons and with regard to appropriation of the resources produced in the household; which implies better outcomes, such as higher total household income (Baland & Platteau 1998; Agarwal 2000). 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). The latter brings in a dynamic perspective which is not only relevant in CPR settings but also for households who are continuing groups of individuals repeating their interactions, and who may seek maximisation of their utility over a series of interactions, possibly even taking into account mutual obligations or interdependence (Doss & Meinzen-Dick 2015; Munro 2018).

If spouses would have equal bargaining power and this implies both spouses, including the wife, can effectively participate in intrahousehold rule- and decision-making and in monitoring of compliance with those 'rules', each of the spouses is expected to be able to more effectively demand for the other's contribution to the commons, as well as to claim his/her share of resources. In CPR settings, reduced information asymmetry, credible commitments to and mutual monitoring of mutually agreed upon 'rules' have been shown to be instrumental for cooperation (Ostrom 1990; Bardhan 2000; Agarwal 2003). Efficiency can thus benefit directly from equal participation in rule-making and monitoring as it strengthens incentives for contributions to the commons and discourages overconsumption. Indirectly, reduced inequality could contribute to efficiency by alleviating constraints to opt for the most efficient options (Slootmaker 2013), and because fairness in the allocation of benefits from common resources is conducive for sustained cooperation (Ostrom 1990; Baland & Platteau 1998).

A debate that comes to the fore is whether stimulating intrahousehold cooperation or empowering women is more effective to improving household welfare and household public goods provision? The debate is inconclusive and supporting evidence is still embryonic, particularly of the impact of increased cooperation on household welfare within rural households in developing contexts (McCarthy & Kilic 2017). Yet, the question is highly relevant, not only from a theoretical perspective, but especially for development policy where the recognition of the need to address the lack of cooperation within households gains terrain.

The contribution of this article is to provide evidence of the impact of intrahousehold cooperation on household welfare and household public goods provision in agricultural households in East Africa. While one of the main empirical challenges is that intrahousehold cooperation and household welfare are likely to be endogenous (Doss 2013), we make use of the random encouragement for an intervention intended to stimulate intrahousehold cooperation to estimate the effect on household welfare and household public goods provision that is mediated through cooperation. The random encouragement fulfils the conditions to be used as an instrument to estimate the causal effect of the otherwise potentially endogenous treatment variable cooperation.

3. THE RANDOMLY ENCOURAGED INTERVENTION

We make use of the random encouragement for participation in specific activities of an intervention called the Gender Household Approach (GHA) implemented by the Hanns R. Neumann Stiftung (HRNS), a non-profit foundation working with coffee farmers, among its member smallholder coffee farming households in Mubende district in central Uganda and in the area around Mbeya in southern Tanzania.

3.1. Pathways of change

The pathways of change of the GHA are compatible with the conceptualisation of agricultural households proposed by Doss and Meinzen-Dick (2015) (cfr. *Infra*) as groups managing a set of common resources where members are mutually interdependent on the others' individual decisions about provision and appropriation of (the benefits of) those resources.

The GHA projects agricultural production as a household farm enterprise where all household members, and specifically the spouses, can contribute to, and equally benefit from, coffee production. The idea behind this approach is that, together, household members, when they jointly make decisions and plan the way they will generate income as a household and the way they will utilize the produce and income they generate, they can better achieve their common goals and aspirations. The GHA, by introducing so-called participatory intrahousehold decision-making, whereby spouses consult each other and come to compromises, emphasizes intrahousehold cooperation.

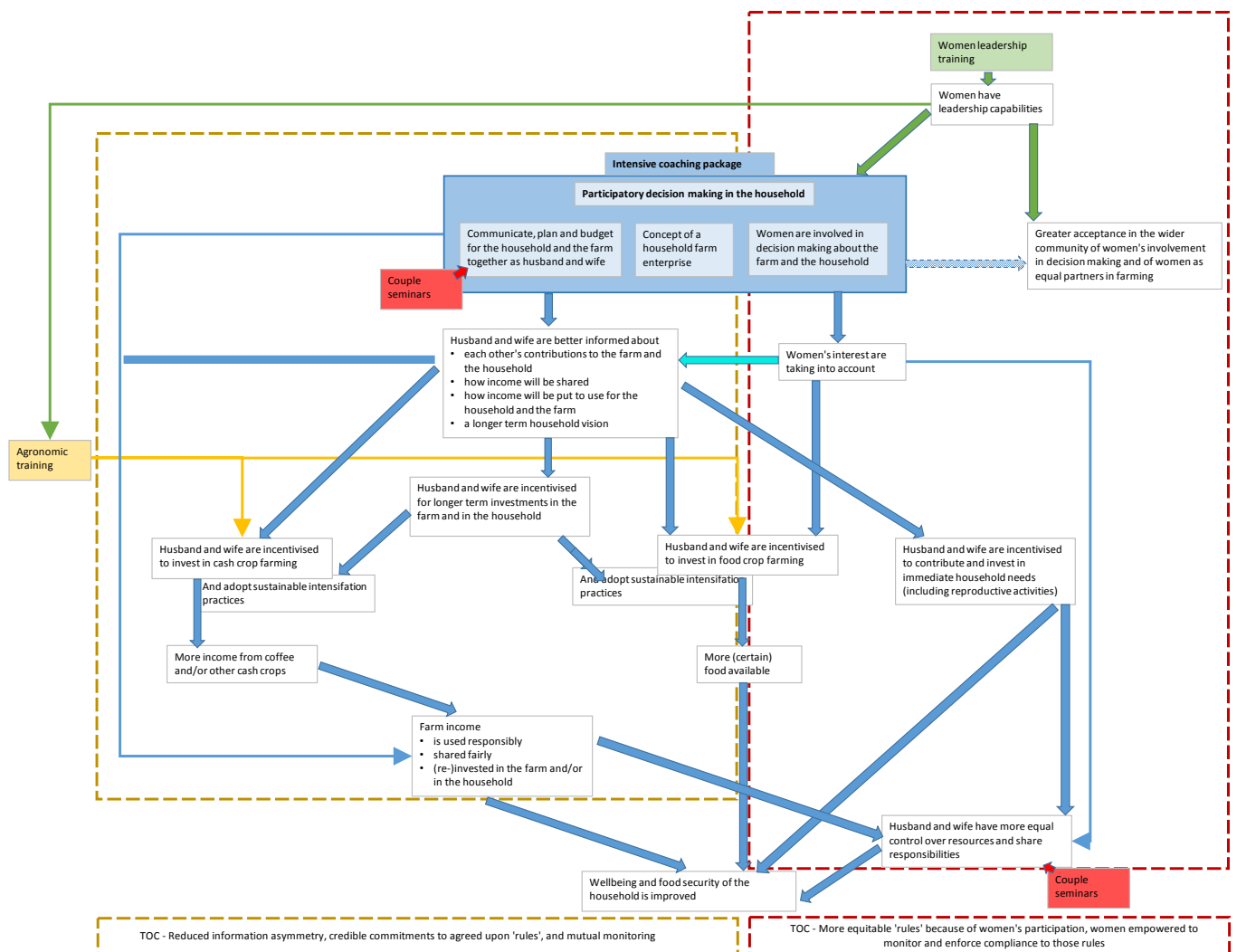
The theoretical underpinning why participatory intrahousehold decision-making is expected to promote cooperation is the following: Participation in rule- and decision-making by members of groups that collectively manage the provision and allocation of the resources in common - as agricultural households do - strengthens those members' incentives to comply with those rules (Bardhan 2000). Another important contribution of participatory intrahousehold decision-making is the reduction of information asymmetries between husband and wife. Both husband and wife can be better informed about, and can mutually monitor, how much their spouse has contributed to generating farm income and producing food and how the income and other resources generated in the household farm are used. As is the case in other groups collectively managing common resources, this is expected to decrease the likelihood of opportunistic behaviour and stimulate cooperation, which contribute to efficient and sustainable management of those common resources (Baland & Platteau 1998; Agarwal 2000). The experience of less opportunistic provision and consumption is expected to create positive feedback loops as it strengthens incentives for cooperative behaviour (Ostrom 1990; Baland & Platteau 1996; Agrawal 2003; Doss & Meinzen-Dick 2015). As such the approach of a household farming enterprise through continued efficient and sustainable use of the common household farm resources is anticipated to contribute to household welfare and economic wellbeing.

