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Gender, agricultural commercialization, and collective action in Kenya

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Abstract With the commercialization of agriculture, women are increasingly disadvantaged because of persistent gender disparities in access to productive resources. Farmer collective action that intends to improve smallholder access to markets and technology could potentially accelerate this trend. Here, we use survey data of small-scale banana producers in Kenya to investigate the gender implications of recently established farmer groups. Traditionally, banana has been a women's crop in Kenya. Our results confirm that the groups contribute to increasing male control over banana. We also analyze nutritional implications. While male control over banana revenues does not affect household calorie consumption, it has a negative marginal effect on dietary quality. We demonstrate that the negative gender implications of farmer groups can be avoided when women are group members themselves. In the poorest income segments, group membership even seems to have a positive effect on female-controlled income share. Some policy implications towards gender mainstreaming of farmer collective action are discussed.

Keywords Gender · Collective action · Market access · Agricultural technology · Household food security and nutrition · Kenya

Introduction

Women make essential contributions to agriculture and rural livelihoods. While their access to productive resources, such as land and capital, is often constrained, women play a large role in food crop production (Quisumbing et al. 1995; Udry 1996; Ibnouf 2011). Especially in Africa, women also tend to control the income derived from semi-subsistence crops (Njuki et al. 2011). However, gender relations change with changing conditions. Agricultural commercialization is often associated with a decline in women's control, because cash crops usually fall into the male domain. Commercialization is sometimes also associated with the adoption of new technologies, which may further reduce the role of women. Such developments were analyzed in previous research (von Braun and Webb 1989; Sorensen 1996; Doss 2001; Negin et al. 2009; FAO 2011). Furthermore, it was shown that the loss of women's control may have a negative marginal effect on household nutrition, although income gains from commercialization may outweigh this negative marginal effect (von Braun and Kennedy 1994).

More recently, there has been a renewed policy focus on linking smallholder farmers to markets and emerging value chains (Wiggins et al. 2009). In this connection, promotion of collective action has gained popularity, in order to help farmers reduce transaction costs and increase their bargaining position vis-à-vis companies and traders (Markelova et al. 2009; Shiferaw et al. 2011). The formation of farmer groups or cooperatives is often assisted by development organizations. Determinants of farmer participation in collective action and impacts on the degree of commercialization, prices, and incomes have been analyzed in the recent literature (e.g., Barham and Chitemi 2009; Bernard and Spielman 2009; Fischer and Qaim 2012). Yet, the gender implications have hardly been examined up till now.

The impact of collective action on gender roles can be manifold, depending on the social context, the type of collective activities, and the rights that women have

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within the groups. A few studies have explored gender issues in collective action for natural resource management (e.g., Meinzen-Dick and Zwarteveen 1998; Agarwal 2000; Pandolfelli et al. 2008). Mayoux (1995) and Gotschi et al. (2009) have analyzed gender equity and mainstreaming within rural farmer groups and cooperatives, while Barham and Chitemi (2009) have examined linkages between the gender composition of groups and marketing performance. We are not aware of any previous study that has explicitly looked at the impact of agricultural production and marketing groups on women's control over output and income and related implications for household nutrition.

We address these questions by analyzing the situation of small-scale banana producers in Kenya, where farmer groups were recently established to promote technological innovation and commercialization. In Kenya and other East-African countries, banana is a semi-subsistence food crop and has traditionally often been in the women's sphere of control (Qaim 1999; Smale and Tushemereirwe 2007; Beed et al. 2012). However, due to rising urban demand, banana is also gaining importance as a cash crop. This as such may reduce the role of women. We suppose that farmer groups may accelerate this trend, but that appropriate mechanisms can possibly prevent undesirable gender outcomes. We also analyze nutritional effects in terms of household calorie consumption and dietary quality.

The rest of this article is structured as follows. In the next section, we discuss linkages between gender, agricultural commercialization, and collective action from a theoretical perspective. This allows us to derive concrete research hypotheses. Subsequently, we describe the situation of banana producers in Kenya and the survey data, before discussing regression approaches and estimation results. The last section concludes with some policy implications.

Background and research hypotheses

Theoretical framework

In many regions of Sub-Saharan Africa, a traditional gender division exists in agriculture, which can be based on crops, tasks, or both (Doss 2001; McPeak and Doss 2006). Cash and export crops are often found to be male-dominated, because men are considered the family's major cash earners. Subsistence crops mostly fall under the women's sphere of control (Njuki et al. 2011). The nature of this gender division can be complex and depends on the specific socio-cultural context. Generally, gender relations are dynamic and can change as a response to commercialization and innovation (Sorensen 1996; Ibnouf 2011).

Fafchamps (2001) developed a model of intra-household resource allocation that is of particular relevance here. In this model, productive household members allocate their total time to labor for own income-generating activities, labor provided to others, and leisure. An individual is willing to work on the partner's agricultural plot if he or she receives compensation that is at least equal to what could be earned in the off-farm labor market. When markets are competitive, household resources are allocated efficiently. However, this only holds when constant returns to scale of production are assumed. With decreasing returns to scale, efficiency can be increased when each individual is an independent producer. With increasing returns to scale, on the other hand, efficiency can be increased if production is centralized. Whether increasing or decreasing returns to scale apply depends on various factors. When external transactions increase through commercialization, more intensive use of purchased inputs, and adoption of new technologies, increasing returns to scale are often observed (Wiggins et al. 2009). Production is then likely to be centralized in the hands of the male household head, because of his better access to land, inputs, and other productive resources.

