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The Unintended Side-Effects of a Major Development Strategy: Commercialization of Smallholder Production and Women Empowerment in Uganda

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ABSTRACT *As many African countries promote commercial agricultural production, it is important to understand how this strategy influences the intra-household balance of power. Commercial crops are traditionally considered the domain of men, and women empowerment may suffer. We use a quasi-experimental design to address the relation between commercial production and women's voice within the household in rural Uganda. We compare empowerment in households in an area targeted by a large program stimulating rice as a non-traditional cash crop with similar households elsewhere using double robust regression methods. We conclude that the commercialisation program had a significant negative effect on women empowerment in production and women's control over income, while men's empowerment in those domains increased. We find only weak effects for social empowerment. Based on these results, we recommend that policies and programs to stimulate commercial agricultural production among smallholder include a strong gender component.*

KEYWORDS: Commercialization; smallholders; intra-household bargaining; women empowerment

1. Introduction

Increasingly, African countries stimulate commercial agriculture to simultaneously decrease poverty and food-insecurity. The underlying argument is that food insecurity is primarily a problem of low incomes and poverty, which can be solved by increasing the returns to farmers' resources, both on farm and off-farm (Gladwin, Thomson, Peterson, & Anderson, 2001). Uganda is no exception. Agriculture is the backbone of Uganda's economy, and the government aims at increasing commercialisation: between 2014/15 and 2019/20 the value of agricultural exports was targeted to triple and the labour force in subsistence agriculture to halve (The Republic of Uganda, 2015). Despite the governments' efforts, these targets were not reached: between 2012/2013 and 2017/2018, the total export value of the three key crops coffee, tea and

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maize increased by only 28 per cent, and 69 per cent of household was still employed in subsistence agriculture in 2018.

Commercialisation of agricultural production involves a significant reallocation of household resources and may result in a shift in control between household members. Traditionally, in Africa cash crops and income from production are predominantly controlled by men (Jaleta, Gebremedhin, & Hoekstra, 2009) while household crops are typically considered female crops (Peterman, Quisumbing, Behrman, & Nkonya, 2011). Hence, while an increased commercial orientation generally has a positive effect on household income, it may decrease women's control over resources and income and thus lower their intra-household bargaining power. This would counteract the many efforts to increase women's empowerment in Africa and would likely lead to a decrease in the share of income utilized for expenditures on health, food and schooling.

The literature provides evidence of a shift in control over crops from women to men in response to commercialisation for different countries in Africa. Crops formerly known as women's crops have been claimed by men after they were commercialized – for instance cassava in Benin (Coquery-Vidrovitch, 1994, according to Gray & Kevane, 1999), banana in Kenya (Fischer & Qaim, 2012) and rice in Gambia (Von Braun & Webb, 1989). In Malawi and Uganda commodities that generate lower revenues are likely to be controlled by women, while those that generate high revenues are more likely to be controlled by men (Njuki, Kaaria, Chamunorwa, & Chiuri, 2011). In addition, research in Malawi has shown that when the profitability of male-dominated cash crops increases, these crops are increasingly grown at the cost of women-dominated food crops (Due & Gladwin, 1991).

Yet the gender implications of commercialisation may be more subtle than a mere shift of control from women to men. First, women may willingly cooperate with men toward commercialisation even at the cost of autonomy. Tsusaka et al. (2016) observed that women in Eastern Zambia seemed prepared to trade some degree of control over groundnuts -a traditional women's crop- to men in exchange for participation in the dull task of shelling. Second, women's empowerment is a complex concept, and African women are by no means voiceless puppets in their households. A pilot of the Women's empowerment in Agriculture Index (WEAI) in five spatially dispersed rural districts in the north, central, and eastern regions of Uganda shows that 43 per cent of women were empowered, compared to 63 per cent of men, and 46 per cent of women were less empowered than the primary man in their household (the remainder 54 per cent had gender parity) (Alkire et al., 2013). Yet, not control of production but time burden and lack of control over resources contributed most of women's disempowerment, whereas lack of decision making around agricultural production contributed relatively much to men's disempowerment. Other studies resonate these issues. For example, Kishor and Subaiya (2008) find that women's control over income is not very high: in 60 and 53 per cent of Ugandan households the husband alone decides on large household expenditures and household purchases for daily needs, respectively. In addition, Doss, Truong, Nabanoga, and Namaalwa (2012) conclude that while many rural Ugandan women report joint or even individual ownership of land, women were less likely than men to say that they had the right to sell, bequeath or rent out the land they owned.

In this study, we look in detail at the consequences of policies stimulating commercial agricultural production impact on empowerment within the household in Kanungu district in Southwestern Uganda. We collected data on agricultural production, commercialisation, and women's empowerment among 892 couples, part of whom had been exposed to a program stimulating commercial rice production. To identify the causal relation between the program and women's empowerment, we use double robust estimation methods.

Contrary to the studies mentioned before, who look at a single crop, we take a broader look and analyse decision making power not only in rice but also in eight other commonly cultivated crops. Tavenner et al. (2019) take a somewhat similar whole-farm approach using data from

three East African countries, but refrain from efforts to control for self-selection into commercialisation. In addition, we consider men's control over production, as in this case gendered control is not necessarily a zero-sum game: individual decisions may develop into joint decisions. Finally, we study the effects of commercialisation on social empowerment and control over income. We hypothesize that loss of control over production will spill over to these other domains of empowerment. The context of Uganda is particularly interesting because of the relatively large empowerment of women in agriculture: What happens to women's -and men's- empowerment within the household when a policy supposedly favours men in an area where women, who are overall less empowerment than men, currently play a dominant role? Will the policy indeed make empowerment in production more balanced? If so, will it spill over to other domains and disempower women in areas in which they already had a low level of empowerment?

2. Commercial production and intra-household bargaining

Women's empowerment is a complex concept roughly referring to an increased ability of women to exercise choice (Alkire et al., 2013). Kabeer (1999) separates this ability in three inter-related dimensions: resources (access and claims to material, human and social resources), agency (for example, decision making and negotiation) and achievements (well-being outcomes). For this study, we decided to focus on agency, and specifically on decision making power, as agency is arguably the most direct measure of empowerment (Malapit et al., 2019). In particular, we focus on intra-household decision making power and power relations between spouses.