In addition, the GHA, by effectively including women in intrahousehold decision-making, implies strengthening the voice and influence of women in intrahousehold decision-making (agency), which are normally limited in these patriarchal societies. An interpretation of the GHA as exclusively empowering women is avoided as experience has shown that when women take over responsibilities and roles that are normally shared by spouses they risk to be overburdened. "When [women] take on roles couples should have shared, women become isolated and overburdened. This doesn't bring freedom, only pressure." (*F. Paska, HRNS gender coordinator, personal communication, 23 June 2017*). Besides, introducing efforts for the empowerment exclusively of women may also spark opposition by men, and the wider community, in-

cluding women, where a patriarchal family model prevails. Hence, the way in which the GHA may contribute to women's empowerment differs from interventions that focus on strengthening women's bargaining power by increasing their individual access and control over resources, for instance by the promotion of income generating activities. The promotion of participatory intrahousehold decision-making of the GHA fits into interventions that aim to change decision-making processes within the household thereby strengthening women's voice and facilitating women to build their bargaining power by increasing their share of and control over household resources.

Theory predicts a reduction of the likelihood of inequitable outcomes by promoting the participation of women in intrahousehold rule- and decision-making, on the one hand, because of women's greater ability to include their claims in the 'rules', and, on the other hand, through the increased compliance with sharing 'rules' that spouses jointly devised (Agarwal 1997; Agarwal 2001; Doss & Meinzen-Dick 2015). Her participation in intrahousehold decision-making also makes it more likely a woman's interests and priorities are taken into account. There is ample evidence that increased women's bargaining power and more intrahousehold cooperation go hand in hand with a prioritisation of the households' food needs and household public goods (Quisumbing & Maluccio 2003; Duflo & Udry 2004; Njuki, Kaaria, Chamunorwa, & Chiuri 2011). Reduced inequities in the household are also expected to be beneficial for the efficiency of household farm management because being allocated a fair share of the benefits derived from common resources is motivational for sustained cooperation (Ostrom 1990; Baland & Platteau 1998); and because reducing inequalities may alleviate constraints to choose for the most household efficient options, like for instance the investment in sustainable intensification of food production (Slootmaker 2013). The effects on household welfare and household public goods provision of the GHA that are expected to work through the strengthening women's bargaining power therefore follow from women's inclusion in intrahousehold decision-making and the household farm enterprise; not from giving the exclusive control over resources and decisions.

Figure 1 Pathways of change of the Gender Household Approach



3.2. The context and specificities of the intervention

Smallholder coffee farming households in Mubende district in central Uganda and in the area around Mbeya in southern Tanzania typically 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 smallholder coffee farming households who are member of HRNS are organized in producer organisations (POs).

The elements of the GHA that we focus on and that are part of the randomized encouragement trial are the ones targeted towards spouses in married couples, addressing mainly intrahousehold cooperation and sharing of household resources and responsibilities. Even if some proportion of couples who participated in the study are in polygamous relationships, in this study, we focus on monogamous couples for the sake of comparability across couples.

The GHA starts by introducing it to the members of the depot committees, which are overseeing a number of POs, and the leaders of the POs to sensitize them about the house-

hold farm enterprise approach and about gender inequities in coffee farming and to emphasize on the importance of including both men and women in actions and strategies to assist coffee farming households in their development.

Couple Seminars, organized at the level of the producer organisations, make up the first GHA activity with member couples (Red boxes in Figure 1). Together with the PO leaders, farmer facilitators, the HRNS gender officers invite all couples from one or two POs to the couple seminars. Member couples self-select into the couple seminars. Participation without one's spouse is not allowed.¹ During the couple seminars, couples are guided through a self-assessment of the division of roles and responsibilities and control over resources in their household. The enhanced awareness of the current gender division and imbalances is to motivate couples to introduce changes. One suggested way for change towards better cooperation as a couple and sharing costs and benefits more equally, is a more participatory way of intrahousehold decision-making, in which spouses consult each other and make decisions jointly.

The next stage of the GHA is the *Intensive Coaching Package*, a package of activities intensively coaching couples on how to implement participatory intrahousehold decision-making, for a selection of couples who participated in the couple seminars (Blue box in Figure 1). The participation in the Intensive Coaching Package was randomly encouraged among couples who participated in couple seminars. The encouragement consisted of a folder containing an invitation letter by HRNS for participating in the Intensive Coaching Package, a blank notebook, and two pens, that was handed over to the couple by the enumerator who visited them for the individual baseline interviews (conducted after the couple seminar but before the implementation of the Intensive Coaching Package). Encouraged couples received a reminder phone call for the first activity in the Intensive Coaching Package, and, if they were unable to attend on the proposed date for any of the activities in the Intensive Coaching Package, they were allowed to join in the activity on another date or in another location. Once encouraged couples showed up for the first activity, close monitoring and, if needed, additional efforts ensured they participated in all four activities in the coaching program.

The activities in the intensive coaching program include a one-day *intra-household decision-making seminar* 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 *household 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* to develop women's leadership skills and increase the participation of and representation by women in meetings, trainings and decision-making processes of farmer groups, POs and depot committees (Green box in Figure 1). The fourth activity is a *follow-up workshop* in which couples share experiences and self-evaluate the intensive 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 spillover and widen the program's reach.

All members of HRNS received the standard agronomic and marketing trainings regardless of their encouragement status (Yellow box in Figure 1).

[1] Typically one or two single women heading their households participate as well, a decision by HRNS to avoid these women feeling excluded.

4. METHOD

4.1. Data

We make use of baseline and endline data collected among individual spouses in the framework of the randomized control trial. We focus on two intervention areas, each with a different starting date but each with approximately one year between baseline and endline data collection. In the first area of Mubende district (Uganda), baseline data was collected from half November 2016 until March 2017 and endline data from half January 2018 till half March 2018. In the second area including Mbeya rural and Mbozi districts (Tanzania), baseline data was collected from January till May 2017, endline data from March till May 2018.

The *Treatment group (T)* is composed of couples who were randomly selected out of the couples who participated in couple seminars and who were encouraged to follow the intensive coaching treatment.² The *Control group (C)* is composed of a random selection of couples who participated in couple seminars and who were not encouraged to take part in the intensive coaching. We avoided the presence of couples who followed the intensive coaching program in their PO, hence, reduced the risk of spillovers, by delaying that intervention until after endline data collection in this control group.³

For this analysis, we excluded all couples in which either spouse reported that they are a polygamous household from the three sub-samples because cooperation and the empowerment of women is subject to other dynamics than in monogamous couples.⁴

Table 1 Sub-samples

	Mubende				Mbeya-Mbozi				Total			
	Original	Minus attrited	Minus polygamous	Non compliers	Original	Minus attrited	Minus polygamous	Non compliers	Original	Minus attrited	Minus polygamous	Non compliers
Treatment	186	180	180	4	191	189	147	10	377	369	327	14
Control	87	82	82		73	71	53		160	153	135	
All	273	262	262		264	260	200		537	522	462	

In the final Mubende sub-sample we are working with in this article, there are 180 monogamous couples in the Treatment group (T), of which four did not comply and 82 Control couples (Table 1). The final Mbeya-Mbozi sub-sample used here includes 147 Treatment couples, of which 10 non-compliers, and 53 Control couples.

We collected baseline and endline survey data among individual spouses of all

[2] In Mubende we each time made a selection of maximum six couples to be encouraged (Treatment) and maximum six couples to be non-encouraged (Control). In Mbeya-Mbozi, the program only allowed a selection of two and maximum three couples out of the couples who participated couple seminars to be encouraged for the intensive coaching package, a maximum we stuck to for the selection of non-encouraged couples as well. In Mubende 42 couple seminars were conducted, in Mbeya-Mbozi 110.

[3] 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 in Mubende, 17 out of 110 in Mbeya) and baseline data collection in this group to a later date (conducted from half July till half August 2017 in Mubende; and in August 2017 in Mbeya).