While centralization may increase efficiency, the distribution of the gains may not be equitable. Markets for labor and land may not be complete. Thus, for individuals it is difficult to identify a wage rate that determines the opportunity cost of time, which leaves room for bargaining over the size of the compensation for the labor provided to other household members. The conditions under which a woman will agree to provide labor depend on whether she is better off with or without intra-household cooperation. The utility level outside the household depends on income sources, asset endowments, laws, and customs regarding the rights and obligations of separating household members. These factors also determine the level of bargaining power in negotiating intra-household compensation via an explicit or implicit threat to leave the household. Compensation for women may be low when their outside options are poor.

Against this background, technology adoption and agricultural commercialization may weaken the role of women and their control over production and income. This could also affect household nutrition. While higher household income through commercialization usually has positive effects on overall consumption, income controlled by women is more likely to be spent on food and other basic household goods (Hoddinott and Haddad 1995; Quisumbing et al. 1995). Moreover, when men take over production, more food may be sold and the revenues may not be equitably distributed.

Farmer groups that market collectively and promote the adoption of new technologies may potentially reinforce this loss of women's control. On the other hand, a gender-sensitive group design may have the opposite effect. Because of their multiple responsibilities in the farm and the

household, women often have high opportunity costs of time, which lowers their incentive to participate in markets. Groups that facilitate market access may therefore be very helpful. However, group activities can be time-consuming themselves, lowering the incentive for women to participate (Weinberger and Jütting 2001; Meinzen-Dick and Zwarteveen 1998). Moreover, except for pure women's groups, group leadership is often male dominated, making it more difficult for women to assert their interests. Even if women join a group, they are often less likely to adopt innovations, which may be due to the lack of complementary services, such as credit or extension. Collective action that fails to adequately understand and address gender issues may worsen women's position in the long run (Padmanabhan 2008; Gotschi et al. 2009).

Collective action in the Kenyan banana sector

In Kenya, banana is a semi-subsistence food crop, produced under low-input regimes (Beed et al. 2012). Due to rising demand in urban areas, the marketed share has been increasing recently. A few banana producers are able to sell at local markets or to small shops, but the majority sell their harvest to local traders at the farm gate (Fischer and Qaim 2012). Because of remoteness, poor infrastructure, market information asymmetries, perishability, and bulkiness, smallholders have very limited marketing alternatives. This also contributes to low bargaining power vis-à-vis traders.

Recognizing the problems of low banana yields and farmers' limited access to markets on the one hand, and the increasing commercial potential of the crop on the other, efforts have been started by different development agencies to improve the situation through dissemination of better planting material and related measures. One of these initiatives was jointly launched by Africa Harvest and TechnoServe – two international non-governmental organizations (NGOs). Since 2003, Africa Harvest and TechnoServe have been working together in encouraging banana farmers in Central Kenya to establish self-sustaining groups in order to facilitate access to clean planting material, technical extension, and output markets. Up till now, several thousand small-scale banana growers have become organized in such farmer groups (Fischer and Qaim 2012). These groups in Central Kenya are also the focus of our empirical analysis.

One benefit of these groups is improved access to tissue culture planting material, which is propagated in the laboratory and thus free from pests and diseases. Linkages between farmer groups and tissue culture laboratories and nurseries were established through Africa Harvest. Group members can collectively procure plantlets, thereby reducing transaction costs. Related technical advice is provided by NGO field officers in group training sessions. Tissue culture plantlets are higher yielding, but they also require more inputs such as water and fertilizer (Kabunga et al. 2012). These other inputs are usually not purchased collectively. Likewise, most of the groups do not provide credit. Collective marketing was introduced by TechnoServe. Group participants regularly deliver their bananas to designated collection centers, where they are directly sold to urban wholesale traders for a collectively negotiated price. Training sessions on record keeping, negotiation, and other business skills are also provided. Group membership is individual; both men and women are allowed to join. The groups have an elected leadership, which is mostly male dominated.

Research hypotheses

Building on the theoretical framework outlined above, we formulate three concrete research hypotheses, which we test for the case of banana farmers in Kenya. We have argued that with increasing returns to scale, male household heads tend to centralize crop production. This tendency may be reinforced through farmer collective action aimed at exploiting new marketing and technological opportunities. Therefore, the first hypothesis is.

Hypothesis 1 Farmer groups contribute to increasing male control over crop production and revenues.

Until the new constitution, passed in 2010, women in Kenya could not inherit land. Women also have little access to other productive resources, so their outside options are poor and their bargaining position within the household is probably weak. Male control of crop revenues may lead to lower food consumption and dietary quality. Hence, we hypothesize:

Hypothesis 2 Male control over crop revenues negatively affects household nutrition.

To what extent collective action changes gender roles will depend on various factors, including the question as to who within the household is actually member of a farmer group. Considering gender-specific constraints in terms of accessing markets, women are likely to benefit from groups if they become members themselves. Since banana has traditionally been a women's crop in Kenya, female group membership may potentially also reduce the tendency of men taking over control. Hence, we hypothesize:

Hypothesis 3 Female membership in farmer groups increases women's probability of keeping control over revenues and positively affects female-controlled income share.

