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Linking Smallholders to Markets: Determinants and Impacts of Farmer Collective Action in Kenya

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Summary. *This article investigates determinants and impacts of cooperative organization, using the example of smallholder banana farmers in Kenya. Farmer groups are inclusive of the poor, although wealthier households are more likely to join. Employing propensity score matching, we find positive income effects for active group members. Yet price advantages of collective marketing are small, and high-value market potentials have not yet been tapped. Beyond prices, farmer groups function as important catalysts for innovation adoption through promoting efficient information flows. Some wider implications are discussed under what conditions collective action is useful, and through what mechanisms the potential benefits emerge.*

Key words: agricultural markets, smallholder farmers, collective action, cooperative organization, Kenya, East-Africa

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1 INTRODUCTION

Many of the world's poor still directly or indirectly depend on agriculture for their livelihoods, most of them as small-scale farmers. Besides building up farmers' production capabilities, improving their access to markets has become a key element in strategies to promote rural development and poverty reduction. In order to be successful, development programs have to address the multiple market failures that the small farm sector suffers from (Jayne et al. 2010). In particular, small-scale farmers face many constraints that impede them from taking advantage of market opportunities. Often living in remote areas with poor infrastructure, they face high transaction costs that significantly reduce their incentives for market participation (Omamo 1998; Key et al. 2000; Barrett 2008). This holds true for both agricultural input and output markets. In addition, small farms with little assets often have limited access to services, including effective extension and rural credit, which are important preconditions for upgrading production systems (Wiggins et al. 2010, Reardon et al. 2009).

Farmer groups, cooperatives, and similar forms of collective action are one form to reduce many of the problems associated with high transaction costs (Valentinov 2007; Markelova et al. 2009). The promotion of farmer collective action through outside assistance has recently re-gained popularity in the context of the agri-food system transformation (e.g., Narrod et al. 2009), which is characterized by a growing role of supermarkets and high-value exports. Emerging high-value chains often involve strict standards and new procurement systems of agribusiness companies – factors that may further exacerbate market access for small farms (Reardon et al. 2009).

While there is much evidence indicating that smallholders are unable to compete in high-value markets, there are also examples where they successfully participate through collective action and institutional support (Narrod et al. 2009). For example, Roy and Thorat (2008) showed that in India marketing cooperatives for grapes reduced transaction costs and contributed to a better bargaining position of smallholders vis-a-vis foreign traders. For the dairy sector in Ethiopia, Holloway et al. (2000) demonstrated the positive role of cooperative marketing for small

producers. Wollni and Zeller (2007) found that coffee cooperatives in Costa Rica facilitated small-scale growers' participation in specialty markets with higher prices. However, these examples cannot simply be generalized. There are also cases where collective action did not improve the farmers' situation and where groups dissolved after disappointing experience (Markelova et al. 2009; Poulton et al. 2010). Clearly, there is a need to better understand under what conditions and for whom collective action is useful, and through what mechanisms the potential benefits emerge.

This article contributes to the literature by analyzing the example of farmer groups in the Kenyan banana sector. In particular, we add to the research direction in three ways. First, we provide insights into the determinants of group participation. This allows us to draw implications on the group outreach, or inclusiveness. For example, understanding whether marginal farmers are also motivated to join is important from a poverty perspective. Second, we investigate impacts of group participation at a wider scale. Previous studies have mostly focused on impacts in terms of access to output markets, output prices, and farm profits. We extend this focus and also analyze the effects of group participation on access to information and innovation, input intensification, commercialization, and broader household welfare. This is important in order to grasp dynamic potentials, especially when groups are still relatively young. Third, we distinguish between different intensities of group participation, because membership per se may not determine impacts when members participate in group activities to varying degrees.

Bananas in Kenya are an interesting example. In the regional context, the crop is gradually transforming from a subsistence food crop to a cash crop for small-scale farmers. Banana also has the potential to penetrate higher-value domestic and export markets, although this has not yet happened at a large scale. With outside assistance by international non-governmental organizations (NGOs), farmer groups were recently formed, in order to promote innovation and improve market access (Acharya and Alton Mackey 2008). Our analysis is based on a cross-section survey of members and non-members of such farmer groups. For the impact assessment, we use propensity score matching to correct for selection bias.

The article is organized as follows. In section 2, we briefly discuss organizational theory as a conceptual basis for the advantages and disadvantages of cooperative organization in a small farm context. In the same section, we also provide some further background on the Kenyan banana sector. In Section 3, we describe the survey data and the methodological approach. The estimation results are presented and discussed in section 4, while section 5 concludes.