[4] In Mubende district, the couples to be part of the Treatment or Control group were randomly selected out of couples who participated in couple seminars and of whom we knew they are were not polygamous. Still, a few polygamous couples were selected whom have been blocked from the sample used in the analysis in this article. In Mbeya-Mbozi in Tanzania, we randomly selected couples to be part of the Treatment or Control group out of couples who participated in couple seminars regardless of whether they were monogamous or polygamous. We oversampled by 25% which was the expected proportion of couples in polygamous relations in this area. For this article, we excluded the couples in polygamous relations ex-post.

couples included in the study.⁵ Spouses were interviewed separately. Apart from individual and household socio-demographics, the survey questions relevant for the analysis in this article include questions about the main food crops and cash crops grown in the household farm, who manages these crops and the seasonal income earned. Detailed questions were asked about whom in the household receives what amount of income from coffee, which is one of the main cash crop in most of the households. Questions about different types of expenditures from the household farm income, and adoption of sustainable intensification practices for coffee production are included, as are questions about the decision-making about the expenditures and adoption. We inquired about individual and household livestock ownership and sales, and individual off-farm income.

4.2. An instrumental variable approach

Our objective is to estimate the impact of intrahousehold cooperation on household welfare and household public goods provision. To circumvent the challenge of the potential endogeneity of cooperation, we make use of the random encouragement for an intensive coaching intervention which is hypothesized to stimulate intrahousehold cooperation (cfr. Supra). We use the random encouragement as an instrument in an instrumental variable (IV) approach to estimating the causal effects of cooperation on household welfare and household public goods provision.

Our IV model is estimated using two stage least squares, which involves estimating the following two equations sequentially:

$$M_{ci} = \gamma_0 + \gamma_1 Z_i + \delta \{X_i\} + \epsilon_i \quad (1)$$

$$Y_i = \beta_0 + \beta_1 \hat{M}_{ci} + \tau \{X_i\} + u_i \quad (2)$$

In the first stage (equation 1), cooperation \hat{M}_{ci} between spouses within each household i is predicted by regressing the exogenous randomly assigned encouragement Z_i and a vector of exogenous co-variables $\{X_i\}$ on the endogenous variable M_{ci} . In the second stage (equation 2), we regress household welfare, respectively household public good provision, Y_i on the predicted values of cooperation \hat{M}_{ci} obtained from the previous regression and the vector of exogenous co-variables $\{X_i\}$. This way we are only using the exogenous part of the variation in cooperation to identify the effect of cooperation on the outcome.

4.2.1. The validity of the instrument

First, as the encouragement has been randomly assigned among couples who participated in initial couple seminars, our instrument is exogenous by design. However, the groups of non-encouraged and encouraged couples are not for a 100% statistically identical (see balance check in section 4.3.) which is why we will additionally use of propensity score matching with inverse probability of treatment weighting to do away with imbalance (this implies that, rather than including a vector of co-variables $\{X_i\}$, we control for these through matching) (cfr. Infra).⁶

The encouragement itself consisted of a folder with an invitation letter by HRNS addressed to the couple for participating in the Intensive Coaching Package, a blank notebook,

[5] Baseline interviews were conducted after the couple seminar but before implementation of the Intensive Coaching Package.

[6] There is still a chance the groups of non-encouraged and encouraged couples could differ in other unobservable or uncontrolled for observable characteristics, which, however, cannot be checked.

and two pens, which is highly unlikely to have a direct effect on household welfare or public goods provision. Rather, we expect that invitation will lead the randomly selected treatment group to attend the intensive coaching package and subsequently increase cooperation within their households, which in turn is expected to lead changes in household welfare and public goods provision. In other words, if the encouragement has an effect on household welfare of public good provision, it can only be through increasing cooperation within households that received the encouragement.

While the particular design of the study lend high credibility to the exclusion restriction⁷, the strength of our instrument may be an issue, because it depends on both compliance and effectiveness of the treatment itself in terms of stimulating cooperation within households. Inspection of the first stage suggests the instrument has reasonable explanatory power for a range of proxies for intrahousehold cooperation: in a regression of the endogenous variable on only the instrument as explanatory variable we generally find F-statistics well above the rule-of-thumb cut-off of 10 percent.

Under the above conditions, the random encouragement can be used as an instrument in an IV approach to estimating the causal effects of the potentially endogenous variable cooperation on household welfare and household public goods provision (Aronow & Carnegie 2013). The IV estimation of the impact of cooperation on household welfare and household public good provision is an estimation of a local average treatment effect (LATE), meaning it is only externally valid for couples who would increase their cooperation if an encouragement is present but would not become more cooperative in the absence of such encouragement.

4.3. Propensity score matching with inverse probability of treatment weighting

Despite the random selection of couples out of those who participated in initial couple seminars to be encouraged and non-encouraged for the intensive coaching package, the groups are imbalanced with regard to a number of characteristics measured at baseline. In particular, we find imbalance in the number of small livestock owned in the household, the likelihood of food security, of the husband owning a bicycle, and housing built with fire-baked bricks (Table 2).

As a matching procedure, we estimated the propensity score, more specifically the probability of being encouraged, on the basis of observable individual and couple characteristics measured at baseline using a probit regression, separately on the sub-sample of Mubende and sub-sample of Mbeya-Mbozi. The choice of covariates is not only informed by existing imbalances between the Treatment and the Control group but also by qualitative work conducted in Uganda and Tanzania.⁸ The included covariates therefore also serve to level possible differences in initial degrees of intrahousehold cooperation and women's empowerment.

The covariates included in the estimation of the propensity score comprise the wife's age as a proxy for the duration of marriage (*Age wife*); the age difference between husband and wife (*Age difference*); a dummy indicating the wife's highest level is secondary education or higher (*Wife sec edu*); a dummy indicating husband's highest level is secondary education

[7] The nature of the encouragement also means it is unlikely that the non-interference assumption is violated: The invitations were addressed to the randomly chosen couples and could thus not be easily passed on to the neighbours, family or friends..

[8] The qualitative analysis and choice of covariates is documented in Lecoutere and Wuyts (2017), and Lecoutere and Jassogne (2016); the qualitative work conducted in Tanzania will be documented in forthcoming publications.

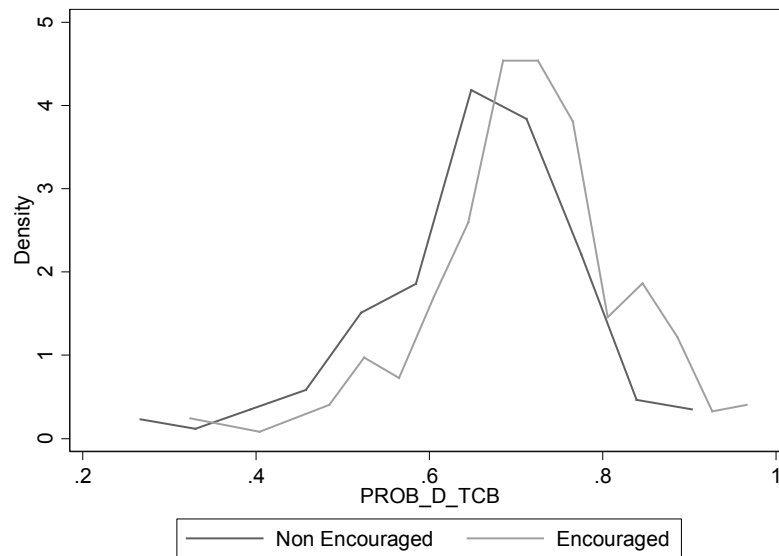
or higher (*Husband sec edu*); the likelihood of food security⁹ (*Foodsecure*); the number of cattle (cows, oxen, bulls, heifers, calves) owned in the household (reported by husband) (*# cattle*); the number of small livestock (goats, sheep, pigs) owned in the household (reported by husband) (*# small livestock*); housing built with fire-baked bricks (reported by wife) (*Fire-baked bricks*); the husband's personal ownership of a bicycle (*Bicycle*); and the acreage of land owned by the household (reported by husband) as a proxy for exogenous wealth (*Acreage*). In Table 2 we present the significance of difference between the group of encouraged and non-encouraged couples across the co-variates before matching and after matching using inverse probability of treatment weighting, which shows groups are balanced after matching. The density of the propensity scores of the encouraged and non-encouraged group of couples is visualized in Figure 2 which shows the matching procedure does not suffer from lack of common support.