Data and sample characteristics

We conducted a survey of banana farm households in Central Kenya between April and July 2009. We focused on those districts where the two NGOs, Africa Harvest and

TechnoServe, had been promoting the establishment of farmer groups since 2003 (see above). In particular, we purposively selected the districts of Muranga, Nyeri, Embu, and Meru. These are all located within the same agro-ecological zone, have similar access to road infrastructure, and are classified as high-potential banana-growing areas. In these districts, we selected banana growers who are members of farmer groups as well as non-members, using a stratified random sampling procedure. We first obtained a list of all 240 banana farmer groups in the four districts from the NGOs. Out of these 240 groups, 17 groups were randomly selected in different sub-locations. From each group, around 12 member households were randomly selected, resulting in a total of 201 group member observations. In the same 17 sub-locations, we also randomly sampled 137 non-members. As these non-member households are located in areas where farmer groups operate, they are exposed and might potentially be affected by spill-overs from group activities. Hence, we further identified 10 sub-locations in the same four districts where no banana farmer groups operate yet. In these control regions, we randomly selected another 106 banana growers. Thus, the total sample consists of 444 households. It is representative of members and non-members of banana farmer groups in the central highlands of Kenya.

For the design of the sampling framework and initial local contacts with farmer groups, we were assisted by Africa Harvest and TechnoServe. The survey itself and the household interviews were conducted together with a small team of independent local enumerators that we recruited for this purpose. Household heads – mostly together with their spouse, when a spouse was living in the same household – were interviewed using a carefully pre-tested questionnaire. The interviews covered farm and household characteristics, details of the banana business, other sources of income and credit, food and non-food consumption, asset ownership, and other information. Questions about male and female control of banana production and revenues were asked, as is further explained below. Household-level food consumption data were elicited using a 7-day recall for 94 food items, differentiating between food consumed from home production, market purchases, and gifts. Food items were reported in local measures and converted to kilograms using appropriate conversion factors. For the nutrition analysis, calorie contents of food items were derived from the World Food Dietary Assessment System (FAO 2010). While our data are suitable for deriving household level measures of calorie consumption, more detailed analysis of intra-household distribution or nutritional outcomes were not possible (de Haen et al. 2011).

Table 1 compares sample characteristics for selected variables between group members and non-members. With average farm sizes of less than 4 acres, banana farmers can be characterized as typical smallholders. Group members are more specialized in banana production. This is likely a result of facilitated access to tissue culture planting material, which has allowed farmers to significantly expand their banana plantations over the past few years (Fischer and Qaim 2012). In general, members seem to be better off than non-members in terms of income, education, and productive assets. The income difference may in part be caused by collective marketing, but the other differences probably rather reflect self-selection of better-off farmers into groups. This will be accounted for in the statistical analysis below.

In terms of gender, 15 % of all group members are females from female headed households. Yet, women can also become group members when they are from a male headed household, which was observed for 30 % of all group members. Thus, 45 % of all group members are female, whereas 55 % are male. In principle, also more than one person per household can formally join the groups, but this was not observed in our sample.

Regression approaches and results

In this section, we want to test the three research hypotheses explained above, in order to better understand how group membership affects gender roles and household nutrition. One issue in the statistical analysis is potential selectivity bias, because households (and individuals) self-select into farmer groups. Thus, observed differences in gender roles between member and non-member households may not necessarily be due to group membership alone, but can also be the result of preexisting heterogeneity. We will deal with this issue through various approaches, including instrumental variable (IV) techniques and inverse probability weighting with propensity scores, as is further explained below.

Control over banana production and revenue

Membership in farmer groups improves access to banana technology, training, and output markets, which increases expected profits and may lead to men taking over the banana enterprise. One possible way of analyzing this is by looking at the allocation of family labor. There is a traditional gender division of labor, with men usually carrying out the work for the initial establishment of banana plantations (e.g., land preparation, planting) and women being responsible for plantation maintenance and harvesting. In our sample, households that are members in a farmer group spend more labor days for banana production and marketing than non-member households. This is due to somewhat more intensive production patterns and a higher quantity of output to be marketed. With 57 %, the share of female labor in banana is higher in member households than in non-member households, where the female labor share is 48 %. However, this alone cannot be interpreted as an increase in female control,

Table 1 Selected household characteristics

Variable	Description	Members		Non-members		
		Mean	S.D.	Mean	S.D.	Diff.
Ln income	Natural logarithm of annual income in KShs per adult equivalent	4.12	0.06	3.70	0.05	***
Non-farm share	Share of income derived from non-farm activities	0.38	0.02	0.31	0.02	***
Land holding	Size of land owned in acres	3.22	0.21	2.05	0.18	***
Productive assets	Value of productive assets in 1000 KShs	173.16	24.98	53.81	8.32	***
Banana plot size	Total size of banana plots in acres	0.44	0.03	0.19	0.02	***
Marketed surplus	Share of marketed surplus to total banana production	0.62	0.02	0.50	0.02	***
Cash crop	Production of cash crops other than banana (e.g., tea, coffee) (dummy)	0.61	0.03	0.66	0.03	***
Schooling	Years of schooling of household head	9.27	0.27	7.82	0.28	***
Age	Age of household head in years	55.99	0.92	51.95	0.98	***
Household size	Household size in adult equivalents	4.54	0.13	4.05	0.11	***
Female head	Female headed household (dummy)	0.15	0.03	0.18	0.02	
Female membership	Female membership in a producer marketing group (dummy)	0.45	0.04	–	–	
Observations		201		243		

*, **, and *** denote significance of mean difference at the 10 %, 5 %, and 1 % level, respectively

because carrying out the work is not equivalent to decision making.[1]

In order to get a better sense of decision making, survey respondents were asked who within the household controls banana production, output (e.g., how much to sell), and revenues.[2] Using this information, we categorized as follows: (1) husband alone makes decisions, (2) husband is major decision maker after consulting with wife, (3) wife is major decision maker after consulting with husband, and (4) wife alone makes decisions. We further aggregated these categories to distinguish between male, (1) + (2), and female, (3) + (4), decision making and control.