Agricultural policies in Africa often ignore intra-household dynamics. Many attempts to introduce new crops or technologies have been less successful than anticipated because policymakers did not sufficiently consider the responsibilities of different household members (Alderman, Chiappori, Haddad, Hoddinott, & Kanbur, 1995). Often the husband – with most power and access to resources, has been able to take the initial advantages of the innovation (Doss, 2001). Even technologies specifically designed for women are taken over by men if women are not powerful enough (Von Braun & Webb, 1989). Similarly, as indicated above, several studies find that men disproportionally reap the benefits of commercialisation (for example, Fischer & Qaim, 2012; Von Braun & Webb, 1989). We argue that this goes further than a simple appropriation of benefits and involves a shift in bargaining power from women to men.

Gender blind agricultural policies are implicitly based on the idea of the household as a unit that pools resources and income and allocates these according to a joint utility function or the choices of a benevolent dictator. In this context, introducing a new and profitable commercial crop would simply result in increased income and wellbeing for the household. The assumptions of such a unitary model have, however, been frequently rejected, in favour of models explicitly accounting for intra-household dynamics. Such dynamics will shape the process and consequences of commercialisation, with the exact consequences depending on the local nature of gender relations.

Gender relations in Southwestern Uganda are anchored in a patriarchal system that favours male control over resources (Mbabazia, Asiimweb, & Kazooba, 2018). Even when formal laws protect women's right to property, their implementation is hindered by customary law practices, socialization and the weak economic capacity of many women in Uganda (Kafumbe, 2010). In case of a divorce/separation, men tend to keep the land: because of this, 88 per cent of women felt insecure about family land compared to less than 1 per cent of men in a recent study in Kabale, a neighbouring district to our study district Kanungu (Mbabazia et al., 2018). As in much of Africa, traditional gender roles dictate that women are responsible for domestic duties and food production while men are in charge of cash crop production (Mbabazia et al., 2018).

When men and women have separate plots, women must carry out duties in their husbands' plots before they invest any time in their own plots (Tanellari, Kostandini, Bonabana-Wabbi, & Murray, 2014). Women provide 56 per cent of agricultural labour, which is high compared to other African countries, but they are slightly less involved in cash crop production (Palacios-Lopez, Christiaensen, & Kilic, 2017). Even though women participate actively in the production of all crops and animals -and may even make most productive decisions, it is mainly men who decide on how to spend the financial proceeds (Alkire et al., 2013; Kishor & Subaiya, 2008; Mbabazia et al., 2018). Finally, gender norms constrain female farmers' access to markets and information, which is reflected in lower yields (Larson, Savastano, Murray, & Palacios-López, 2016). Below we will use non-unitary household models to derive hypotheses about how commercialisation affects agency within the household in this specific context.

A first alternative of the unitary model is the cooperative model. Cooperative models of household behaviour use the Nash-equilibrium concept: spouses negotiate decisions with as fall-back option or threat point either divorce or a non-cooperative model with traditional gender roles (Anderson & Eswaran, 2009). The individual's capacity to negotiate – as shaped by personal characteristics and social norms, determines how individual fall-back options are translated into agency (Iversen, 2003; Katz, 1997). Gender shapes the fall-back options of the spouses, which, as we will show below, are influenced by agricultural commercialisation.

Divorce is a credible threat in Uganda: 38 per cent of first marriages/unions ends through divorce/separation within 20 years (Clark & & Brauner-Otto, 2015). If indeed couples negotiate with divorce as a threat point in this setting, increased agricultural commercialisation would favour men: Their threat point increases because of the increased production value of the land they keep in case of a divorce, whereas their wives' threat point is unaffected. In the extreme (and unlikely) case that land would be equally split in case of a divorce, men's better market and information access would still enable them to benefit most from increased commercialisation options. Hence, the cooperative model with divorce as threat point predicts that women's intrahousehold bargaining power would decrease as a result of commercialisation.

Yet, in some cases non-cooperation may be a more realistic fallback option than divorce, or couples may already operate in this equilibrium. A substantial number of empirical studies have rejected the cooperative model (see Doss & Meinzen-Dick, 2009 for a review). Using experimental data from rural Uganda, Iversen, Jackson, Kebede, Munro, and Verschoor (2011), for example, found that a narrow majority of married couples did not maximise the surplus from cooperation. In traditional patriarchal societies in Africa, bargaining by women is often viewed as disrespectful and disobedient and may cause domestic violence and threats of divorce (Bowman, 2002). In central Uganda, for example, 14 per cent of women admitted to being physically assaulted by their husbands because of arguments over money (Koenig et al., 2003). This may force couples in a non-cooperative equilibrium. Both when couples bargain with non-cooperation as fallback option and when they do not cooperate, the non-cooperative equilibrium determines their bargaining power.

Non-cooperative models can take various forms, for example using a Cournot-Nash equilibrium – where household members take behaviour of others as given (for example the separate spheres model were couples revert to traditional gender roles), or a principal-agent framework – modelling the household analogous to the employer-employee relation with the husband owning the means of production and thus having an upper-hand in resource allocation (Katz, 1997). In the principal-agent model, intra-household bargaining power is endogenous, as husbands can constrain their wives' exit options by monopolizing access to productive resources (Katz, 1997). When commercial crops are considered part of the male domain, men have better market access, and/or men control productive resources, the introduction of profitable commercial crops (predominantly) increases the income-generating capacity of men, thus lowering women's bargaining power in all model variants.

The above models consider a marrow version of agency as economic decision power. In the basic version of the cooperative model, bargaining power relates to spending power of money only. As income pooling is assumed, the allocation of productive resources is pareto efficient, which makes decision power of productive resources irrelevant. In non-cooperative models, this is not the case. In addition, bargaining power is relevant for resource allocation and crop choice when food markets are imperfect, as is the case in most of rural Africa. With imperfect food markets, the relative prices for food and non-food depend on crop choice and production levels. As men tend to put a lower value on food than women do (Dzanku, 2019), increased male agency will be reflected in a larger control over crop production.

In conclusion, unless farm households operate according to the frequently rejected unitary model, men will usurp most of the benefits of commercialisation and – consciously or unconsciously, lower their wives' voice in the process. We therefore hypothesize that increased commercialisation will result in decreased bargaining power of women within the household. We have shown that this is relevant for at least two subdomains of agency: control over income and production decisions. However, as different aspects of empowerment are interrelated (Kabeer, 1999), lower economic agency of women could translate into lower social agency as well. An often-used argument for the empowering effect of microcredit is that control over income can lead to a better overall position and more independence of women within the household (Duvendack & Mader, 2020).