Table 2 Significance of difference between the group of encouraged and non-encouraged couples before matching and after matching using inverse probability of treatment weighting

Co-variates	p-value before matching	N before	p-value after matching	N after
Age wife	0.835	462	0.806	442
Age difference	0.385	462	0.976	442
Wife sec edu	0.930	462	0.779	442
Husband sec edu	0.335	462	0.872	442
Foodsecure	0.077	462	0.667	442
# cattle	0.916	462	0.828	442
# small livestock	0.025	462	0.934	442
Bicycle	0.106	462	0.642	442
Fire-baked bricks	0.003	462	0.892	442
Acreage	0.450	462	0.372	442

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

Figure 2 Density of the propensity scores of the encouraged and non-encouraged group of couples



4.4. Indicators

4.4.1. Indicators for the outcomes of household welfare and household public good provision

As a first indicator for household welfare we use (the natural log of) total household income per capita (*Income per capita*) as in McCarthy and Kilic (2017). The total household income is calculated on the basis of the average of total income earned from the latest season’s coffee sales reported by the husband and the wife, plus the income the household earned from selling the other main cash crops (maximum two other crops included), plus the off-farm income (from salary, shop, business, fishing, and/or remittances) and income from livestock sales the husband reported to have personally earned during the three months prior to endline data collection, plus the off-farm income and income from livestock sales the wife reported to have personally earned.¹⁰ The number of household members includes husband and wife and the number of wife reported (resident) girls and boys between six and 18.¹¹ Descriptive statistics for all indicators of household welfare and household public good provision are presented in Table 3 below.

As a second (subjective) indicator for household welfare, we constructed a dummy variable taking the value one if husband and wife agree that their household is better or much better off in terms of income and consumption as compared to one year ago (*Wellbeing*).¹²

The third indicator for household welfare is a dummy variable taking the value one if the wife reported the household did not have to eat less preferred foods nor did it have to reduce the number or size of meals in the course of three months prior to endline data collection (*Endline foodsecure*).

[10] We converted Tanzanian Shilling to Ugandan Shilling (UGX) multiplying amounts by 1.6, equivalent to the average exchange rate during the period of endline data collection. (4400 UGX is equivalent to 1 Euro).

[11] Outliers of total income per capita over 300000 UGX were set as missing.

[12] Both in Mubende and Mbeya, we consistently used a locally relevant significant date or event that happened a year prior to endline data collection as a reference point.

As a first indicator of household public good provision we constructed a dummy taking the value one if husband and wife agree that, in the course of three months prior to end-line data collection, household farm income has been used for buying inputs or seeds or hiring labour for agricultural production (*Agr input*). Our second indicator of household public good provision is a dummy variable taking the value one if husband and wife agree that during the last three months household farm income has been used for school fees and expenditures for other necessities for children (*School*). We did not dispose of detailed expenditure data which prevented us from constructing indicators for expenditures on food and adult goods as in McCarthy and Kilic (2017) and Duflo and Udry (2004).

Table 3 Descriptive statistics of the different indicators for household welfare and household public goods provision

Outcome variables	Mean / Proportion	S.E.	N
Income per capita (natural log)	12.243	0.053	387
Income per capita (original)	348768	20809	387
Agr input	0.641	0.023	454
School	0.864	0.016	448
Wellbeing	0.221	0.019	457
Endline foodsecure	0.623	0.023	462

4.4.2. Indicators for intrahousehold cooperation

As a proxy for intrahousehold cooperation, we constructed a first indicator based on the income earned from coffee as all couples in the sample are smallholder coffee farming households with coffee as their most, or second most important, cash crop. We divided the average of the income that husband and wife reported to have received jointly with their spouse by selling coffee in the latest season by the average of the total income husband and wife reported to have received by selling coffee.¹³ If the share of jointly received over total household coffee income is larger than 50%, our indicator takes the value one (*Joint to total coffee income*). Descriptive statistics for all indicators of cooperation are presented in Table 4 below.

The second indicator is based on the share of jointly owned tropical livestock units in the total tropical livestock units owned by the household.¹⁴ In the individual interviews, we inquired about the total number of cattle, respectively small livestock, owned in the household from both husband and wife and go by the maximum as the indication of total number of household cattle, respectively small livestock. After inquiring about the household cattle, respectively small livestock, each spouse was asked how many cattle, respectively small livestock, out of that total household stock they personally owned.¹⁵ Jointly owned cattle, respectively small livestock, is the total number of household cattle, respectively small livestock, minus the number

[13] The total income is the sum of amount the respondent reported to have personally received, jointly receive with his/her spouse, his/her spouse personally received and any other household member received by selling the amounts of coffee specified by type of coffee (Fair Average Quality (dehusked), parchment (dried green bean), “Kiboko” (dried cherries) (in bags or kilo) or as red cherries (per bucket) in Uganda; in Tanzania parchment on season to auction (in bags or kilo), pre-sold before harvest (“Kata Kitchwa”) or as red cherries (per bucket).

Enumerators explained that selling jointly implies doing the transaction and receiving the payment together. It is not considered joint selling if spouses only agree on selling but do not make the transaction together.

[14] We did not take into account poultry.

[15] It was explained to respondents that personal ownership means the person could sell without consulting anyone else and/or s/he had acquired the livestock with her/his own money.

the husband reports he personally owns and minus the number the wife reports she personally owns. We then divided jointly owned cattle and small livestock transformed to tropical livestock units (TLU) by total household cattle and small livestock in TLU.¹⁶ The indicator takes the value one if the share of jointly owned over total household TLU is larger than 50% (*Joint to total TLU*).

We included a third pair of indicators as proxies for cooperation based on respondents' opinions about husband and wife having an equal say about the cash crops in the household farm (*Equal say cashcrop*) and about the way the household farming income will be spent (*Equal say income*).¹⁷ If husband and wife agree that having an equal say about cash crops or the use of household farming income is the case in their household, the indicator takes the value one.

A fourth pair of indicators take the value one if husband and wife agree they jointly manage (i.e. make the majority of agricultural decisions) their agreed upon most important food crop (*Jointly manage foodcrop*), respectively their agreed upon most important cash crop (*Jointly manage cashcrop*), grown in the household farm.¹⁸

A fifth pair of indicators take the value one if the proportion of decisions that have been done jointly (agreed upon by husband and wife) is higher than 50%. We look at decisions about expenditures for strategic expenditures in the three months prior to endline data collection (*Jointly decide expenditures*) and decisions about the adoption of eight possible sustainable intensification practices for coffee production (*Jointly decide adoption*).¹⁹

4-4-3. Indicators for women's exclusive control over resources and decisions

As proxies for women's bargaining power following McCarthy and Kilic (2017), we constructed indicators based on women's share in resources exclusively controlled by spouses that contrast with the proxies used for cooperation based on the share of household resources jointly controlled by spouses. First, the counterpart for the proxy indicator of cooperation based on coffee income is the share of coffee income controlled by the wife in total disjoint coffee income. We divided the average of what the husband and wife reported as the income the wife personally received by the sum of the averages of what the husband and wife report as the income the wife and the husband personally received. The indicator takes the value one if the share of the coffee income personally received by the wife in total disjoint coffee income is larger than

[16] Tropical livestock units are calculated by multiplying the number of cattle by 0.7 and the number of small livestock by 0.15 (Jahnke & Jahnke 1982).

[17] The statements on which respondents are asked for their opinion are the following: Husband and wife have an equal say about the cash crops grown in the household farm (what cash crops to grow and how to care for the crops); Husband and wife have an equal say about the way the household farming income will be spent. Respondents can answer: I would not like that in my household; I do not think that is important; I would like that in my household; that is the case my household; or they can have no opinion.

[18] We specified the most important food crop as the staple food crop that is the most important source of food for the household, makes out a dominant portion of the standard diet, is important source of energy, and is eaten routinely.

The agreed upon most important food crop is maize in all cases in Mbeya-Mbozi. In Mubende it is sweet potato in about 50% of the cases; maize 30%; matooke banana 15 %; and cassava in 5% of the cases.

We specified the most important cash crop as the crop that generates the most cash income for the household.

The agreed upon most important cash crop is coffee in 99%, maize in 1% of the cases in Mbeya-Mbozi. In Mubende it is maize in about two thirds of the cases; coffee in 30%; and beans in about 4% of the cases.

[19] Strategic household expenditures include buying inputs or hiring labour for agricultural production, school fees and expenditures for other necessities for children, major household expenditures like house repair, buying a motorcycle, bicycle, or radio, and expenditures for investing in a business.

The adoption decisions include decisions about the use of trenches or measures for moisture and soil control, intercropping of crops with complementary nutrients, mulch, manure or compost, inorganic fertilizer, pruning of coffee trees, and desuckering; or the use improved seed(ling)s for other crops.