Table 2 gives a descriptive overview. For control of production, no significant difference can be observed between members and non-members of farmer groups. While in about 50 % of the sample households, banana production is controlled by men, group membership does not seem to have an influence. This is different for the control of output and revenues. While among non-member households, in around one-third of the cases, banana output and revenues are controlled by men, this proportion is significantly higher among member households. The results in Table 2 suggest that farmer groups contribute to men taking over control of the banana enterprise. But this is not proof of a causal relationship. The observed differences between group member and non-member households could also be due to self-selection. For instance, households in which banana output is already controlled by men may be more likely to join a group.

To further analyze the net impact of group membership on control in the banana enterprise, we exploit the fact that the farmer groups were established and had started their collective marketing activities at different points in time. The left-hand panels in Fig. 1 show the proportion of group member households in which men control the banana enterprise, disaggregated by groups with longer or shorter histories of group marketing activities. A rising trend is observed, suggesting that male control increases with the time of participation in farmer groups.[3] The same trend over time is not observed among non-member households, as can be seen in the right-hand panels of Fig. 1. This analysis supports our first hypothesis that farmer groups contribute to male control over banana production and revenues.

Effects on nutrition

The centralization of banana production does not necessarily imply negative effects for women's position or household welfare, because there may be some form of intra-household compensation. While we are unable to examine such intra-household compensation due to data constraints, we analyze the impact of group membership and male

[1] In fact, more female family labor in banana production and marketing adds to women's daily workload and may potentially entail a reduction in time available for household activities such as cooking and child care. In the survey, we did not collect details of women's time allocation in non-farm activities.

[2] Such questions may potentially lead to unreliable answers if the male household head alone is asked. As mentioned above, we tried to include spouses into the interviews wherever possible. Moreover, field enumerators were carefully trained and sensitized. Thus, we reduced the probability of strategic responses.

[3] The rising trend could also be the result of more and more households with male control of banana joining farmer groups over time. However, in our sample, 94 % of the member households had joined their groups from the date of formal group establishment. Hence, later entry into existing groups is rare.

Table 2 Gendered control over banana activities

Variable	Members	Non-members	Diff.
Proportion of households in which men control production	0.50	0.52	
Proportion of households in which men control output	0.43	0.30	***
Proportion of households in which men control revenues	0.46	0.35	**

*, **, and *** denote significance of difference at the 10 %, 5 %, and 1 % level, respectively

control on household nutrition. In particular, we estimate regression models of calorie consumption and dietary quality, including group membership and male control of banana production and revenues as explanatory variables.

Undernutrition is widespread in Kenya and other countries in Sub-Saharan Africa. Moreover, nutritional deficiencies are commonplace due to low dietary diversity and quality (Ecker and Qaim 2011). In the sample