3. Empirical approach

Assessing the impact of increased commercialisation on women's empowerment is not straightforward. A methodological difficulty arises from the fact that participating in commercial production is not a random decision. It is a conscious choice and thus influenced by multiple factors, some of which may be unobservable variables also related to women's empowerment –like entrepreneurial capacity. In addition, causality may run from empowerment to commercial production: In Ethiopia, where the proceeds of cash crops are controlled by men who rely on their wives' labour, cash crop production was lower in households with more empowered women (Lim, Winter-Nelson, & Arends-Kuenning, 2007). Hence, simply regressing the level of empowerment on the degree of commercialisation likely gives biased results. We use variation in commercialisation caused by a program exogenous to the farmer's production and commercialisation decisions to address these problems.

3.1. Commercialisation program and case study area

The commercialisation program studied in this paper is the AAMP/NAADS (Area Based Agricultural Modernization Program/National Agricultural Advisory Services), which has stimulated commercial agricultural production in parts of Kanungu district, Southwestern Uganda since 2004. The program has promoted the production of rice – a non-traditional cash crop, in selected sub-districts. Rice was introduced in the district at the start of the program, when trials of New Rice for Africa (NERICA) were set up. The program officially targeted smallholder households with less than five acres of land, but in practice this constraint was not implemented. The program has been gender blind and offers farmers extension and training in modern farming technologies, including the use of improved seeds and inorganic fertilizers. In addition, the program aims to strengthen the capacity of farmers to access markets by training them in business development and market linkages, training marketing associations, and providing support to value addition initiatives. All these activities may have had an impact beyond rice cultivation in stimulating commercial production overall.

The allocation of AAMP/NAADs is exogenous to the farmers: allocation was decided upon by the government. This implies that additional commercialisation in the project area compared

to otherwise similar areas is due to project efforts and that being exposed to the project can serve as an exogenous indicator of commercialisation in a regression to explain women's empowerment when data is available for farmers in project areas and comparable comparison areas.

The program started in 2004 in the two northernmost sub-counties: Kihihi and Nyamirama. These sub-counties are located in the rift valley and are considered relatively fertile. Later, the project extended southwestwards into four other sub-counties (see Figure 1). Due to budget limitations, it did not extend into the adjacent sub-counties of Katete and Kanbuga, which we will use as comparison area. The program area and the comparison area present comparable agro-ecological and socioeconomic conditions. Except for the northern part of Kihihi subdistrict, which is slightly drier, bimodal rainfall ranges from 950 to 1050 mm, and soils are predominantly greyish brown sandy loams and reddish brown (The Government of Uganda, 2016). Literacy rates of adults over 19 are around 80 per cent, and share of female headship is round 24 per cent (UBOS, 2014, according to Kanungu District Local Government, 2015). Also culturally, the district is relatively uniform: the majority of the population belongs to Bantu ethnic groups that share similar characteristics and traditions, and 95 per cent is Christian (UBOS, 2002).

While most farmers in the targeted sub-counties were exposed to information about commercial production and to marketing support, similar high level support and promotion of market production has not been in place in the comparison sub-counties. This does not imply that farmers in these areas are fully subsistence-oriented. They sell surpluses of their food crops, and a substantial share cultivates coffee, which is also an important crop in the program area. Yet although the non-targeted sub-counties are equally suitable for rice cultivation, rice is hardly cultivated there.

3.2. Data

We collected survey data from farm households in both the AAMP/NAADS program area and the comparison sub-counties during the first pre-harvest period of 2014, between 26 March and 11 May. Production and sales data refer to previous two cropping seasons. This implies that all households had had sufficient time to sell their harvest. We employed a multi-stage sampling procedure to select respondents (see Table 1). Within the program sub-counties, we randomly selected 20 villages. From each village, we interviewed almost 30 randomly selected farm households on average. Similarly, we interviewed on average just over 60 randomly selected farm households from nine randomly selected villages in the non-exposed sub-counties. We drew our sample from all farm households, not accounting for household composition, farm size, cultivation practices, AAMP/NAADS participation, or any other characteristics. This resulted in a sample of 1137 households of which 592 were from program areas and 545 from non-exposed areas. In each household, we interviewed both the head of the household, who is mostly male, and an adult women. The head answered questions about family composition, asset ownership and agriculture, whereas the women answered questions about gender roles, food security, and consumption. When the head was female, both sets of questions were answered by the same person. As we are interested in intra-household bargaining between husband and wife, for this research only the 892 of the households with married/cohabiting household heads were relevant.

With a subset of the couples from the married/cohabiting households, we also played a number of games in which individuals first decided on the allocation of money independently and subsequently negotiated the allocation with their spouse. We invited one couple each from 145 households in program sub-counties and one couple each from 100 households in non-exposed sub-counties. We randomly selected households from parishes that are distant from each other to control for other participants getting prior information before the game. Save two sessions