50% (*Wife's share of disjoint income*). Descriptive statistics for all indicators of women's exclusive control over resources and decisions are presented in Table 4 below.

The counterpart for the proxy indicator of cooperation based on tropical livestock unit ownership is the share of TLU (cattle and small livestock respectively) the wife reported to personally own out of the total household TLU over total disjoint TLU (the sum of TLU the wife reported to personally own and TLU the husband reported to personally own). The indicator is equal to one if the share of wife's owned TLU over total disjoint TLU is larger than 50% (*Wife's share of disjoint TLU*).

The counterparts for the proxies based on the management of the most important food and cash crops take the value one if husband and wife agree they the wife manages the most important food crop (*Wife managed foodcrop*), respectively cash crop (*Wife managed cashcrop*) by herself.

Finally, we constructed indicators taking the value one if the proportion of strategic expenditures decisions (*Wife decided expenditures*), respectively adoption decisions (*Wife decided adoption*), that are taken by the wife alone is larger than 50%.

Table 4 Descriptive statistics of the different proxy indicators for cooperation and women's exclusive control of resources and decisions

Proxy indicators	Mean / Proportion	S.E.	N
Joint to total coffee income	0.496	0.026	385
Joint to total TLU	0.267	0.021	461
Equal say cashcrop	0.377	0.023	462
Jointly decide adoption	0.452	0.025	394
Jointly manage cashcrop	0.653	0.025	378
Jointly manage foodcrop	0.858	0.019	330
Equal say income	0.238	0.020	462
Jointly decide expenditures	0.668	0.023	404
Wife's share of disjoint income	0.066	0.013	394
Wife's share of disjoint TLU	0.230	0.020	460
Wife managed cashcrop	0.003	0.003	378
Wife managed foodcrop	0.036	0.010	330
Wife decided adoption	0.008	0.004	394
Wife decided expenditures	0.002	0.002	404

5. RESULTS

We will first present first stage regressions where cooperation, respectively exclusive women's control over resources and decisions is predicted on the basis of the randomized encouragement; after which we will discuss the instrumental variable estimations of the impact of cooperation on different measures of household welfare and household public goods provision. We also check for potential effects of exclusive women's control over resources and decisions.

5.1. The relation between the randomized encouragement, cooperation and women's exclusive control of resources

The first stage regressions presented in Table 5 shows that the randomized encouragement predicts cooperation well, whether it is proxied by the indicators of joint over

total coffee income (*Joint to total coffee income*), joint over total TLU (*Joint to total TLU*), equal decision-making power over cash crops (*Equal say cashcrop*), joint decision-making on adoption (*Jointly decide adoption*), joint management of the main food crop (*Jointly manage foodcrop*) and cash crop (*Jointly manage cashcrop*). The F-statistic shows we can confidently reject the null hypothesis that all of the coefficients on the independent variables are equal to zero, and the randomized encouragement significantly increases the likelihood of cooperation measured by the different (dummy) indicators by 16 up to 27 percentage points. The randomized encouragement is not a good predictor for cooperation as measured by the indicators of equal decision-making power over spending income (*Equal say income*) and joint decision-making on strategic household expenditures (*Jointly decide expenditures*). Hence, we will not discuss the IV estimates of the impact of cooperation on household welfare based on the two latter proxies.

In support of the exclusion restriction, the randomized encouragement does not predict women's exclusive control of resources and decisions well. As evident from the first stage regressions presented in Table 6, neither of the measures (*Wife's share of disjoint income*, *Wife's share of disjoint TLU*, *Wife managed cashcrop*, *Wife managed foodcrop*) has a sufficiently high F-statistic; and only in one case the coefficient of the randomized encouragement is significant. As it is highly unlikely that women decide on adoption (*Wife decided adoption*) or strategic household expenditures (*Wife decided expenditures*) by themselves makes it impossible to estimate the likelihood with the randomized encouragement as a predictor.

Table 5 First stage regression: The relation between the randomized encouragement and indicators for cooperation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Proxies for cooperation	Joint to total coffee income	Joint to total TLU	Equal say cash-crop	Jointly decide adoption	Jointly manage cashcrop	Jointly manage foodcrop	Equal say income	Jointly decide expenditures
Encouraged	0.184*** (0.064)	0.162*** (0.044)	0.198*** (0.048)	0.274*** (0.054)	0.190*** (0.062)	0.159*** (0.051)	0.049 (0.046)	0.148** (0.058)
	0.004	0.000	0.000	0.000	0.002	0.002	0.289	0.011
Constant	0.392*** (0.056)	0.155*** (0.035)	0.238*** (0.038)	0.239*** (0.044)	0.517*** (0.054)	0.752*** (0.047)	0.213*** (0.038)	0.573*** (0.051)
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
N	370	441	442	380	363	319	442	385
R²	0.034	0.036	0.044	0.079	0.038	0.045	0.003	0.024
F	8.36	13.61	17.19	26.28	9.39	9.61	1.13	6.54
Adjusted R²	0.03	0.03	0.04	0.08	0.04	0.04	0.00	0.02

First stage regressions with IPTW; Instrument=Encouraged; Significance ***99%, **95%, *90%. Coefficient in 1st, robust S.E. in 2nd, p-value in 3rd row. F=F-statistic

Table 6 First stage regression: The relation between the randomized encouragement and indicators for women's exclusive control of resources and decisions

	(1)	(2)	(4)	(5)	(6)	(8)
Proxies for women's exclusive control of resources and decisions	Wife's share of disjoint income	Wife's share of disjoint TLU	Wife decided adoption	Wife managed cashcrop	Wife managed foodcrop	Wife decided expenditures
Encouraged	0.002 (0.027)	-0.068 (0.047)	-0.023* (0.013)	0.004 (0.004)	-0.049** (0.024)	-0.007 (0.007)
	0.928	0.143	0.086	0.318	0.046	0.318
Constant	0.061*** (0.022)	0.269*** (0.040)	0.023* (0.013)	0.000 (0.000)	0.063*** (0.023)	0.007 (0.007)
	0.006	0.000	0.086	0.480	0.007	0.318
N	379	440	380	363	319	385
R_z	0.000	0.007	0.012	0.002	0.016	0.004
F	0.01	2.15	/	1.00	4.03	/
Adjusted R_z	-0.00	0.00	0.01	-0.00	0.01	0.00

First stage regressions with IPTW; Instrument=Encouraged; Significance ***99%, **95%, *90%. Coefficient in 1st, robust S.E. in 2nd, p-value in 3rd row. F=F-statistic

5.2. The impact of intrahousehold cooperation on household welfare and household public goods provision

5.2.1. The impact on total household income per capita as an indicator of household welfare

The results of the IV regressions presented in Table 7 show that household welfare, as measured by the log of total household income per capita, is positively impacted by intrahousehold cooperation. Note that the estimated coefficients in these second stage regressions are inflated by the fact that not every couple who was encouraged to participate in the intervention that promotes cooperation actually improved intrahousehold cooperation. But if all couples would cooperate as the ones who cooperate as a result of the encouragement, the impact on the measures for household welfare are substantial. The estimated coefficients vary depending on which proxy for cooperation is taken.

In case of the most conservative estimated coefficient (when cooperation is approximated by the spousal agreement on equal decision-making power over cash crops in their household (*Equal say cashcrop*)), cooperation is estimated to cause total household income per capita to increase by more than four times the income per capita in the absence of cooperation. In case of the largest estimated coefficient (when cooperation is proxied by the joint management of the most important food crop (*Jointly manage foodcrop*)), cooperation is estimated to cause an increase in income per capita of more than 30 times the income per capita in the absence of cooperation.

5.2.2. The impact on household food security and subjective household wellbeing as indicators of household welfare

The estimated effects of intrahousehold cooperation on household welfare as measured by the likelihood of household food security (*Endline foodsecure*) using IV regression are presented in Table 8. As above, inflation of the magnitude of the effects needs to be considered. At the lower end, the likelihood of household food security is estimated to increase with 52.1 percentage points (pp) in case when cooperation is proxied the joint decision-making about adoption of more than half of the sustainable practices for coffee (*Jointly decide adoption*) and when every couple would cooperate in that way as those who do so because of the encouragement. At the higher end, cooperation increases the likelihood of food security by 134.6 pp if cooperation is taken to mean that the main food crop is being jointly managed (*Jointly manage foodcrop*).