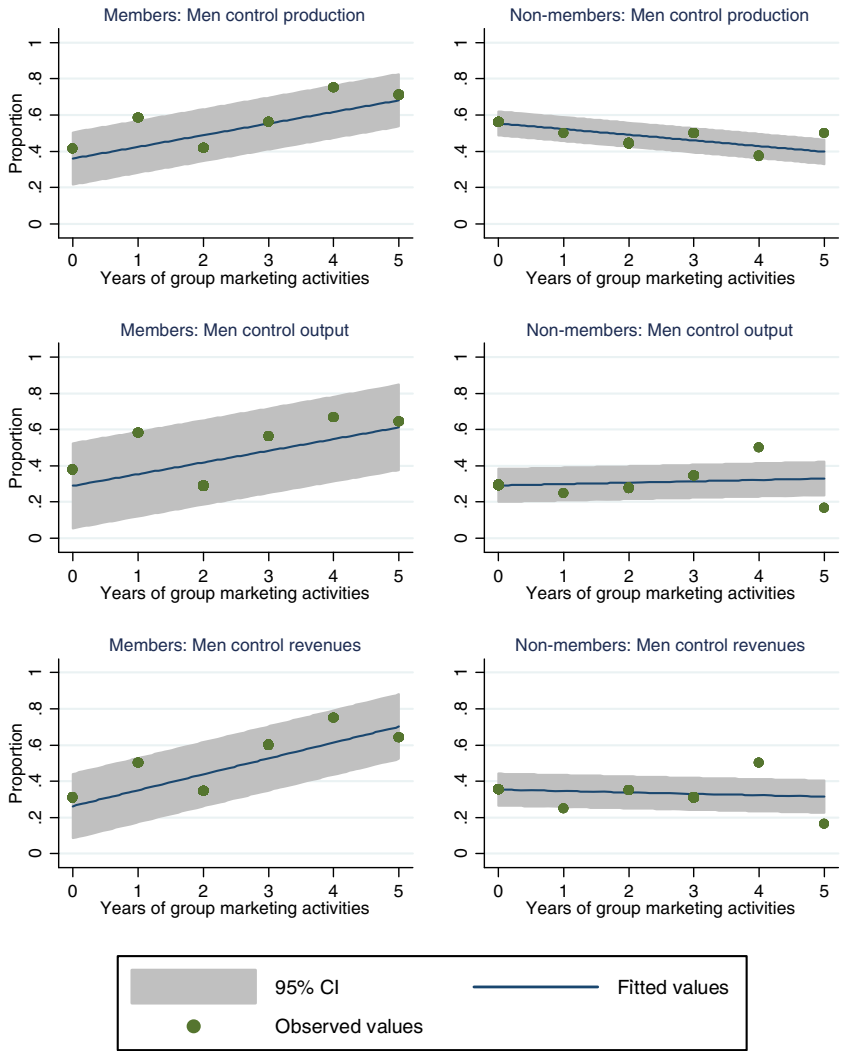

Fig. 1 Proportion of households in which men control banana production, output, and revenues. Notes: The left-hand panels refer to group member households, whereas the right-hand panels refer to non-member households. For member households, the sample is split according to the number of years of group marketing activities. Member households of groups that had been established but had not yet started collective marketing at the time of the survey are in the zero years category. Each data point shows the proportion of households in which men control banana production, output, or revenues. Fitted values are predictions based on simple linear regressions with proportion of male control as dependent and years of group marketing as independent variables (CI: confidence interval). Non-member households are split in the same way, using the number of years of marketing activities of groups that exist in the same sub-locations. Households in sub-locations without existing groups are in the zero years category. The rising trend in the left-hand panels indicates that male control increases with the time of membership and participation in farmer groups. On the right-hand side, the same trend is not observed. This comparison suggests that the increase in male control among member households is actually due to group membership rather than other factors that would have influenced non-member households, too

households, mean per capita calorie consumption is 2178 kcal per day; 52 % fall below recommended calorie levels, 34 % even fall below average calorie requirements of 1700 kcal. This is in line with official statistics for Central Kenya (KNBS 2008). For the regression analysis, we use calorie consumption per adult equivalent (AE) as dependent variable, as this takes better account of household composition and calorie needs (Deaton 1997). On average, households in our sample consume 2512 kcal per AE and day. In order to capture dietary quality, we build on an approach that was recently used by Babatunde and Qaim (2010) and measure the calories stemming from fruits, vegetables, and animal products, which are important sources of micronutrients. On average, in the sample households fewer than 30 % of the calories (733 kcal) are coming from such higher-value products. There are no significant differences between members and non-members in farmer groups, neither in terms of total mean calorie consumption nor in terms of dietary quality.

In the regression analysis, we need to account for possible issues of endogeneity due to self-selection into farmer groups. We test for this possibility by using an IV approach. As potential instruments for group membership we identified mobile phone ownership, distance to roads, and participation in other social groups, such as church or savings associations. These variables are significantly correlated with membership of farmer groups (Fischer and Qaim 2012). For distance to roads, we additionally use a square term as instrument, because road distance affects group membership in a non-linear way.[4]

To be valid, the instruments also need to be uncorrelated with the outcome variables. To test for this and eliminate possible indirect effects through the instruments' influence on group membership, we took advantage of our sampling frame. In particular, we estimated models of calorie consumption and dietary quality, including the instruments but only using observations from the sub-locations where no farmer groups operate yet (households not exposed to farmer groups). We found no indication for significant direct effects of the instruments, except for participation in other social groups, which affects dietary quality (Table 6 in the Appendix). Hence for this model we did not use participation in other social groups as an instrument. Additional tests with the full sample confirmed that there are no problems of overidentification.

Using these instruments, we ran the Durbin-Wu-Hausman test of endogeneity. The F-values of 3.25 (p= 0.36) and 0.70 (p=0.71) suggest that the null hypothesis of no correlation between group membership and the error term cannot be rejected in the calorie consumption and dietary quality model, respectively. We conclude that there is no bias stemming from unobserved factors. Hence, for the analysis we use group membership as observed, instead of instrumenting this variable.

However, there may potentially be other sources of bias caused by omitted variables. In the descriptive statistics above we saw that members in farmer groups are better off than non-members in terms of asset ownership. One way of avoiding estimation bias is to include different asset variables into the calorie consumption and dietary quality models directly. Another way, which we prefer to keep the models more comprehensible, is inverse probability weighting (Nichols 2007). For this, we first derive propensity scores for group membership, using a probit model. In this probit, we include assets – such as the number of large livestock, the value of agricultural equipment, and ownership of motor vehicles – and other socioeconomic covariates. Following Nichols (2007), inverse probability weights are then calculated as:

For members:

$$w_T = \frac{1}{\lambda} * \frac{p}{(1-p)}$$

For non-members:

$$w_C = \frac{1}{(1-\lambda)}$$

where λ is the propensity score, and p is the proportion of the sample receiving group "treatment". We rescaled the weight for members by $\frac{p}{(1-p)}$ to preserve proportions in treatments. The weights are used as analytical weights in the regressions.