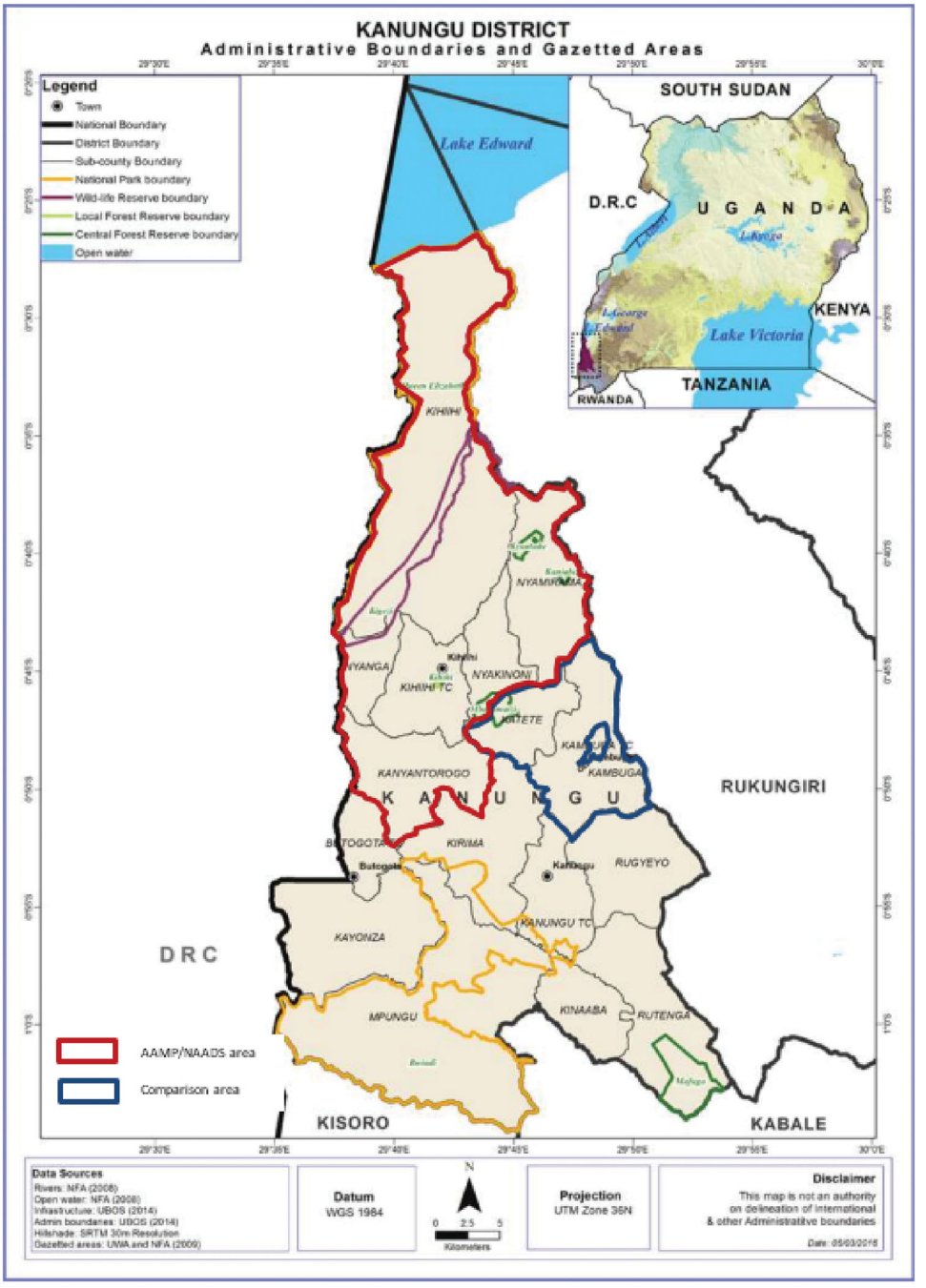

Figure 1. Map of the research area (adjusted from The Republic of Uganda, 2016, Kanungu district: Hazard, risk and vulnerability profile).

for which we invited 10 couples for each, we invited 15 couples for each session. They were informed that they would receive a transport compensation of Ug. Shs 5000 ($2). Since this is slightly more than a daily wage for farm labour, it motivated all those invited to show up. In most cases, the couples were also interviewed during the survey. In some cases, they belonged to an interviewed household, but did not do the interviews themselves. We had only one meeting in each parish to avoid prior knowledge about the game.

Table 1. Sampling strategy

Area	Sub-counties (*N*)	Villages (*N*)	Households (*N*)	Households with married/ cohabiting heads (*N*)	Households bargaining game (*N*)
Treatment	6	20	592	496	145
Control	2	9	545	396	100

IRB for the survey and the experiment was obtained from NARO. All participants gave oral consent and could stop their participation at any time. Participants in the experiments all received positive pay-offs in addition to the transportation compensation. Pay-offs were paid individually based on a lottery, and earnings were not disclosed to someone's spouse or anyone else. All data are anonymized.

3.3. *Measuring empowerment*

As explained in the theoretical section, we focus on three aspects of agency: (1) control over use of income; (2) participation in decisions about agricultural production; and (3) social agency or participation in social activities and household choices. The first two are also part of the Women's empowerment in Agriculture Index (WEAI) (Alkire et al., 2013), though our specific indicators are different. For the second domain, we calculate indexes for both men and women. Due to data limitations, we calculate the social empowerment only for women. As will become clear below, the gendered indexes for our indicator for control over use of income are mirror images, so we only present the index for women.

The proxy for control over use of income is based on the bargaining game. We asked both of the spouses separately to allocate vouchers between household use and a donation to charity and subsequently had them repeat this decision jointly. We first asked the spouses separately which part of a starting endowment of ten vouchers representing a total of Ug. Shs. 800 they wanted to keep to themselves and which part they wanted to donate to a commonly agreed charity. All charity donation would receive a topping of 25 per cent from the research project. This game allows elucidation of individual preferences for donating. We then asked the couple together the same question, with the common choice supposedly the result of a negotiation process. We revealed the participants that they would play a joint game only after they finished the individual game. At the end of the session, one game was randomly drawn for payoff.

Following Wiig, Braten, and Fuentes (2011) and Melesse, Dabissa, and Bulte (2018), we deduct the bargaining power of the wife compared to her husband in the following way:

$$\text{Control over income} = \begin{cases} 1 & \textit{if joint decision outside interval on woman's side} \\ \dfrac{\text{Joint donation} - \text{male donation}}{\text{Female donation} - \text{male donation}} & \textit{if joint decision in the interval between the two individual decisions} \\ 0 & \textit{if joint decision outide interval on man's side} \end{cases}$$

which equals 1 when the wife's decision is adopted, 0 when the husband's decision is adopted and between 0 and 1 for intermediate decisions. When joint decisions lie outside the range of individual decisions, we assign full bargaining power to the spouse whose decision lies closest to the joint decision. When husband and wife make equal choices, the experiment is not informative about bargaining and the observation drops. This indicator does reflects both men's and

women's empowerment, as empowerment of one person goes directly at the cost of empowerment of the other. As decisions are not tied to a specific gender in the study area, we think this variable gives a good proxy for general control over money.

The other two indicators are extracted from the survey data. The women production empowerment indexes are based on women's participation in making at total of seven decisions concerning production, marketing, and use of income of rice and eight other crops commonly cultivated in the region.[1] For each decision, we score 1 if the woman makes the decision by herself or co-decides with her husband, 0 if she is not involved in the decision.[2] As not all households grow all nine crops, we take the average over the crops cultivated. We calculate the index both with an without decisions in rice cultivation. The production empowerment indexes for men are calculated in the same way, with the only difference that we now score 1 if the husband makes a decision, either by himself or together with his wife. In addition to these indexes, we include a variable reflecting the share of the commonly cultivated crops that are fully under control of the wife, in the sense that she takes all decision for these crops on her own. Whereas it is not a priori clear whether full control over specific crops this reflects women's empowerment or an attempt to control at least some income for otherwise less-empowered women, we think this is anyway an interesting variable to take into consideration.