2 BACKGROUND

(a) *Family farms and the role of cooperative organization*

Organizational theory provides the conceptual basis for explaining the role of cooperative organization and its importance in agriculture. Despite substantial structural change in global agri-food systems over the last decades, family farms continue to dominate the agricultural sector, even in developed countries. Compared to larger, hierarchically organized enterprises, family farms have lower internal transaction costs through their ability to minimize the costs of supervision and monitoring of labor. This is so, because more family than hired labor is employed, and family labor is usually characterized by higher levels of intrinsic motivation and loyalty (Pollak 1985). However, there are also two major disadvantages for small family farms when considering their interactions with upstream and downstream agents. First, small farm sizes are associated with higher external transaction costs, because economies of scale in buying inputs and selling outputs cannot be realized. Second, higher degrees of concentration in upstream and downstream markets can lead to asymmetries in market power. This makes small family farms more vulnerable to opportunistic behavior. These problems are particularly severe in developing countries, where institutions and physical infrastructure are often weak.

Hence, hierarchical organization is too costly for production activities, while market organization is too costly for marketing activities (Valentinov 2007). This provides a functional niche for hybrid organizations that allow the combination of hierarchical and market mechanisms and help to make family farms a viable option. Cooperative organizations can economize on external transaction costs and build up countervailing market power. Cooperative

organizations, such as farmer groups, may take over responsibilities for agricultural extension, input provision and distribution, bulking, grading, selling, and even processing. The relevance of collective action may potentially increase with agricultural development, because more intensive use of purchased inputs and higher degrees of commercialization increase the number of market transactions. Moreover, modernizing supply chains are often associated with tighter product and process-related quality and food safety standards. These factors can add to external transaction costs, and the observed tendency towards vertical supply chain integration may also further aggravate power asymmetries (Reardon et al. 2009; Wiggins et al. 2010). In such situations, collective action is likely to improve market access for smallholders (Holloway et al. 2000).

On the other hand, agricultural development is often associated with improved physical infrastructure and institutions, reducing external transaction costs and potentially also lowering incentives for collective action. More generally, the disadvantages of family farms vary across different production systems and institutional contexts, which determines the extent of benefits that can be achieved through cooperative organization (Valentinov 2007). The establishment and sustainability of cooperative organizations is often conditioned on external support, for example by NGOs, government agencies, or private businesses. Moreover, cooperative organization itself induces transactions costs related to internal governance and incentive problems. While small groups are more likely to achieve internal cohesion, large groups can realize higher economies of scale, which is particularly important for marketing and processing functions (Stringfellow et al. 1997). Hence, there is need to further analyze under what conditions and in what form collective action makes sense for small-scale farmers in developing countries.

(b) *Cooperative organization in the Kenyan banana sector*

Recent developments in the Kenyan banana market provide an interesting example to analyze determinants and impacts of cooperative organization. Banana and plantains are among the four most important staple food crops and an important source of income for millions of people in developing countries (Arias et al. 2003). In contrast to large-scale export-oriented banana production in Latin America, the majority of the banana growers in East Africa are small-scale farmers who produce for own consumption and domestic markets. Traditionally, banana in Kenya was seen as a security crop, because it provides continuous food supply and cash income even under low input regimes (Qaim 1999). This is gradually changing, however. Although banana yields are still quite low – mostly due to poor crop management, low input levels, and use of inferior planting material – the crop's commercial potential is increasingly being recognized.

With continuing urbanization, a growing middle class, and the expansion of supermarkets, the demand for high-quality dessert banana is growing in Kenya. Hence, over the past few years smallholder producers have become more reliant on the cash income generated from banana sales. This has occurred especially in areas where farmers saw their incomes from coffee and other traditional cash crops decline (Wambugu and Kiome 2001). However, unlike coffee, for which marketing is usually done through cooperatives, bananas are mostly marketed individually; the majority of the farmers sell to traditional traders at the farm gate. Despite reported trends on the transformation of procurement systems and tighter vertical integration (Reardon et al. 2009; Neven et al. 2009), Kenyan supermarkets still largely source bananas from wholesalers.

Recognizing the problems of low banana yields, increasing commercial potential, and farmers' limited access to high-value markets, efforts have been started by the Kenyan government and different development agencies to improve the situation through dissemination of better planting material and related measures. One of these initiatives was launched by Africa Harvest and TechnoServe – two international NGOs. Since 2003, Africa Harvest and TechnoServe have

encouraged banana farmers to establish groups, in order to facilitate access to clean planting material, extension, and marketing (Acharya and Alton Mackey 2008). Thus, during the past few years, several thousand small-scale banana growers in the central highlands of Kenya became organized in farmer groups.

One tangible benefit of these farmer groups is improved access to tissue culture (TC) planting material for banana. Traditionally, bananas in Kenya are propagated by suckers from old plantations, a procedure through which pests and diseases are spread. In contrast, TC bananas are propagated in the lab, so that the plantlets are pathogen-free. However, buying TC plantlets instead of using suckers is more expensive, and successful innovation adoption also requires certain changes in traditional banana cultivation practices (Qaim 1999). Africa Harvest links farmer groups to TC labs and nurseries and also provides technical advice on proper plantation establishment and maintenance through regular group sessions.