Table 3 reports the estimation results. As expected, income has a positive effect in both models. We use a log-transformation of the income variable, because the calorie-income relationship is non-linear. The non-farm income share has a significant positive impact on calorie consumption, but not on dietary quality. The same holds true for farm size (land holding). Each additional acre of land owned increases daily calorie consumption by 49 kcal per AE. On the other hand, banana plot size and the production of cash crops other than banana have a positive effect on dietary quality. Cash crop production increases daily calorie consumption from high-value foods by 83 kcal per AE.

[4] Variables capturing male control over production, output, and revenue may potentially also be correlated with the error term. Instead of directly including group membership into the nutrition regressions, one could also think of structural models where a set of exogenous variables explains group membership in a first stage, which explains male control in a second stage. The endogenous male control variables would then be used as explanatory variables for calorie consumption and dietary quality in a third stage. Unfortunately, we could not identify proper instruments to estimate such structural models.

Table 3 Determinants of household nutrition

	Calorie consumption		Dietary quality	
	Coefficient	SE	Coefficient	SE
Group membership	101.89	112.03	−20.46	31.69
Male control over banana production	−40.21	93.22	8.43	47.99
Male control over banana output	59.70	221.09	148.05*	79.11
Male control over banana revenues	−35.08	218.88	−159.65**	61.33
Ln income	169.60***	55.27	143.94***	33.48
Non-farm share	567.29***	200.72	33.02	68.79
Land holding	48.70***	16.07	8.41	7.76
Banana plot size	13.30	152.84	242.90*	137.45
Marketed surplus	207.83	141.74	−5.15	63.1
Cash crop	119.77	78.45	82.77***	23.74
Schooling	−4.98	10.43	2.38	4.36
Age	−3.90	3.81	0.42	1.33
Household size	−292.10***	19.67	−105.26***	13.1
Constant	2,960.01***	286.08	589.80***	148.31
District fixed effects[a]	Yes		Yes	
Observations[b]	433		433	
R-squared	0.42		0.45	

*, **, *** denote significance at the 10 %, 5 %, and 1 % levels, respectively. Standard errors (SE) are robust and cluster corrected by sub-location. The dependent variables are total calories consumed and calories consumed from high-value products, both measured in kcal per AE and day

[a]District dummies included in estimation to control for district fixed effects

[b]Eleven out of 444 observations were dropped, because no bananas were harvested in the survey year

Group membership as such does not seem to have a significant impact on calorie consumption. Nor does male control over production, output, and revenue affect total calorie consumption. However, male control over output has a positive and male control over revenues has a negative and significant effect on dietary quality. Holding other things constant, male control over cash revenues decreases calories consumed from high-value products by 160 kcal per AE and day. This is plausible, because the cash spending behavior of males and females is often different (Hoddinott and Haddad 1995). Women tend to care more for a balanced diet and nutritional diversity, which is reflected in the way they allocate cash resources for consumption. The combined effect of group membership on nutrition is therefore ambiguous. On the one hand, group membership increases the tendency of male control over revenues with a negative marginal effect on nutritional quality. On the other hand, group membership contributes to higher household income with a positive effect on nutrition. Hence, searching for mechanisms to realize the positive but avoid the negative effects is important from a broader welfare and equity perspective. This is addressed in the following section.

Female group membership and income share

We now analyze how the tendency towards male control can potentially be reduced or avoided. For this, we estimate several regression models with different dependent variables. In the first model, the dependent variable is a dummy, taking a value of one if women control banana revenues and zero otherwise. This is estimated as a probit. In the second model, the share of female-controlled banana income to total household income, measured in percentage terms, is taken as dependent variable. Both cash revenues and subsistence income are counted here. We suppose that a larger female-controlled share is associated with a stronger role of women in decision making. In the third model, the female-controlled share of home-consumed bananas in total subsistence income is used, and in the final model, the female-controlled share of banana cash revenues in total household cash revenues is taken as dependent variable.

As explanatory variables, we use membership in banana farmer groups, regardless of who in the household is registered as member. Furthermore, we use a dummy for female membership, next to a number of control variables. Both membership and female membership may potentially be endogenous, for which we test using IV regressions. As above, we use mobile phone ownership, distance to paved roads, and participation in other social groups as instruments for group membership. Female membership is instrumented with age and education of the female household head or the spouse of the male head, which proved to be significant determinants. Table 7 in the Appendix, which shows regressions for the subsample of households not exposed to groups, confirms that these instruments do not influence the outcome variables directly. One exception is road distance and distance squared, which we therefore omit as instruments in the total household income share model. Results of the Durban-Wu-Hausman test show that group membership and female membership are not endogenous (Table 4). To control for potential

Table 4 Test statistics for IV regressions

Outcome variables	Group membership				Female membership			
	Test of endogeneity		Overidentifying restrictions		Test of endogeneity		Overidentifying restrictions	
	F-value	*P*-value	Chi^2	*P*-value	*F*-value	*P*-value	Chi^2	*P*-value
Female control over banana revenues	0.09	0.77	0.25	0.97	0.73	0.40	0.79	0.37
Female share in total household income	0.34	0.57	0.30	0.58	0.00	0.95	0.00	0.94
Female share in total subsistence income	0.61	0.44	2.56	0.47	0.78	0.39	0.20	0.65
Female share in total cash income	0.01	0.92	0.11	0.74	0.22	0.64	1.29	0.26

omitted variable bias, we use an inverse probability weighting procedure, as explained above.