Similarly to the production empowerment index, we assess women's social empowerment based on their participation in social activities and household decision making. We asked women eight questions – five on whether she asks for permission and three on whether she participates in household decisions.[3] We scored one point for each question in which the woman did not ask for permission or participated in the decision mentioned, which resulted in maximum score of 8. We rescaled this score to range from 0 to 1, 1 implying maximum empowerment.

3.4. Estimation procedure

Our objective is to compare the empowerment of women in the program area with that of women in the comparison area to assess the impact of commercialisation. While our research design avoids endogenous selection bias, we still want to control for differences between individual households in our sample. There are two main types of procedures for doing so: matching and regression. Both rely on slightly different assumptions. Matching involves linking program households to comparable comparison households based or relevant characteristics. The standard procedure is to match based on the propensity score, which is generated by regressing the program dummy on the set of household characteristics. In regression analysis, the outcome indicator of interest, in this case empowerment, is regressed on the program dummy and the relevant control variables. For this paper, we use a model that combines these two methods: the inverse-probability weighted regression-adjustment model (Wooldridge, 2010). The estimation is done in two steps. First, propensity scores using a logit regression -the treatment model. Second, the inverse probabilities resulting from this model are used as weights in the linear regression estimation of empowerment -the outcome model. This approach has the double-robust property, which implies that it can consistently estimate the effects if either the outcome model or the treatment model is correctly specified. As we test for the impact of AAMP/NAADS on several empowerment indicators, we use sharpened q-values and Bonferroni corrected p-values to control for multiple hypothesis testing.

As control variables in both regressions, we use variables reflecting the capital endowment of the household: livestock ownership, farm size, household size, dependency ratio, and education of husband and wife (full sample) or age of husband and wife (bargaining game sample). The personal characteristics included differ between the two samples, as different personal data was collected in the survey and during the experiment. Whereas the couples do not necessarily match the men and women interviewed during the survey, all household match, so we use

household characteristics from the survey as controls for the regressions using experimental data. In addition, we control for the self-reported distance from the homestead to the nearest market. Because of the cultural homogeneity of the district, we do not control for religion and ethnicity Polygamy is not uncommon in the region, but unfortunately we have no direct information about this: The household composition information in the survey is limited to the number of males and females per age group. Yet, only 13 per cent of our survey had more adult women than adult men, which could be an indication of a low number of co-habiting polygamous marriages. Controlling for this variable did not affect the results.[4]

4. Results

4.1. Commercialisation

The data supports our proposition that AAMP/NAADS has provided an effective stimulus for commercial rice production, but did not cause spillovers to neighbouring areas: Although our sampling strategy did not account for rice cultivation, 80 per cent of our sample households in the treatment area produced rice, compared to 0.3 per cent of sample households in the control area (Table 2). Considering the share of produce marketed, the indicator used by Carletto, Corral, and Guelfi (2017) to measure the level of commercialisation, rice was a more commercial crop than marketed: 60 per cent compared to, for example, 23 per cent of maize production.

The question is why rice cultivation, which was widely adopted in the program area, did not spread not spread to these otherwise similar neighbouring areas. A key constraints for the diffusion of innovation is limited opportunities to learn about the specifics of the innovation. Learning opportunities have been severely constrained in the case of rice production in non-program areas. Social learning through information sharing within farmer networks, which has shown to be crucial for widespread technology diffusion (see, for example, Doss, 2006) is not possible when nobody in the network applies the innovation. This is why formal extension is crucial at the early stages of adoption, and formal extension about rice was only given in the program area. We believe that if a similar program would have been introduced in the non-rice growing area, households would equally participate in commercial rice production.

The overall level of commercialisation was substantially higher in the program area. On average, households exposed to AAMP/NAADS sold 52 per cent and comparison households sold 41 per cent. Interestingly, this higher share of produce sold was not only due to commercial rice production but also due to higher commercialisation rates for maize, millet, and sweet potatoes (though not for beans). This suggests that the effects of the program had spilled over to other crops. This is not unexpected, as project activities involved not only rice-specific trainings but also more general training on business development and market linkages. The presence of an almost pure cash crop, coffee, which was cultivated by a somewhat larger share of households in the control area, did not outweigh the increased commercialisation of food crops in the program area. Commercialisation was also more pronounced in the program area when considering the use of external inputs. While on average, the use of such inputs was low, it was significantly higher in the AAMP/NAADS area. This is especially due to a higher share of famers using such inputs: 37 per cent compared to 13 per cent in the control area.

4.2. Women's empowerment

Although there was quite some variation between households, the production empowerment indexes for women are high on average: women participate in more than 90 per cent of decisions on crop production, though few crops are fully controlled by women (Table 3). This is much higher than the production empowerment indexes for men, which reveal that men are involved in around 65 per cent of decisions. Looking at the data in more detail, on average 7

Table 2. Market integration in Kanungu, Uganda

	Total			Treatment			Comparison			Test for equality	
	N	Mean	Std. dev.	*N*	Mean	Std. dev.	*N*	Mean	Std. dev.	*T*-value/Pearson Chi2	Prob
Share of output sold (MPI)											
Total	892	0.47	0.22	496	0.52	0.20	396	0.41	0.23	−7.63	0.00
Maize	761	0.23	0.28	471	0.31	0.29	290	0.09	0.20	−11.31	0.00
Millet	655	0.22	0.26	357	0.27	0.27	298	0.17	0.23	−5.33	0.00
Beans	880	0.22	0.23	484	0.20	0.23	396	0.25	0.23	3.46	0.00
Sweet potatoes	805	0.09	0.18	418	0.12	0.21	387	0.05	0.13	−5.36	0.00
Coffee	534	0.99	0.08	231	0.99	0.09	303	0.99	0.07	1.04	0.3
Rice	370	0.60	0.26	369	0.60	0.26	1	0.58		NA	
External inputs/value of production											
Total	890	0.01	0.02	494	0.01	0.03	396	0.00	0.01	−7.53	0.00
Maize	757	0.00	0.03	468	0.01	0.03	289	0.00	0.01	−1.98	0.05
Millet	653	0.00	0.01	355	0.00	0.01	298	0.00	0.02	1.62	0.11
Beans	873	0.03	0.10	479	0.03	0.11	394	0.02	0.08	−2.41	0.02
Sweet potatoes	804	0.00	0.00	417	0.00	0.01	387	0.00	0.00	−1.65	0.10
Coffee	534	0.00	0.00	231	0.00	0.00	303	0.00	0.00	NA	
Rice	369	0.05	0.11	368	0.05	0.11	1	0.00		NA	
Share of farmers using	892	0.37		496	0.56		396	0.13		177.58	0.00

Notes: External internal inputs are purchased seeds, inorganic fertilizers, herbicides and pesticides. NA means not applicable. *Source*: own data.