TechnoServe concentrates on the marketing side. Through the organization of group marketing days, middlemen are excluded and farmers are directly linked to wholesalers from urban centers. On the marketing days, group members are invited to deliver their bananas to designated collection centers, where the bunches are weighed, graded and picked up by wholesale traders. While farmers have to pay a certain fee for group membership, they keep individual accounts; that is, sales revenues are distributed according to actual delivery. There are also plans to directly link banana farmers to high-value markets, including supermarkets, processing companies, or exporters, but these plans have not yet materialized.

3 DATA AND METHODOLOGY

(a) *Household survey*

The data used in this study were collected in June and July 2009 in the central highlands of Kenya. Using a carefully designed and tested questionnaire, we conducted structured, household-level interviews with banana growers in the districts of Muranga, Nyeri, Embu, and

Meru. These districts are all located within the same agro-ecological zone, have similar access to road infrastructure, and are classified as high-potential banana-growing areas. We randomly sampled banana growers who are members of farmer groups as well as non-members for comparison.

In order to select members, we first obtained a complete list of 240 banana farmer groups; out of these, 17 groups were randomly selected, which were located in different sub-locations. Within 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 to the initiative and might potentially be affected by spillover effects. In order to have a more robust control group, we further identified 10 sub-locations in the same districts but without any group activities. In these control regions, we randomly selected another 106 banana growers.

Thus, the total sample consists of 444 banana-growing households, including group members, non-members in regions where groups operate, and farmers (non-members) in control regions where no groups operate. As agroecological and socioeconomic conditions vary across different banana-growing areas of Kenya (Qaim 1999), our sample is not representative for the country as a whole. But it is representative for members and non-members of banana farmer groups in the central highlands of Kenya. Sample descriptive statistics are provided further below.

(b) *Methodology for analyzing determinants of group participation*

Our first objective is to identify determinants of farmer group participation. Participation is associated with potential costs and benefits, which may be perceived differently by different households. Costs involve membership fees, time to participate in group activities, and transportation costs to deliver bananas to the collection centers, whereas the benefits are mostly in terms of better access to input and output markets, including technology and information. The individual decision to participate can be modeled in a random utility framework, which is a

common approach to analyze innovation adoption under uncertainty (Feder et al. 1985; Marra et al. 2003). Hence, group participation can be modeled as a binary choice decision, assuming utility maximization subject to household resource constraints (Manski 1977). The actual utility level of each individual farmer U_i is not observed. The part of the utility function that is observable can be expressed as a function of a vector of exogenous variables X_i and a vector of parameters β to be estimated:

(1) $$V_i(\beta X_i) \text{ , where } U_i = V_i(\beta X_i) + u_i$$

The unobservable part of the farmers' utility is represented by an error term u_i and assumed to be independently and identically distributed with mean zero. The farmer will choose to participate if the utility U_i^c derived from group participation is higher than the utility U_i^f derived from non-participation.

The probability of a farmer being a member of the group is given by $P(u_i < \beta X_i)$. Hence, , the participation model to be estimated is:

(2) $$P(C = 1) = P(u_i < \beta X_i) = \beta X_i + u_i,$$

$$\text{where } C_i = 1 \text{ if } U_i^c > U_i^f \text{ and } C_i = 0 \text{ if } U_i^c < U_i^f.$$

Farmers face different transaction costs that stem from asymmetries in access to assets, information, services, and markets, leading to different market behavior (Barrett 2008; Key et al. 2000). The farmer's choice whether to join the group depends on the comparison of benefits and costs, hence on individual comparative advantage. This binary choice model can be estimated with a probit specification. To identify explanatory variables, we draw on the existing literature.

Supporting the hypothesis that human capital increases "the ability to perceive, interpret, and respond to new events" (Schultz 1982), education and age, both proxies for human capital, are included in our analysis. Since we expect openness to innovations to decrease with old age, we also include a squared term of age. Physical assets, such as financial capital, land and labor, are other important factors of innovation adoption (Boahene et al. 1999). Cash is needed to buy agricultural inputs or TC planting material. Although group members are not required to adopt

particular new technologies, improved access to TC planting material and related extension is one of the advantages of membership on the production side. Furthermore, farm size can play a role, because larger land holdings contribute to lower average fixed costs of membership. Sufficient labor availability is required for participating in direct group activities. And, with the upgrading of farm management practices the amount of labor required is likely to increase, too. We use physical assets such as land holding, value of agricultural equipment, number of cattle owned, access to credit, and non-farm employment as proxies for physical capital endowment and access to finance. Household size is used to measure labor availability. As increased land-tenure security has been found to increase investment incentives (Besley 1995), we also include a variable for property title into our group participation model.