The estimation results for all four models are shown in Table 5. Group membership has a negative effect on the probability and share of female-controlled banana income in total income, which further supports our first hypothesis. Holding other things constant, the female-controlled share decreases by 8–11 percentage points. However, female membership offsets this negative effect, as indicated by the significantly positive coefficients in similar absolute magnitude. That is, women who are themselves members of a banana farmer group have a higher likelihood of keeping control over banana output and revenues, also leading to a higher female-controlled share in total income. These results support our third research hypothesis.

There are some further interesting results in Table 5. In order to analyze differential gender effects by household income, we include interaction terms between group membership and income quintiles into the models. The first quintile includes the poorest 20 % of households. The fifth quintile with the richest 20 % is excluded and therefore constitutes the reference. Noteworthy is that most of the coefficients of these interactions terms are positive, and some of them are significant. This implies that group membership has a less negative effect on the share of

Table 5 Determinants of women's control over banana revenues and share in household income

	(1) Control over revenues (Probit)	(2) Share in total household income	(3) Share in total subsistence income	(4) Share in total cash income
Group membership	−0.85*** (0.30)	−8.74** (3.48)	−10.11** (3.71)	−11.08*** (3.62)
Female membership	1.19*** (0.26)	10.88*** (3.47)	9.83*** (3.29)	10.34*** (3.47)
Group membership*1st income quintile	0.22 (0.34)	15.17*** (5.43)	11.68** (4.49)	16.78*** (5.39)
Group membership*2nd income quintile	−0.46* (0.27)	4.01 (3.02)	0.52 (2.97)	3.68 (2.94)
Group membership*3rd income quintile	0.15 (0.40)	4.41 (3.55)	3.41 (3.42)	3.79 (2.56)
Group membership*4th income quintile	0.75*** (0.26)	3.27 (2.53)	5.06* (2.93)	7.14*** (2.39)
Land holding	−0.01 (0.02)	−0.46** (0.19)	−0.79*** (0.20)	−0.33* (0.18)
Banana plot size	−0.40 (0.26)	6.15 (4.24)	2.72 (3.61)	8.89** (4.09)
Household size	0.03 (0.03)	−0.37 (0.36)	−0.14 (0.31)	−0.34 (0.29)
Female self-employment	0.01 (0.22)	−2.94 (1.74)	−4.74*** (1.61)	−3.23* (1.75)
Female outside employment	0.20 (0.25)	−3.00** (1.42)	−2.77 (2.08)	−1.98 (1.98)
Participation in women's groups	−0.33* (0.17)	1.35 (0.88)	−0.29 (1.34)	0.61 (0.73)
Constant	0.42 (0.36)	6.03*** (1.53)	8.99*** (2.15)	3.71*** (1.29)
District fixed effects[a]	Yes	Yes	Yes	Yes
Observations[b]	432	432	432	432
(Pseudo) R-squared	0.14	0.25	0.16	0.26

*, **, *** denote significance at the 10 %, 5 %, and 1 % levels, respectively. Standard errors, shown in parentheses, are robust and cluster corrected by sub-location. The income shares used as dependent variables in models (2) to (4) are measured in percentage terms.

[a] District dummies included in estimation to control for district fixed effects

[b] Twelve out of 444 observations were dropped because there was no female household member

female-controlled income in lower income households, as compared to the richest quintile. The coefficients for the poorest quintile are especially large; they are even somewhat bigger than the group membership coefficients in absolute terms, implying that the negative gender effect of group membership is avoided completely. If women in these poorest households are group members themselves, their role and income control even seems to increase significantly.

Farm size is negatively related to female-controlled income share, which is probably due to a higher degree of commercialization and centralization on relatively larger farms. Banana plot size has a positive effect on female-controlled cash income share (model 4), underlining the traditional importance of women in the banana crop. Table 5 also includes two dummy variables capturing female employment in non-agricultural activities. Female self-employment takes a value of one if the relevant female (female household head or spouse of male head) has an own non-agricultural micro-business. Female outside employment takes a value of one if the female is employed in non-agricultural activities outside the household. The coefficients for these dummies are positive but insignificant in model (1). They are negative and some of them are significant in models (2) to (4). This is plausible: when women have income sources outside of agriculture, their focus on the banana enterprise is somewhat reduced.

Conclusion

With the commercialization of agriculture, women are increasingly disadvantaged because of persistent gender disparities in access to productive resources. When new marketing or technological opportunities emerge, farm production is often centralized under men's control. This can have negative implications for women's ability to generate income as well as for overall household welfare. Farmer collective action, which has recently received renewed policy attention as a mechanism to improve access of small farms to markets and technologies, could potentially accelerate this trend.

We have analyzed data from small-scale banana producers in Kenya to investigate the gender implications of farmer groups, which were recently established to promote innovation and commercialization in the banana sector. Traditionally, banana has been a women's crop in Kenya. Our results confirm the hypothesis that farmer groups contribute to increasing male control over banana production and revenues. Furthermore, while male control over revenues does not affect total calorie consumption, it has a negative marginal effect on dietary quality. This suggests that the gains from centralization are not shared equally within the household. Finally, we have shown that the negative gender implications of farmer groups can be avoided when women are group members themselves. In the poorest income quintile, group membership even seems to have a positive effect on female-controlled income share.