Table 3. Empowerment indicators in Kanungu, Uganda

	All			Treatment			Comparison			Test for equality	
	Obs	Mean	Std. dev.	Obs	Mean	Std. dev.	Obs	Mean	Std. dev.	*T*-value	Prob < 0
Women's empowerment											
Production empowerment (all)	845	0.92	0.18	471	0.88	0.21	374	0.97	0.13	6.88	0.00
Production empowerment (non-rice)	842	0.93	0.18	468	0.90	0.20	374	0.97	0.13	5.11	0.00
Share of women's crops	892	0.05	0.09	496	0.04	0.08	396	0.06	0.10	3.75	0.00
Social empowerment	822	0.56	0.19	461	0.54	0.19	361	0.58	0.19	3.32	0.00
Control over use of income	199	0.42	0.46	120	0.42	0.48	79	0.42	0.43	0.06	0.95
Men's empowerment											
Production empowerment (all)	845	0.65	0.40	471	0.69	0.35	374	0.61	0.45	0.25	0.80
Production empowerment (non-rice)	842	0.64	0.41	468	0.67	0.38	374	0.61	0.45	0.48	0.63

Source: own data

per cent of decisions is made by men, 45 per cent by women, and 48 per cent jointly. Women participate less in decisions about rice cultivation, and to a smaller extent banana, than in decision making about other crops. There are no substantial gendered differences in decision making between the different types of activities. Social empowerment and control over income are lower: women participate in/do not ask permission for 56 per cent of social decisions on average; and in just over 40 per cent of cases, the joint income allocation decision from the experiment was closer to the women's individual decision than to that of her husband.

These differences between the three domains indicate that each index measures a different aspect of empowerment, as is also reflected in weak associations between the different areas of women's empowerment listed in Table 4. Only the share of women's crops and social empowerment are moderately positively correlated. Interestingly, there are large negative correlations between the production empowerment of men, the share or women's crops and social empowerment of women.

Except for control over use of income, all women's empowerment indicators are on average significantly lower in the AAMP/NAADS area. The indexes for men's empowerment are higher for the AAMP/NAADS area. However, the standard deviations for these indicators are very high and neither of the differences is statistically significant from 0. We will further analyse these differences in the following subsection.

4.3. Commercial production and women's empowerment

Table 5 shows results of the double robust estimation procedure: the logit regressions used to estimate the inverse probability weights. We present results for both the full sample and the bargaining game sample. The results suggest that the regional subsamples are similar for most variables, providing support for our selection of comparison households, although households in the program area live somewhat further from the market on average. This is interesting, as *ceteris paribus*, we would have expected this to result in lower commercialisation rates, whereas in reality commercialisation is substantially higher. As we cannot reject the null hypothesis that the IPW model balanced the covariates, we interpret the resulting average treatment effects resulting from the second stage as causal impacts (Table 6).

We find strong evidence that AMMP/NAADS decreased women's empowerment in production. Participation in decision making decreased by 8 percentage points for all crops and 6 percentage points for non-rice crops at an average potential treatment outcome of 96 per cent. This is related to a decrease in the share of crops fully controlled by women by 1 percentage point at an average potential treatment outcome of 5 per cent (out of a maximum of 9 commonly cultivated crops). This does not mean that women work less: They contribute substantial amounts of labour to all crops, also rice. Correcting for multiple hypothesis testing does not change these conclusion other than that the very conservative Bonferroni correction -but not the use of sharpened q-values, makes the program's effect on the share of women's crops insignificant.

We also find evidence that this lower production empowerment results in a lower control over income: the commercialisation program resulted in 19 per cent less women controlling the choice between household expenditure and charity in the charity game. Even when using the Bonferroni correction, this result is still significant at the 10 per cent significant level.

We find no evidence for an impact of the program on social empowerment. This suggests that this domain develops relatively separately from the economic empowerment measured by control over production and income. Remember that this was the area where we measured the lowest levels of empowerment, so these results indicate that agricultural commercialisation has not decreased social empowerment any further.

Table 4. Relationships between different empowerment indicators in Kanungu, Uganda

	Women's empowerment					Men's empowerment	
	Production empowerment (non-rice)	Production empowerment (all)	Share of women's crops	Social empowerment	Control over use of income	Production empowerment (non-rice)	Production empowerment (all)
Correlations							
Women's empowerment							
Production empowerment (non-rice)	1						
	(842)						
Production empowerment (all crops)	0.98***	1					
	(842)	(845)					
Share of women's crops	0.13***	0.11***	1				
	(842)	(845)	(892)				
Social empowerment	0.08**	0.07*	0.48***	1			
	(791)	(794)	(822)	(822)			
Control over use of income	−0.02	−0.03	0.00	−0.06	1		
	(190)	(191)	(199)	(186)	(199)		
Men's empowerment							
Production empowerment (non-rice)	−0.06*	−0.02	−0.78***	−0.52***	−0.04	1	
	(842)	(842)	(842)	(791)	(190)	(842)	
Production empowerment (all crops)	−0.07*	−0.04	−0.78***	−0.53***	−0.04	1.00***	1
	(842)	(845)	(845)	(794)	(0.62)	(842)	(845)

Notes: *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$; number of observations in parentheses.
Source: own data.