Even though selling bananas collectively is not an obligation for group members, it is one of the major expected benefits on the marketing side. Hence, the decision to join a group is also a decision between selling individually at the farm gate and selling collectively at the collection center. Selling collectively may be associated with higher prices, but delivering to the collection center also involves a cost. In a similar context, Fafchamps and Hill (2005) found that output quantity sold and proximity to the collection center positively influences the likelihood of traveling to a market. We use the size of the banana plantation as a proxy for quantity sold. In order to avoid problems of endogeneity, we asked farmers for their banana holding five years ago, before farmer group activities had started. Collection centers are typically located near paved roads, so that distance to the nearest paved road is also included as an explanatory variable. Furthermore, we use ownership of a donkey cart and motorized vehicle as indicators for transportation costs.

Gender can also influence a farmer's choice to participate in groups. Women may have different opportunities, motivation and capabilities than men to engage in collective action (Pandolfelli et al. 2007). For example, in the case of group-based extension approaches, women are often neglected, because male extension agents prefer working with male landowners (Doss 2001). Because of their reproductive responsibilities in addition to farming, women may also have

higher opportunity costs of time, which may reduce their incentives for participation (Meinzen-Dick and Zwarteveen 1998). We include a dummy for female headed households to account for possible gender effects.

And finally, the efficiency of information flows may influence the decision to join a group. Empirical evidence shows that individual social networks are often relevant for the adoption of technologies and other innovations among smallholder farmers (Boahene 1999; Matuschke and Qaim 2009; Conley and Udry 2010). We account for this by considering whether or not a farmer participates in other community-based groups (e.g., church groups, savings clubs). Moreover, we include a dummy for mobile phone ownership, because mobile phones can reduce the cost of information exchange substantially. This is especially true in the context of central Kenya, where households belonging to one community are not located in a central village place, but are scattered in the countryside.

(c) *Methodology for analyzing impacts of group participation*

Our second objective is to estimate impacts of farmer group participation on various variables of interest. These variables are explained further below. Here, we first elaborate on the methodology of estimating unbiased treatment effects. We are interested in how participation affects the outcome for those who have decided to join a group; hence, we want to estimate the average treatment effect on the treated (ATT). However, since we cannot observe how the outcome levels would have looked like without participation, we face the problem of missing data on the counterfactual. The challenge is to identify a suitable control group among those farmers who have not participated, which can be used as a counterfactual. Due to non-random self-selection into farmer groups, we cannot simply compare outcomes of members and non-members, but need to account for self-selection bias.

There are two potential sources of bias in assessing the impact of group participation. First, group members may differ from non-members with respect to observed characteristics, such as education, wealth, etc. We control for observed characteristics by using Propensity Score

Matching (PSM). The main idea of PSM is to construct a suitable comparison group with non-member individuals that are similar to group members in all relevant observed characteristics (Caliendo and Kopeinig 2008). Second, members may differ with respect to unobserved characteristics, such as motivation. While PSM cannot control for bias due to unobservables, we test the robustness of the impact results through alternative specifications of the participation model.

Applying a PSM approach, the effect of group participation is modeled in two stages. In the first stage, we generate propensity scores $P(X)$ from the probit model of group participation, which indicate the probability of a farmer to participate. Then we construct a control group by matching group members to non-members according to their propensity scores. Members for whom an appropriate match cannot be found, as well as non-members not used as matches, are dropped from the further analysis. In the second stage, we calculate the ATT of group participation on outcome variable Y using matched observations of members and non-members. The PSM estimator of the ATT is the difference in outcomes between treatment and control group appropriately matched by the propensity score:

$$\tau_{ATT}^{PSM} = E_{P(X)|C=1}\{E[Y(1)|C=1, P(X)] - E[Y(0)|C=0, P(X)]\}. \quad (3)$$

We consider a broad set of outcome variables, in order to understand group impacts and dynamic potentials from a wider perspective. We use the size of the banana plot, plot size changes over the past five years, and the share of banana in household income, to assess impacts on crop specialization. Share of banana sold is used to capture potential effects on commercialization. To measure the impact of groups on technology adoption, we use a TC adoption dummy. Moreover, we look at the quantity of inputs used, such as family and hired labor, fertilizers, and pesticides. Farmer group effects on productivity and quality are captured through yield per acre and average bunch weight (larger bunches are preferred by traders). Finally, we analyze differences in banana gross margins and total annual household income, to assess potential welfare effects of group participation.

4 RESULTS AND DISCUSSION

(a) *Descriptive statistics*

Table 1 reports sample mean values for group members, non-members in the same regions, and farmers (non-members) in control regions where no groups operate. On average, group members are wealthier in terms of land and various other assets owned than farmers in the two non-member categories. They are also slightly older and better educated. This hints at a positive selection bias in farmer group participation; better-off farmers are more likely to join groups. Nonetheless, for many of the variables the differences between members and non-members are relatively small. Members can still be considered small-scale farmers; their average farm size is only 3.22 acres.