We have tried to control for issues of endogeneity and self-selection, but a perfect elimination of potential bias is difficult with the cross-section data available. The collection and use of panel data would be an interesting avenue for future research in this direction. Too broad generalizations should also be avoided because of the situation-specificity of the results. Apart from considerable heterogeneity between countries and regions in terms of socioeconomic conditions and gender roles, group structures, objectives, and details of collective activities may differ substantially from case to case.

Nonetheless, some cautious broader conclusions may be permissible. First, collective action and other interventions set out to promote market access for smallholders can change gender relations to the detriment of women. Second, gender mainstreaming can avoid and reverse this trend. In particular, if women are members in farmer groups themselves, this can contribute to empowerment and a better position in intra-household bargaining. But female membership is not only a question of legal rules. The formation of farmer groups is often facilitated by outside field officers, who are mostly male and may have a preference to communicate with male farmers. Moreover, due to high opportunity costs of time and more severe market access constraints, the benefit-cost ratio of group participation may be lower for women than for men. Groups that are better targeted to the needs of women farmers may increase the likelihood of female participation. For instance, group-organized microcredit schemes, input acquisition, or transport services may ease some of the specific constraints.

In conclusion, farmer groups have the potential to promote smallholder commercialization in a gender equitable way. But this potential has not yet been fully tapped in the case analyzed here. Further research is necessary to gain a deeper understanding of the trends in different settings and to help design mechanisms towards gender mainstreaming in collective action.

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Appendix

Table 6 Determinants of household nutrition (subsample of farmers not exposed to farmer groups)

	Calorie consumption		Dietary quality	
	Coefficient	SE	Coefficient	SE
Mobile phone (dummy)	−37.93	197.49	−44.19	53.39
Distance to paved road	1.09	54.51	−25.11	18.61
Distance squared	0.90	3.07	1.84	1.31
Social participation (dummy)	30.76	120.05	145.69*	67.84
Male control over production	−83.99	137.50	−29.99	41.90
Male control over output	9.28	353.91	256.09**	95.94
Male control over revenues	−31.38	355.44	−124.02	85.19
Ln income	326.03***	79.82	281.97***	50.81
Non-farm share	621.74	364.25	281.15	200.89
Land holding	−3.45	50.20	10.78	23.72
Banana plot size	−157.75	589.97	276.52	282.02
Marketed surplus	424.94	325.46	−253.72	148.42
Cash crop	205.34	198.64	−34.83	61.77
Schooling	−16.32	19.21	1.32	6.25
Age	−4.13	5.05	0.79	3.38
Household size	−320.54***	44.76	−82.80**	27.98
Constant	2,517.43***	757.42	−48.91	253.70
District fixed effects	Yes		Yes	
Observations	105		105	
R-squared	0.58		0.65	

*, **, *** denote significance at the 10 %, 5 %, and 1 % levels, respectively. Standard errors (SE) are robust and cluster corrected by sub-location

Table 7 Women's control over banana revenues and share in household income (subsample of farmers not exposed to farmer groups)

	Control over revenues	Share in total household income	Share in total subsistence income	Share in total cash income
Mobile phone	−0.01 (0.12)	−0.01 (1.73)	−2.11 (5.40)	1.18 (3.87)
Distance to paved road	0.01 (0.03)	−1.17** (0.43)	0.16 (0.84)	−0.38 (0.33)
Distance squared	−0.00 (0.00)	0.05* (0.02)	−0.03 (0.05)	−0.01 (0.03)
Social participation	0.11 (0.18)	0.38 (2.36)	0.60 (5.47)	−1.18 (4.58)
1st income quintile	−0.07 (0.28)	5.96* (3.18)	15.35* (7.08)	7.16 (4.00)
2nd income quintile	−0.04 (0.26)	5.71 (3.35)	6.48 (4.81)	4.71 (2.57)
3rd income quintile	−0.08 (0.24)	0.70 (0.98)	3.61 (4.57)	−0.37 (0.80)
4th income quintile	0.03 (0.25)	1.88 (1.88)	1.59 (3.59)	−1.35 (1.26)
Land holding	−0.07 (0.28)	5.96* (3.18)	15.35* (7.08)	7.16 (4.00)
Banana plot size	−0.04 (0.26)	5.71 (3.35)	6.48 (4.81)	4.71 (2.57)
Household size	−0.08 (0.24)	0.70 (0.98)	3.61 (4.57)	−0.37 (0.80)
Age of female	0.03 (0.25)	1.88 (1.88)	1.59 (3.59)	−1.35 (1.26)
Schooling of female	−0.07 (0.28)	5.96* (3.18)	15.35* (7.08)	7.16 (4.00)
Female self-employment	−0.04 (0.26)	5.71 (3.35)	6.48 (4.81)	4.71 (2.57)
Female outside employment	−0.08 (0.24)	0.70 (0.98)	3.61 (4.57)	−0.37 (0.80)
Participation in women's groups	0.03 (0.25)	1.88 (1.88)	1.59 (3.59)	−1.35 (1.26)
Constant	0.25 (0.48)	3.06 (8.54)	2.01 (13.81)	0.12 (8.79)
District fixed effects	Yes	Yes	Yes	Yes
Observations	101	101	101	101
R-squared	0.15	0.30	0.29	0.25

*, **, *** denote significance at the 10 %, 5 %, and 1 % levels, respectively. Standard errors, shown in parentheses, are robust and cluster corrected by sub-location

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