Table 5. Logit regression of living the AAMP/NAADS area

	Descriptives Mean/sd	Full sample b/(cluster robust se)	Bargaining game sample b/(cluster robust se)
Livestock ownership (yes = 1)	0.814	−0.247	−0.018
	0.389	(−0.274)	(−0.488)
Farm size (acre)	4.819	0.041	0.010
	6.894	(−0.035)	(−0.027)
Dependency ratio (children/all)	0.554	0.100	−0.626
	0.181	(−0.337)	(−1.117)
Household size	6.522	0.063	0.192*
	2.604	(−0.044)	(0.081)
Distance to the market (miles)	3.871	0.600***	0.626***
	2.943	(−0.13)	(−0.111)
Education husband (years)	6.815	−0.018	
	3.616	(−0.027)	
Education wife (years)	5.245	−0.028	
	3.107	(−0.025)	
Age husband (years)	44.467		0.016
	13.404		(−0.028)
Age wife (years)	27.623		−0.062
	10.966		(−0.036)
Constant		−2.040**	−1.116
		(−0.701)	(−0.927)
N		861	197

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

As a robustness check, we repeated the analyses for three restricted samples to potentially increase the comparability of program and comparison farmers even further. First, we excluded households from the two original program sub-districts, which are supposedly more fertile. Second, we ran our regressions for coffee-growing households only. This traditional cash crop was somewhat more cultivated in the comparison area compared to the program area. The number of non-coffee growing households was too low to do a similar analysis for this sub-group. Third, we limit our sample to households living within a seven mile radius of the nearest market, the largest distance reported in the comparison area. The results of these analyses are shown in Tables A1–A3 in the Appendix.

The additional regressions support our main results: increased commercialisation production empowerment and control over the use of income decrease for women and increase for men. Interestingly, the negative coefficients for women's social empowerment are significant in all three specifications, proving some evidence of a negative effect of commercialisation on social empowerment.

5. Conclusion

This study examines the effect of commercial production on women's voice within the household in Uganda. We use a combination of a household survey and a lab-in-the-field experiment to collect data from farming couples in rural Uganda. We employ double robust methods to estimate the effects of a government-driven program to stimulate commercial agricultural production on women's empowerment. As in much of Africa, in the study area commercial crops are traditionally considered the domain of men, while women are responsible for food production. This implies that strengthening commercial agriculture and farmer-market linkages may mainly result in increased opportunities for men, which could result in lower empowerment of women in the household.

Table 6. Summary table of inverse probability weighted regressions of empowerment on living in the AAMP/NAADS area of Kanungu, Uganda

	Average treatment effect on the treated			Overidentification test	
Outcome indicators	Coefficient	Standard error[a]	*N*	Chi2	Prob > chi2
Women's empowerment					
Production empowerment (all crops)	−0.080	0.022	817	3.022	0.933
p-Value	0.000				
Production empowerment (non-rice)	−0.057	0.021	814	3.268	0.916
p-Value	0.006				
Bonferroni corrected p-value	0.030				
Sharpened *q*-value	0.024				
Share of women's crops	−0.012	0.007	862	3.350	0.911
p-Value	0.091				
Bonferroni corrected *p*-value	0.455				
Sharpened *q*-value	0.070				
Social empowerment	−0.010	0.022	793	2.719	0.951
p-Value	0.664				
Bonferroni corrected *p*-value	1.000				
Sharpened *q*-value	0.154				
Control over income	−0.161	0.062	197	8.69	0.466
p-Value	0.009				
Bonferroni corrected *p*-value	0.045				
Sharpened *q*-value	0.024				
Men's empowerment					
Production empowerment (all crops)	0.120	0.046	817	3.354	0.910
p-Value	0.009				
Production empowerment (non-rice)	0.096	0.047	814	3.268	0.916
p-Value	0.039				
Bonferroni corrected p-value	0.195				
Sharpened *q*-value	0.041				

Notes: Logit regressions used for first stage. Linear model for the second stage.
Control variables: livestock ownership, farm size, household size, dependency ratio, distance to the market, education husband, education wife. For control over income, the latter two variables are replaced by age of husband and wife due to differences in data availability.
Bonferroni corrected *p*-values and sharpened *q*-values are calculated based on 5 hypotheses, as the two production empowerment indexes for each gender are very highly correlated and are counted as one hypothesis each.
[a]Standard errors are robust for clustering at the parish level.

Our findings indicate that results indicate the gendered consequences of commercialisation are more nuanced than the bleak picture that has been painted by several previous studies. While commercialisation affected women's say in production and the spending of income negatively – shifting power to men – we found only weak evidence that this would translate into lower empowerment in social decisions, where we found women were least empowered. In addition, even after the commercialisation program, women had a larger control over production than men, so arguably, the resulting shift in power contributed to a more equal power balance in production within the household.

This does not imply that we can ignore gender in commercialisation programs. The resulting lower control over income for women is undesirable in a context were this control is already limited. In addition, this consequence of commercialisation may frustrate its positive effects on food and nutrition security through increased household income: Lower women's control over income has been shown to results in decreased nutrition and health of their children (Duflo, 2012; Smith & Haddad, 2000). We therefore recommend that policies and programs to

stimulate commercial agricultural production among smallholder include a strong gender component. It is not enough to account for the specific roles of women or even to target women explicitly. What is needed is to address gender roles and women's empowerment directly in order to avoid unintended shifts in control and unbalanced appropriation of direct and indirect program benefits by a specific gender.

Though we go beyond control over production in our assessment of empowerment, the paper still focuses on women's voice or decision making power within the household alone. This implies that we miss two important empowerment domains that are for example considered in the Women's empowerment in Agriculture Index: Leadership in the community and time allocation (Alkire et al., 2013). The relationship between commercialisation and women's leadership in the community is not immediately obvious. However, Gupta, Pingali, and Pinstrup-Andersen (2017) observe that in India women in cash cropping households were more empowered than women in food cropping households in all domains of the WEAI, also in leadership. It would be interesting to see whether these results would also hold in a completely different setting like Uganda and whether the relationship is causal. Perhaps more obvious, commercialisation could have implications for women's time use. The commercial crops could imply an additional claim on the already limited time of women. However, the opposite may also be true if less of women's labour is used in the commercial crop than in the crops it replaces. The sign and size of the effects thus depend on the specific context and the nature of the various crops and technologies and is open to empirical scrutiny.