[TABLE 1]

Control regions without farmer group activities were specifically sampled to have similar characteristics as the "treatment regions" in terms of agro-ecological and infrastructure conditions. We performed tests on the inequality of variable means between non-members in the treatment and control regions. We found significant differences with respect to the number cattle owned, membership in other groups, and distance to the nearest paved road, where farmers in control regions have higher values than non-members in treatment regions. This is plausible, because farmers in control regions could not self-select into group membership. For all other variables, differences are not statistically significant, so that we conclude that farmers in treatment and control regions are generally similar and comparable.

(b) *Determinants of group participation*

We now estimate the probit model of farmer group participation, as described above. Since farmers in control regions did not have the chance to participate, the sample for this estimation is confined to group members and non-members in treatment regions. The results are shown in Table 2.The size of the land holding has a positive and significant effect on the probability of

participation; each additional acre of land owned increases the probability by almost five percentage points. This is plausible, because larger farms are not only wealthier but also have a higher capacity to expand banana production. Similarly, the value of agricultural equipment and ownership of a donkey cart have positive and significant effects on the probability of group participation. While the value of agricultural equipment reflects the ability to invest in innovations and inputs, a donkey cart facilitates transportation to the group collection centers. Somewhat surprisingly, the banana plot size five years ago has no significant effect on the probability of participation. This implies that specialization on banana prior to group membership does not affect farmers' interest or ability to join.

[TABLE 2]

Age exhibits a positive effect. This can be explained by farming experience, which is usually positively correlated with age. Furthermore, additional discussions that we had with farmers in the survey regions revealed that the younger generation is not very interested in farming but rather hopes to find employment outside agriculture in the future, preferably in urban areas. However, the significant and negative effect of age squared demonstrates that the probability of group participation decreases again after a certain age threshold. This may be due to higher risk aversion and higher time preference rates among the elderly. Education and gender do not have significant effects. Especially the fact that there is no gender bias in group participation is an important and welcome finding, because banana has traditionally been a women's crop in Kenya.

In terms of social networks, participation in other community groups does not affect the decision to join a banana group significantly, but mobile phone ownership seems to be an important determinant of group participation. One explanation is that phone owners may have been the first to learn about farmer group formation. Moreover, farmers with mobile phones are more easily contacted and notified to attend market days and other group activities. It follows that efficient means of communication can facilitate the formation of farmer collective action, especially when households are not located in a central village place.

Access to credit also shows a positive effect on group participation. As mentioned, farmers have to pay a membership fee when they join a group. Also, the adoption of TC technology and related investments require access to sufficient financial capital. During the time of the survey, TC plantlets were sold at a price of 80 to 100 KES each, so that buying only a few already entails a relatively large investment for resource-poor smallholders. Finally, the distance to the nearest paved road has a positive, curvilinear effect on the probability of group participation. Farmers located very near to a paved road have better access to markets anyway, so that they are less dependent on group activities, especially collective marketing. Hence, they are less likely to participate. Distance increases the probability of participation, but only up to a distance of about 5 km, after which the probability decreases again. This is plausible, because the cost of transportation to banana collection centers and the cost of participation in group meetings increases with distance. Thus, farmers in very remote locations may prefer selling to traders at lower prices at the farm gate.

It should be noted that some of the covariates may potentially be endogenous. For example, ownership of mobile phones among group members could be higher due to higher incomes as a result of group membership, which would lead to reverse causality. Likewise, higher incomes from group marketing could potentially be used for additional investments into farm and non-farm assets. However, most of the groups have only started with collective marketing around one year before we implemented the survey, so that the monetary benefits may not yet have resulted in significant new investments. We also tested for differences in all covariates between group members who started collective marketing before and after 2008, in order to find out whether members in older groups have accumulated more assets than members in younger groups. While, we found significant differences with respect to some of the human capital covariates (age, education, household size), differences were not statistically significant for most of the asset variables. One exception is the value of agricultural equipment, but, strikingly, this is higher for members in younger farmer groups. Therefore we conclude that issues of endogeneity are negligible in our context.

(c) *Impacts of group participation*

Using the probit model of group participation, we calculated individual propensity scores, which indicate the farmer's probability to participate in a group. To exploit the larger set of control observations that can be used as potential matches for group members, we also predicted propensity scores for the non-member farmers in the control regions, building on the same probit coefficients. This assumes that the same model of group participation holds for the treatment and control regions. As argued above, the conditions in both regions are similar, so that this assumption appears justified.[1]

The propensity scores were then used to match members to non-members. We imposed a tolerance level (caliper) on the propensity score distance of 0.008 to avoid the risk of bad matches (Caliendo and Kopeinig 2008). We then performed radius matching, which uses a weighted average of all available comparison observations within the caliper as the counterfactual. Figure 1 shows the distribution of propensity scores for group members in the upside part and non-members in the downside part. As can be seen, the condition of common support is fulfilled, since the propensity score distributions largely overlap. From this overlap it also follows that farmer groups are relatively inclusive of the poor. The majority of group members seem to be comparable to the majority of the non-members.