When cooperation is proxied by the joint control of most of the total household coffee income (*Joint to total coffee income*), the likelihood of household food security increases with 86.9 pp; with 95.9 pp if cooperation is assessed by the spousal agreement that there is equal decision-making power over cash crops in their household (*Equal say cashcrop*); with 118.2 pp if cooperation is determined by jointly owning more than half of the total household TLU (*Joint to total TLU*); and with 112.8 pp if cooperation means the main cash crop is jointly managed crop (*Jointly manage cashcrop*).

Table 9 presents IV estimations of the impact of intrahousehold cooperation on agreed upon improved subjective household wellbeing (*Wellbeing*) as a measure of household welfare. Only if cooperation is meant to be that spouses agree that they have equal decision-making power over cash crops in their household (*Equal say cashcrop*), there is a significant impact on improved subjective household wellbeing of 38.8 pp. The coefficients for the effects of jointly managing the main cash crop (*Jointly manage cashcrop*), of controlling more than half

of the total coffee income jointly (*Joint to total coffee income*), and more than half of the total household TLU jointly (*Joint to total TLU*) are close to a significance level of 10% and point to effects of cooperation of about 50.0 pp increases in the likelihood improved subjective household wellbeing.

5.2.3. The impact on investments in agricultural inputs and children as indicators for household public good provision

The impact of intrahousehold cooperation on household public good provision, measured by the likelihood of having made expenditures on agricultural inputs or labour (*Agr input*) is presented in Table 10. In case every couple would cooperate as those who do so in response of the encouragement, cooperation, as measured by a share of jointly controlled TLU larger than 50% (*Joint to total TLU*), increases the likelihood of spending household income on agricultural inputs or labour with 59.1 pp. If cooperation is proxied by the fact that spouses agree that they have equal decision-making power over cash crops (*Equal say cashcrop*), that likelihood increases with 46.5 pp; with 68.5 pp if cooperation is taken the mean that they also agree that they jointly manage their main household cash crop (*Jointly manage cashcrop*)

The results in Table 11 show that none of the indicators of cooperation have a significant impact on the likelihood of having made expenditures on school fees and other children's necessities in the last three months (*School*). This is probably due to the fact that school fees are universally due and paying the fees is commonly a decision jointly made by spouses in these communities.

5.3. The effect of women's exclusive control of resources and decisions on household welfare and household public goods provision

It was shown in section 5.1. that women's bargaining power as measured by exclusively women controlled resources and decisions cannot be instrumented by the randomized encouragement. Still, we included the measures of exclusively women controlled coffee income (*Wife's share of disjoint income*) and TLU (*Wife's share of disjoint TLU*), and exclusive women's management of the main cash crop (*Wife managed cashcrop*) and main food crop (*Wife managed foodcrop*) as proxies for women's bargaining power based on their exclusive control of resources and decisions in an IV estimation of their effect on household welfare, measured by total household income per capita, household food security and subjective household wellbeing, and household public good provision, measured by investments in agricultural inputs and children. The results presented in Table 7, Table 8, Table 9, Table 10, and Table 11 and confirm weak identification and/or the absence of significant impact of exclusively women controlled resources or decisions on household welfare and household public goods provision.

Table 7 The effect of cooperation and women's exclusive control of resources on (log) total household income per capita as a measure for household welfare

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Household welfare	Income per capita	Income per capita	Income per capita	Income per capita	Income per capita	Income per capita	Income per capita	Income per capita	Income per capita	Income per capita	Income per capita	Income per capita
Joint to total coffee income	1.875** (0.872) 0.032											
Joint to total TLU		3.032** (1.514) 0.045										
Equal say cashcrop			1.690** (0.747) 0.024									
Jointly decide adoption				1.767** (0.863) 0.040								
Jointly manage cashcrop					2.399* (1.392) 0.085							
Jointly manage foodcrop						3.492* (1.923) 0.069						
Equal say income							8.947 (11.205) 0.425					
Jointly decide expenditures								2.558* (1.541) 0.097				
Wife's share of disjoint income									-88.555 (556.851) 0.874			
Wife's share of disjoint TLU										-5.454 (4.392) 0.214		
Wife managed cashcrop											77.456 (83.784) 0.355	
Wife managed foodcrop												-7.992* (4.783) 0.095
Constant	11.311*** (0.471) 0.000	11.483*** (0.409) 0.000	11.604*** (0.314) 0.000	11.635*** (0.382) 0.000	10.721*** (0.903) 0.000	9.321*** (1.709) 0.000	9.908*** (2.968) 0.001	10.548*** (1.057) 0.000	17.738 (34.340) 0.605	13.493*** (0.969) 0.000	11.958*** (0.140) 0.000	12.629*** (0.152) 0.000
N	367	371	372	335	306	267	372	337	369	371	306	267
R ²	-0.386	-1.099	-0.489	-0.738	-1.149	-1.012	-12.340	-1.280	-401.856	-4.670	-13.152	-1.911
Fdf ₂	365.00	369.00	370.00	333.00	304.00	265.00	370.00	335.00	367.00	369.00	304.00	265.00
F	4.60	3.99	5.09	4.17	2.95	3.27	0.63	2.74	0.03	1.53	0.85	2.77
Adjusted R ²	-0.39	-1.10	-0.49	-0.74	-1.16	-1.02	-12.38	-1.29	-402.95	-4.69	-13.20	-1.92
KPrk-LM	8.30	6.09	15.79	13.75	5.49	5.73	0.63	4.80	0.03	1.85	1.00	4.02
KPrk-WF	8.05	6.21	17.82	15.54	5.46	5.71	0.64	4.75	0.02	1.81	1.00	3.95
Hansen J	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

IV regressions with IPTW; Instrument=Encouraged; Significance ***99%, **95%, *90%. Coefficient in 1st, robust S.E. in 2nd, p-value in 3rd row. Estimates in grey text suffer from weak instruments. Fdf₂=Degrees of freedom; F=F-statistic; KPrk-LM=Kleibergen-Paap rk LM statistic (under-identification test); KPrk-WF=Kleibergen-Paap rk Wald F statistic (weak identification test); Hansen J=Hansen J statistic (overidentifying restrictions test).

Table 8 The effect of cooperation and women's exclusive control of resources on household food security as a measure for household welfare

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Household welfare	Endline food-secure	Endline food-secure	Endline food-secure	Endline food-secure	Endline food-secure	Endline food-secure	Endline food-secure	Endline food-secure	Endline food-secure	Endline food-secure	Endline food-secure	Endline food-secure
Joint to total coffee income	0.869** (0.360) 0.016											
Joint to total TLU		1.182*** (0.422) 0.005										
Equal say cashcrop			0.959** (0.383) 0.012									
Jointly decide adoption				0.521** (0.227) 0.022								
Jointly manage cashcrop					1.128*** (0.398) 0.005							
Jointly manage foodcrop						1.346** (0.558) 0.016						
Equal say income							3.857 (3.808) 0.311					
Jointly decide expenditures								1.159** (0.522) 0.026				
Wife's share of disjoint income									80.358 (882.714) 0.927			
Wife's share of disjoint TLU										-2.859 (1.951) 0.143		
Wife managed cashcrop											49.890 (51.527) 0.333	
Wife managed foodcrop												-4.368* (2.274) 0.055
Constant	0.186 (0.195) 0.342	0.325*** (0.118) 0.006	0.279* (0.149) 0.062	0.476*** (0.109) 0.000	-0.092 (0.266) 0.729	-0.476 (0.494) 0.335	-0.313 (0.938) 0.739	-0.147 (0.362) 0.685	-4.447 (55.657) 0.936	1.272*** (0.429) 0.003	0.490*** (0.054) 0.000	0.811*** (0.063) 0.000
N	370	441	442	380	363	319	442	385	379	440	363	319
R2	-0.026	-0.595	-0.957	0.079	-0.469	-0.638	-11.621	-0.624	-1,563.484	-5.136	-22.026	-2.235
Fdf2	368.00	439.00	440.00	378.00	361.00	317.00	440.00	383.00	377.00	438.00	361.00	317.00
F	5.81	7.80	6.25	5.26	7.97	5.79	1.02	4.92	0.01	2.14	0.93	3.67
Adjusted R2	-0.03	-0.60	-0.96	0.08	-0.47	-0.64	-11.65	-0.63	-1	-5.15	-22.09	-2.25
KPrk-LM	8.62	13.12	15.66	22.30	9.36	9.57	1.12	6.56	567.63	2.18	1.00	4.08
KPrk-WF	8.36	13.61	17.19	26.28	9.39	9.61	1.13	6.54	0.01	2.15	1.00	4.03
Hansen J	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00

IV regressions (GMM) with IPTW; Instrument=Encouraged; Significance ***99%, **95%, *90%. Coefficient in 1st, robust S.E. in 2nd, p-value in 3rd row. Estimates in grey text suffer from weak instruments. Fdf2=Degrees of freedom; F=F-statistic; KPrk-LM= Kleibergen-Paap rk LM statistic (under-identification test); KPrk-WF=Kleibergen-Paap rk Wald F statistic (weak identification test); Hansen J=Hansen J statistic (overidentifying restrictions test).