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Notes

1. We asked who makes the decision on which crop to grow and where to grow it, how to allocate labour, which type and quantity of seed to plant, which quantity of harvest to keep for home consumption, when to sell, which quantity to sell, and how to use the income generated.
2. We also constructed an index in which joint decisions were given a score of 0.5, all else equal. The results of our analyses using this indicator were very similar.
3. We ask whether the woman asks the husbands for permission to; go to the market, visit hospital, visit friends and relatives, attend public functions and spend money. We also ask whether the woman participates in decisions regarding; her own health such as use of contraceptives, children education and household size
4. Results available on request.

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Data availability statement

Data and a do file for reproduction are available on DANS.

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Appendix

Table A1. Summary of inverse probability weighted regressions of women's empowerment on living in the AAMP/NAADS area, excluding the two original districts

	Average treatment effect on the treated			Overidentification test	
	Coefficient	Standard error[a]	*N*	Chi2	Prob > chi2
Women's empowerment					
Production empowerment (all crops)	−0.040	0.027	536	5.748	0.675
p-Value	0.137				
Production empowerment (non-rice)	−0.021	0.024	534	5.879	0.6608
p-Value	0.384				
Bonferroni corrected *p*-value	1.000				
Sharpened *q*-value	0.075				
Share of women's crops	−0.013	0.006	645	5.344	0.720
p-Value	0.027				
Bonferroni corrected *p*-value	0.135				
Sharpened *q*-value	0.019				
Social empowerment	−0.048	0.018	524	5.827	0.666
p-Value	0.008				
Bonferroni corrected *p*-value	0.040				
Sharpened *q*-value	0.015				
Control over income	−0.221	0.088	103	8.747	0.364
p-Value	0.011				
Bonferroni corrected *p*-value	0.055				
Sharpened *q*-value	0.015				
Men's empowerment					
Production empowerment (all crops)	0.150	0.040	536	5.748	0.675
p-Value	0.000				
Production empowerment (non-rice)	0.125	0.041	534	5.878	0.661
p-Value	0.002				
Bonferroni corrected *p*-value	0.010				
Sharpened *q*-value	0.011				

Notes: Logit regressions used for first stage. Linear model for the second stage, except for control over income, for which the second stage is a logit model.
Control variables: livestock ownership, farm size, household size, dependency ratio, distance to the market, education husband, education wife. For control over income, the latter two variables are replaced by age of husband and wife due to differences in data availability.
Bonferroni corrected *p*-values and sharpened *q*-values are calculated based on 5 hypotheses, as the two production empowerment indexes for each gender are very highly correlated and are counted as one hypothesis each.
[a]Standard errors are robust for clustering at the parish level.

Table A2. Summary of inverse probability weighted regressions of women's empowerment on living in the AAMP/NAADS area, coffee farmers only

	Average treatment effect on the treated			Overidentification test	
	Coefficient	Standard error[a]	*N*	Chi2	Prob > chi2
Women's empowerment					
Production empowerment (all crops)	−0.052	0.021	500	0.251	0.409
p-Value	0.012				
Production empowerment (non-rice)	−0.025	0.019	497	8.054	0.428
p-Value	0.185				
Bonferroni corrected *p*-value	0.985				
Sharpened *q*-value	0.080				
Share of women's crops	−0.020	0.011	522	7.652	0.468
p-Value	0.064				
Bonferroni corrected *p*-value	0.320				
Sharpened *q*-value	0.069				
Social empowerment	−0.037	0.018	482	6.259	0.618
p-Value	0.039				
Bonferroni corrected *p*-value	0.465				
Sharpened *q*-value	0.055				
Control over income	−0.160	0.076	103	0.390	0.396
p-Value	0.035				
Bonferroni corrected *p*-value	0.175				
Sharpened *q*-value	0.055				
Men's empowerment					
Production empowerment (all crops)	0.169	0.051	500	0.252	0.409
p-Value	0.001				
Production empowerment (non-rice)	0.143	0.052			
p-Value	0.006				
Bonferroni corrected *p*-value	0.030				
Sharpened *q*-value	0.031				

Notes: Logit regressions used for first stage. Linear model for the second stage, except for control over income, for which the second stage is a logit model.
Control variables: livestock ownership, farm size, household size, dependency ratio, distance to the market, education husband, education wife. For control over income, the latter two variables are replaced by age of husband and wife due to differences in data availability.
Bonferroni corrected *p*-values and sharpened *q*-values are calculated based on 5 hypotheses, as the two production empowerment indexes for each gender are very highly correlated and are counted as one hypothesis each.
[a]Standard errors are robust for clustering at the parish level.

Table A3. Summary of inverse probability weighted regressions of women's empowerment on living in the AAMP/NAADS area, distance to markets <7 miles

	Average treatment effect on the treated			Overidentification test	
	Coefficient	Standard error[a]	*N*	Chi2	Prob > chi2
Women's empowerment					
Production empowerment (all crops)	−0.078	0.018	756	9.066	0.337
p-Value	0.000				
Production empowerment (non-rice)	−0.056	0.018	753	8.808	0.359
p-Value	0.002				
Bonferroni corrected *p*-value	0.010				
Sharpened *q*-value	0.011				
Share of women's crops	−0.017	0.007	798	9.799	0.279
p-Value	0.010				
Bonferroni corrected *p*-value	0.050				
Sharpened *q*-value	0.021				
Social empowerment	−0.027	0.018	734	7.438	0.490
p-Value	0.140				
Bonferroni corrected *p*-value	0.700				
Sharpened *q*-value	0.074				
Control over income	−0.120	0.064	182	13.115	0.108
p-Value	0.063				
Bonferroni corrected *p*-value	0.315				
Sharpened *q*-value	0.050				
Men's empowerment					
Production empowerment (all crops)	0.103	0.033	756	9.066	0.337
p-Value	0.008				
Production empowerment (non-rice)	0.080	0.0391	753	8.808	0.3587
p-Value	0.041				
Bonferroni corrected *p*-value	0.205				
sharpened *q*-value	0.043				

Notes: Logit regressions used for first stage. Linear model for the second stage, except for control over income, for which the second stage is a logit model.
7 miles is the maximum distance for control households.
Control variables: livestock ownership, farm size, household size, dependency ratio, distance to the market, education husband, education wife. For control over income 0.002, the latter two variables are replaced by age of husband and wife due to differences in data availability.
Bonferroni corrected *p*-values and sharpened *q*-values are calculated based on 5 hypotheses, as the two production empowerment indexes for each gender are very highly correlated and are counted as one hypothesis each.
[a]Standard errors are robust for clustering at the parish level.