[FIGURE 1]

Some randomness in the selection into treatment is needed, such that individuals with similar characteristics can be observed among the treated as well as the non-treated (Heckman et al. 1998). With perfect selection into treatment and non-treatment, effects could not be estimated. Furthermore, the major objective of propensity score modeling is not to perfectly predict selection into treatment and non-treatment, but rather to balance all covariates. Since PSM does not match treatment and non-treatment observations on all covariates, but on a single dimension variable that is a function of the covariates, one has to ensure that similar propensity scores emerge from similar characteristics. Therefore, we performed balancing tests after matching. Table 3 reports the means of all covariates for the treated and non-treated before and

after matching. Average land holding of group members is reduced if only matched group members are considered. On the other hand, average land holding is increased for non-members, when those that are not used as matches are dropped. Similar changes can also be observed for other covariates, such as value of agricultural equipment, ownership of motorized vehicle, and number of cattle owned.[2] After matching, no significant differences in covariates remain.

[TABLE 3]

After matching, the ATT for the various outcome variables can be calculated according to Equation 3. The results are shown in Table 4. Since different intensities of participation in group activities can be observed among the members, we differentiate between additional sub-categories. In particular, we observed that around 40 percent of the members did not participate in collective marketing, but continued to sell individually. This may affect output prices obtained and thus also gross margins and incomes. Therefore, we separately compare non-members with members who market collectively and with members who market individually. The results are discussed in the following.

[TABLE 4]

First, we find that both group members and non-members have increased the area allocated to banana production over the past five years. This is due to the fact that banana has become more profitable relative to other crops. However, members have expanded their plantations significantly more than non-members, which is likely due to their improved access to extension information, clean planting material, and other incentives offered through the farmer groups. Indeed, adoption of TC banana is much more widespread among group members, with adoption rates ranging between 66-72 percent compared to 18-19 percent among non-members.

Second, we find that marketing through the group yields a higher price than selling individually at the farm gate. The average price per kg of banana has increased by 16 percent for those members who market collectively. The increase amounts to 28 percent if the price per bunch is considered, because bunches of members seem to be slightly bigger on average. The same

increase in prices cannot be observed for group members who continue to sell individually. However, the magnitude of the price premium for collective marketing is not very large. The average premium is about 55 KES per bunch, which is only slightly more than the cost of transportation; depending on the concrete distance, a casual laborer hired to transport a bunch to the group collection center earns about 20 to 50 KES in the survey region. This is surprising, because one of the objectives of group marketing is also to reduce the number of middlemen and directly link farmers to wholesalers with a better bargaining position. We do not find clear evidence of reduced inefficiencies or improved bargaining power. A possible explanation is that physical infrastructure has improved tremendously in the central highlands of Kenya during the past five years (Chamberlin and Jayne 2009). This has probably contributed to more efficient marketing channels and lower external transaction costs, even without collective marketing. The relatively low price incentive may also explain why many group members prefer selling individually.

Third, we find no change in yields for group members who market through the group and a significant decrease in yields for members who market individually. One explanation is that a number of group members who have recently expanded their banana plantations and adopted TC technology have not yet harvested from the new plants, because it takes more than one year until newly planted bananas bear fruits.[3] In addition, in 2009, when the survey was carried out, bananas had suffered from a prolonged drought. Even though traditional bananas suffered under drought conditions as well, TC plantlets are particularly susceptible to water stress in the first few months after establishment (Qaim 1999). The low yield performance in 2009 may also explain why some group members continued to market individually: they cannot (yet) deliver sufficient quantities that make collective marketing profitable for them. Hence it is not surprising that the share of bananas sold has increased for members who sell through the group, but not for members who market individually.

Fourth, regarding input use for banana production, we find that family labor hours per acre have decreased significantly for members. On the other hand, a significant increase in hired labor use

can be observed. Obviously, group members face family labor constraints when expanding banana production, which is compensated through hired labor. In terms of manure use, we find no significant effects of group participation. Even though manure use is recommended by NGO extensionists, manure availability is limited in central Kenya (Lekasi et al. 1998). Yet, we find a significant increase in the use of chemical fertilizers and pesticides among group members. Likewise, total cash outlays have increased significantly, even though input use still remains far below recommended levels.

Finally, for members selling through the group we observe a significant increase in total banana income, which also translates into a higher contribution of this crop to total income. Furthermore, we find a 26 percent increase in total annual income, implying that group participation has a positive impact on household welfare. Yet the same effects are not observed for members who sell individually, which stresses that not only membership per se but also the intensity of group participation matters. Furthermore, for the members who sell collectively the positive income effects seem to be more due to the expansion of banana production rather than price premiums or productivity gains, because no significant impact on banana gross margins per acre can be observed. This suggests that the benefits of farmer groups in this particular context are more indirect through better access to information and planting material needed for successful expansion of the crop.