Table 9 The effect of cooperation and women's exclusive control of resources on subjective positive evaluation in wellbeing as a measure for household welfare

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Wellbeing	Wellbeing	Wellbeing	Wellbeing	Wellbeing	Wellbeing	Wellbeing	Wellbeing	Wellbeing	Wellbeing	Wellbeing	Wellbeing
Household welfare												
Joint to total coffee income	0.496 (0.316) 0.116											
Joint to total TLU		0.476 (0.292) 0.103										
Equal say cashcrop			0.388* (0.220) 0.078									
Jointly decide adoption				0.188 (0.181) 0.297								
Jointly manage cashcrop					0.431 (0.275) 0.117							
Jointly manage foodcrop						0.214 (0.345) 0.535						
Equal say income							1.619 (1.700) 0.341					
Jointly decide expenditures								0.415 (0.353) 0.240				
Wife's share of disjoint income									54.097 (956.817) 0.955			
Wife's share of disjoint TLU										-1.048 (0.947) 0.269		
Wife managed cashcrop											19.088 (22.034) 0.386	
Wife managed foodcrop												-0.663 (1.078) 0.539
Constant	-0.024 (0.167) 0.887	0.093 (0.078) 0.237	0.074 (0.083) 0.375	0.144* (0.081) 0.077	-0.068 (0.177) 0.700	0.044 (0.299) 0.884	-0.183 (0.425) 0.667	-0.041 (0.240) 0.864	-3.193 (60.610) 0.958	0.456** (0.212) 0.031	0.155*** (0.037) 0.000	0.248*** (0.040) 0.000
N	368	436	437	379	361	317	437	385	377	435	361	317
R2	-0.369	-0.242	-0.101	-0.063	-0.230	-0.022	-2.376	-0.128	-1,015.845	-1.246	-5.135	-0.051
Fdf2	366.00	434.00	435.00	377.00	359.00	315.00	435.00	383.00	375.00	433.00	359.00	315.00
F	2.45	2.64	3.09	1.08	2.45	0.38	0.90	1.38	0.00	1.22	0.75	0.38
Adjusted R2	-0.37	-0.24	-0.10	-0.07	-0.23	-0.03	-2.38	-0.13	-1	-1.25	-5.15	-0.05
KPrk-LM	8.68	12.67	15.04	21.72	9.22	8.99	1.00	6.56	018.56	2.35	1.00	4.13
KPrk-WF	8.41	13.15	16.51	25.59	9.25	9.03	1.00	6.54	0.00	2.32	1.00	4.08
Hansen J	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

IV regressions (GMM) with IPTW; Instrument=Encouraged; Significance ***99%, **95%, *90%. Coefficient in 1st, robust S.E. in 2nd, p-value in 3rd row. Estimates in grey text suffer from weak instruments. Fdf2=Degrees of freedom; F=F-statistic; KPrk-LM= Kleibergen-Paap rk LM statistic (under-identification test); KPrk-WF=Kleibergen-Paap rk Wald F statistic (weak identification test); Hansen J=Hansen J statistic (overidentifying restrictions test).

Table 10 The effect of cooperation and women's exclusive control of resources on the incidence of expenditures on agricultural inputs as a measure for investments in household public goods

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Household public goods	Agr input	Agr input	Agr input	Agr input	Agr input	Agr input	Agr input	Agr input	Agr input	Agr input	Agr input	Agr input
Joint to total coffee income	0.415 (0.316) 0.190											
Joint to total TLU		0.591* (0.338) 0.080										
Equal say cashcrop			0.465* (0.277) 0.093									
Jointly decide adoption				0.181 (0.216) 0.402								
Jointly manage cashcrop					0.685* (0.354) 0.053							
Jointly manage foodcrop						0.761 (0.465) 0.102						
Equal say income							1.779 (1.684) 0.291					
Jointly decide expenditures								0.098 (0.355) 0.784				
Wife's share of disjoint income									-81.534 (2,022.862) 0.968			
Wife's share of disjoint TLU										-1.390 (1.246) 0.265		
Wife managed cashcrop											28.850 (32.535) 0.375	
Wife managed foodcrop												-2.455 (1.758) 0.162
Constant	0.466*** (0.168) 0.006	0.503*** (0.096) 0.000	0.484*** (0.110) 0.000	0.644*** (0.100) 0.000	0.235 (0.233) 0.313	0.057 (0.411) 0.890	0.215 (0.418) 0.607	0.651*** (0.242) 0.007	5.616 (122.643) 0.963	0.975*** (0.278) 0.000	0.589*** (0.053) 0.000	0.784*** (0.051) 0.000
N	366	433	434	376	358	314	434	385	375	432	358	314
R2	0.073	-0.027	-0.131	0.046	-0.255	-0.220	-2.130	-0.013	-1,682.703	-1.345	-8.373	-0.953
Fdf2	364.00	431.00	432.00	374.00	356.00	312.00	432.00	383.00	373.00	430.00	356.00	312.00
F	1.71	3.05	2.81	0.70	3.72	2.66	1.11	0.08	0.00	1.24	0.78	1.94
Adjusted R2	0.07	-0.03	-0.13	0.04	-0.26	-0.22	-2.14	-0.02	-1	-1.35	-8.40	-0.96
KPrk-LM	8.43	12.85	16.69	21.30	8.76	9.27	1.33	6.56	687.22	1.95	1.00	4.00
KPrk-WF	8.18	13.32	18.42	24.92	8.78	9.31	1.33	6.54	0.00	1.92	1.00	3.95
Hansen J	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

IV regressions (GMM) with IPTW; Instrument=Encouraged; Significance ***99%, **95%, *90%. Coefficient in 1st, robust S.E. in 2nd, p-value in 3rd row. Estimates in grey text suffer from weak instruments. Fdf2=Degrees of freedom; F=F-statistic; KPrk-LM= Kleibergen-Paap rk LM statistic (under-identification test); KPrk-WF=Kleibergen-Paap rk Wald F statistic (weak identification test); Hansen J=Hansen J statistic (overidentifying restrictions test).

Table 11 The effect of cooperation and women's exclusive control of resources on the incidence of expenditures on children's school fees and other necessities as a measure for investments in household public goods

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Household public goods	School	School	School	School	School	School	School	School	School	School	School	School
Joint to total coffee income	0.529 (0.343) 0.123											
Joint to total TLU		0.410 (0.317) 0.197										
Equal say cashcrop			0.320 (0.220) 0.146									
Jointly decide adoption				0.206 (0.200) 0.301								
Jointly manage cashcrop					0.324 (0.272) 0.233							
Jointly manage foodcrop						0.543 (0.415) 0.190						
Equal say income							1.179 (1.286) 0.359					
Jointly decide expenditures								-0.088 (0.226) 0.699				
Wife's share of disjoint income									-38.426 (441.802) 0.931			
Wife's share of disjoint TLU										-0.952 (1.132) 0.400		
Wife managed cashcrop											13.924 (18.077) 0.441	
Wife managed foodcrop												-1.697 (1.533) 0.268
Constant	0.606*** (0.188) 0.001	0.752*** (0.091) 0.000	0.736*** (0.093) 0.000	0.770*** (0.095) 0.000	0.639*** (0.182) 0.000	0.354 (0.368) 0.337	0.565* (0.327) 0.084	0.990*** (0.157) 0.000	3.231 (27.043) 0.905	1.077*** (0.248) 0.000	0.806*** (0.047) 0.000	0.874*** (0.042) 0.000
N	362	427	428	371	353	310	428	385	371	426	353	310
R2	-0.613	-0.266	-0.017	-0.110	-0.188	-0.325	-1.785	-0.027	-716.392	-1.584	-3.071	-0.875
Fdf2	360.00	425.00	426.00	369.00	351.00	308.00	426.00	383.00	369.00	424.00	351.00	308.00
F	2.37	1.66	2.10	1.06	1.41	1.70	0.84	0.15	0.01	0.70	0.59	1.22
Adjusted R2	-0.62	-0.27	-0.02	-0.11	-0.19	-0.33	-1.79	-0.03	-718.34	-1.59	-3.08	-0.88
KPrk-LM	7.98	12.55	16.04	20.64	9.18	9.08	1.40	6.56	0.01	1.72	1.00	4.04
KPrk-WF	7.73	13.01	17.71	24.18	9.20	9.11	1.40	6.54	0.01	1.70	1.00	3.99
Hansen J	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

IV regressions (GMM) with IPTW; Instrument=Encouraged; Significance ***99%, **95%, *90%. Coefficient in 1st, robust S.E. in 2nd, p-value in 3rd row. Estimates in grey text suffer from weak instruments. Fdf2=Degrees of freedom; F=F-statistic; KPrk-LM=Kleibergen-Paap rk LM statistic (under-identification test); KPrk-WF=Kleibergen-Paap rk Wald F statistic (weak identification test); Hansen J=Hansen J statistic (overidentifying restrictions test).