To analyze the effects of membership on access to information further, we compare to what extent certain practices recommended by extensionists are followed by farmers in our sample. Figure 2 shows differences in management practices between matched group members and non-members. As can be seen, more group members follow recommendations with respect to most of the practices recommended. One exception is the time of harvesting: while 82 percent of the non-members wait until bananas are fully mature, only around 70 percent of the members do so. This may be explained by the fact that the income-generation function of banana is more important among members, so that they tend to market bunches as early as possible. Overall,

however, it can be concluded that group membership influences plantation management positively, underlining that access to technical information is improved through participation.

[FIGURE 2]

(d) *Testing the robustness of the ATT results*

One of the assumptions of PSM is conditional independence, or un-confoundedness (Rosenbaum and Rubin 1983), which implies that treatment assignment is entirely based on observed characteristics. Therefore, PSM can only account for selection bias due to observables. The assumption is violated if unobserved characteristics also determine treatment assignment. Following Godtland et al. (2004) we test the robustness of the estimated ATTs by using alternative variations in the probit model of group participation. The results from the baseline model and two variations are reported in Table 5. The first variation, a reduced model, excludes potentially endogenous variables, such as number of cattle owned, value of agricultural equipment, means of transportation, and mobile phone ownership. The second variation, an extended model, includes additional variables, such as risk attitude, cash crop production, a dummy measuring the efficiency of the banana supply chain in the sub-location, and ownership of irrigation equipment five years ago. The matching quality of both variations is slightly lower compared to the base model; in particular, access to credit is not balanced in the reduced model, and ownership of irrigation equipment five years ago is not balanced in the extended model. However, the differences between matched members and non-members are small.[4]

Table 5 reveals that several outcomes are sensitive to model specification, particularly the outcomes on input use. While the signs of the ATTs are mostly unchanged, the magnitudes and significance levels vary. For example, total cash outlays for purchased inputs are significantly different between members and non-members in the base model but not in the two variations. The other outcome indicators on land allocation, production, marketing performance and income are relatively robust to alternative model specifications. Therefore, even if unobserved

characteristics should play a certain role, they are unlikely to overturn the general findings on the impacts of group participation.

[TABLE 5]

5 CONCLUSION

In this article, survey data from central Kenya was used to analyze under what conditions farmer collective action is useful, and through what mechanisms the potential benefits emerge. In particular, factors influencing the participation of small-scale banana growers in farmer groups and impacts of group participation were investigated. The groups considered were recently formed with the support of NGOs, in order to improve farmers' access to new banana technology, related extension, and high-value output markets.

The results show that the groups are generally inclusive of poor farmers. Nonetheless, ownership of land and other agricultural assets as well as access to credit significantly increase the probability of joining a group. Moreover, distance to paved roads and ownership of a donkey cart and a mobile phone influence the decision to join a group. Hence, farmers with greater capacity to implement innovations, absorb and exchange information, and deliver bananas to group collection centers are more likely to engage in collective action. This is not surprising, because these group activities are also the ones that promise the biggest benefits. Group participation is not associated with a gender bias.

Impacts were analyzed with a propensity score matching approach. We found that group membership leads to a significant increase in household income, but only for those farmers that also market collectively. This underlines that it is not group membership per se that matters, but the degree of participation in certain group activities. While this may seem obvious, it was not always considered in previous studies. The benefits observed are mainly due to specialization effects. That is, group members expanded their banana area significantly more than non-members, so that the share of banana income and the degree of banana commercialization increased. Group participation is also associated with higher adoption rates of tissue culture

technology and higher use intensities of chemical inputs in banana production. Similarly, more group members follow plantation management practices as recommended by extension workers. These are clear indications that collective action can spur innovation through promoting efficient information flows. Against this backdrop it is surprising that no positive productivity effects could be observed. This may potentially be due to unfavorable weather conditions in the survey year. Moreover, some of the newly established tissue culture plants were still very young, so that positive yield effects may occur when the plantations are further developed.

Price advantages associated with collective marketing are positive and significant, but relatively small in magnitude. The price difference between selling individually at the farm gate and selling collectively is only slightly higher than the average cost of transporting bananas to the group collection center. This may also explain why many group members continue to sell individually. The reason for the relatively low price advantage is probably that infrastructure conditions in central Kenya were substantially improved in recent years. Thus, traditional banana markets became more transparent and efficient even without collective action. This does not mean that there is no role for farmer groups to further improve marketing performance, especially with respect to high-value markets. Emerging supermarket and export supply chains are often associated with new transaction costs through standards, contractual relationships, or other requirements (Reardon et al. 2009). Cooperative organization provides important preconditions for better linking smallholders to such emerging value chains, but this potential is still untapped in the Kenyan banana sector.