6. DISCUSSION AND CONCLUSION

A lack of cooperation within agricultural households in developing contexts is assumed to reduce efficiency of smallholder household farming and households' wellbeing. This article contributes to a debate about the virtues of intrahousehold cooperation versus equal bargaining power between the main decision-makers in households for household welfare and the provision of household public goods. The specific contribution of this article is the estimation of the causal impact of intrahousehold cooperation on household welfare and household public goods provision in agricultural households in East Africa, smallholder coffee farming households in rural central Uganda and southern Tanzania more in particular. The use of the random encouragement for an intervention intended to stimulate intrahousehold cooperation as an instrument for cooperation permitted to estimate the effect of the exogenous part of the variation in cooperation on household welfare and public goods provision; thereby circumventing the empirical challenge of cooperation and welfare being endogenous (Doss 2013).

As intended, the randomized encouragement for the intervention promoting participatory decision-making and farming as a household enterprise has inspired couples to cooperate. The instrumental variable estimates of the impact of improved cooperation, as proxied by measures such as jointly controlled income and livestock, joint decision-making over cash crops, adoption of sustainable intensification practices for coffee, and the joint management of the main household food and cash crop, demonstrate that the gains in household income per capita and the likelihood of household food security are substantial. The likelihood of investing in agricultural production, an important public good in these households, is greatly increased by improved cooperation as well. The first stage regressions, however, show it has not been easy to improve upon cooperation within agricultural households even with an intensive coaching package guiding the couples through a process stimulating a more participatory way of intrahousehold decision-making and the sharing of household income and resources (we measured 15 to 27 percentage points increases in likelihood of cooperation). In sum, the good news for policy and programs aiming to stimulate efficiency, welfare and the provision of household public goods in agricultural households is that improving on intrahousehold cooperation seems to be a promising path. The challenge, however, is finding effective ways to bring spouses to cooperate. This is an area for further research.

The randomized encouragement for the intervention has not lead to women increasing their personally controlled share of income or assets relative to the disjoint income or assets; nor has it stimulated women taking strategic household decisions by themselves. This was also never promoted by the intervention (cfr. Supra in section 3.1).

Equating women's bargaining power with women's exclusive control over income and assets can be debated. What empowers a woman is sometimes difficult to judge by outsiders (Kabeer 1999; O'Hara & Clement 2018), whether individual or joint ownership is better for women is an ongoing discussion (Agarwal 2003; Jackson 2003: in Doss, Kieran, & Kilic 2017), it is possible that women may actually prefer to invest their increased agency in strengthening the household unit rather than gaining more independence (Kabeer 1999; Molyneux & Thomson 2011), and, besides, access to resources only determines the potential for agency but does not guarantee it (Kabeer 1999; Cornwall 2016). In studies in rural development contexts, women's empowerment is often understood as the *involvement* of women in decision-making and the *involvement* of women income or asset control, either jointly with their spouse or alone (Doss, Kieran, & Kilic 2017; Malapit, Sproule, Kovarik, Meinzen-Dick, Quisumbing, Ramzan, Hogue,

& Alkire 2014; Hanmer & Klugman 2016; Malhotra, Schuler, & Boender 2005); rarely women empowerment is defined in terms of exclusively women controlled resources and decisions. Exclusive control over resources and decisions by women, in many cases, is neither possible, acceptable, nor desirable. Rather than opposing cooperation to women's bargaining power conceptualized as exclusive control over resources and decisions in an evaluation of their effect on household welfare, the reality may well be that women find empowerment in cooperation.

In fact, women have been shown to derive empowerment from *involvement* in decision-making and asset control as an effect of the Gender Household Approach intervention (Lecoutere & Wuyts 2017). Qualitative work conducted in central Uganda and the area around Mbeya in Tanzania in the framework of the field experiment studied here, revealed that women see their involvement in receiving and controlling the household income as empowering (Lecoutere & Wuyts 2017 for Uganda; Forthcoming for Tanzania). They emphasized that they can only contribute to the development of their household, which is their greatest priority when it comes to empowerment, if they are informed, can control and make decisions about the household income which mainly comes from coffee sales in this context. In Lecoutere and Wuyts (2017), three pathways of empowerment are distinguished, one where there is scope for cooperation with the husband, one where the husband is not ready for that, and one where -de facto- women are managing the household alone. In case of a cooperatively minded husband, women strive for personal income and personal asset ownership mainly to 'earn' a voice in strategic household enterprises by contributing with personal resources, for instance, to the investment in coffee production by buying inputs. When cooperation with their husband is impossible, women seek to acquire personal income and assets as a back-up and insurance to be able to continue sustaining food and other needs of their household. In none of the pathways, personal income and assets is women's goal in terms of their empowerment; their wish is cooperation and involvement in decision-making and control over resources.

Moreover, the opportunities for acquiring personal income remain limited in this context. Both in Uganda and Tanzania, there are strong and persistent gender roles with regard to coffee production and sales, and other cash crops (Lecoutere & Wuyts 2017). The marketing and payment system in the coffee value chain consolidates traditional gender roles with the registration of the husband as the representative for the household in the coffee collection centres, which makes that husband gets the receipt at delivery of the coffee and receives the cash after sales or auctioning. Other obstacles to women personally receiving and controlling income include, in Uganda for instance, gender norms preventing women from riding bicycles which limits a woman's capacity to transport coffee to the collection centres; hence, her capability to be sell coffee. Women have somewhat more scope to expand their personal livestock ownership, but personal capital acquisition may be seen as confrontational by their husbands, and the wider community. Moreover, personal ownership of assets by a woman is still problematic in this context – in Tanzania even for personally owned livestock women need to seek consent from their husband to sell – and difficult to enforce, especially in informal law, which prevails.

Furthermore, there is increasing evidence that exclusively empowering women may bring about adverse effects including jealousy and distrust in the household, in some cases leading to domestic violence, husbands withdrawing from providing for the household as they feel less responsible, or even reduced women's decision-making power in particular domains (Mayoux, 2001; Molyneux & Thomson 2011; De Brauw, Gilligan, Hoddinott, & Roy 2014). Molyneux (2007) and Cornwall (2016) point out that women who are targeted by empowerment programs do not live in a vacuum but are embedded in social relations with other members of

their household, community, country that entail power structures and institutionalized ‘modes of operation’ backed up by norms, informal and formal rules and customs. The evidence seems to suggest that exclusively empowering the woman in the household without considering the way in which spouses relate and cooperate in some cases has adverse outcomes.

While we agree with McCarthy and Kilic (2017) that using exclusive women controlled resources, more particularly the share of income controlled by the wife in total disjoint income, as a proxy for the wife’s bargaining power allows a cleaner distinction from jointly controlled income in total income as a proxy for cooperation, we should recognize that women can be empowered not only by their exclusive but also by their shared control over resources. Furthermore, a focus on women’s control over resources risks to move ever further away from the essence of empowerment which revolves around balancing power relations and which relies on shifts in consciousness and changes in structural constraints to gender equity (Cornwall 2016). Presenting the challenge of improving efficiency and household welfare of agricultural households as a strict choice between stimulating cooperation or women’s empowerment may be too restrictive.

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