The findings from this study also offer some broader lessons. The first argument for cooperative organization is to reduce external transaction costs through exploiting economies of scale in buying and selling. In many developing countries, poor infrastructure and remoteness have led to highly inefficient supply chains, with a number of non-value adding intermediaries involved. Collective marketing can reduce the number of intermediaries and is therefore particularly relevant in cases where supply chains are long and inefficient. When supply chains are relatively

short, as is now the case for banana in central Kenya, the potential for additional efficiency gains through group marketing is small. The second argument for cooperative organization includes the creation of countervailing power towards upstream and downstream market agents, who are often larger in size and thus may show opportunistic behavior. But banana farmers in central Kenya are hardly suffering from such opportunism, as the traders themselves are small and numerous. In contrast, there are many successful examples of cooperative organization with agricultural products that require processing, such as dairy and coffee (Holloway et al. 2000; Wollni and Zeller 2007), because the processing sector is often more concentrated. A trend towards greater market concentration is also observed in high-value horticultural procurement.

The general conclusion to be drawn is that cooperative organization does not per se improve market access for smallholder farmers. The potential benefits are very product and context specific, and they also depend on the concrete collective activities pursued. Focusing group efforts on better linking farmers to emerging high-value chains seems to be one promising avenue. Yet, the findings also suggest that – beyond mere price advantages – collective organizations can function as important catalysts for innovation adoption and upgrading of production systems through promoting efficient information flows. These are also crucial conditions for smallholders to remain competitive in rapidly changing environments.

Notes

1. Since one of our main interests is in analyzing the effect of collective marketing versus individual marketing, we restricted the sample to banana farmers that had actually been selling bananas during the 12 months prior to the survey. That is, a small number of farmers who had only produced bananas for home consumption were dropped from the PSM analysis.
2. These patterns suggest that the poorest non-members either do not have access to farmer groups or do not find it sufficiently profitable to join. The PSM analysis here

cannot make any predictions about how the effects might look like for them if they were to join a group.

3. In fact, calculating more disaggregated ATT results, we find significantly lower yields for members in younger groups that started after 2008, but not for older groups that started earlier.
4. The detailed results of the balancing tests for the alternative models can be made available upon request.

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Figures

Figure 1: Propensity score distribution

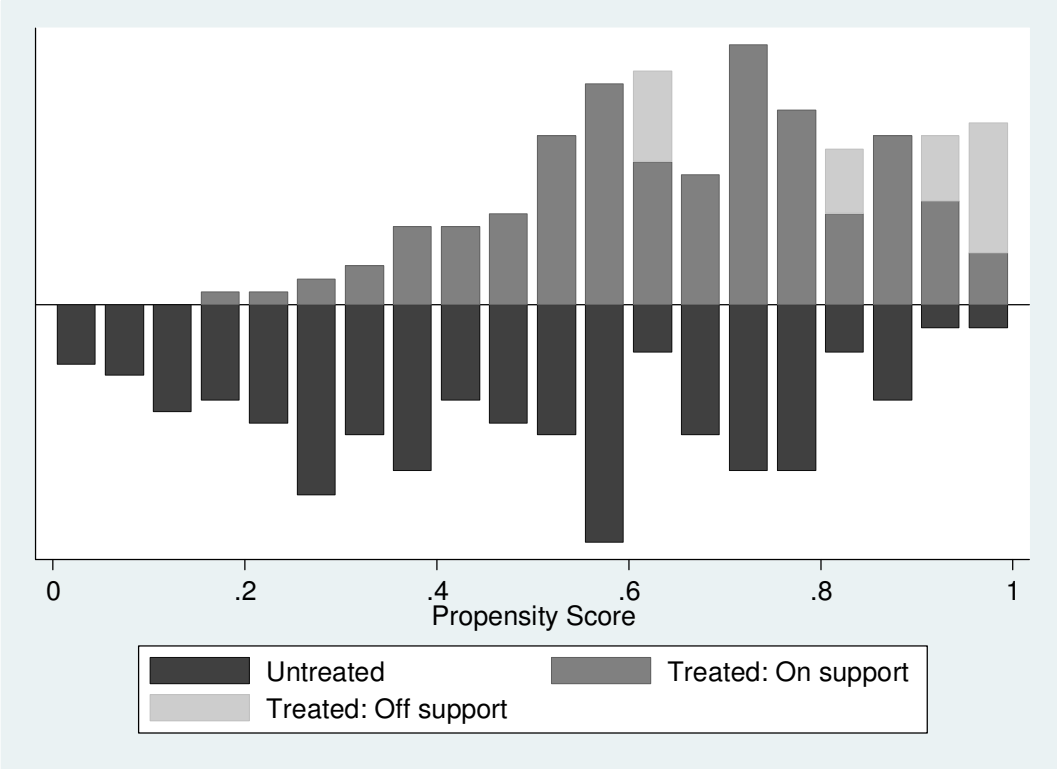
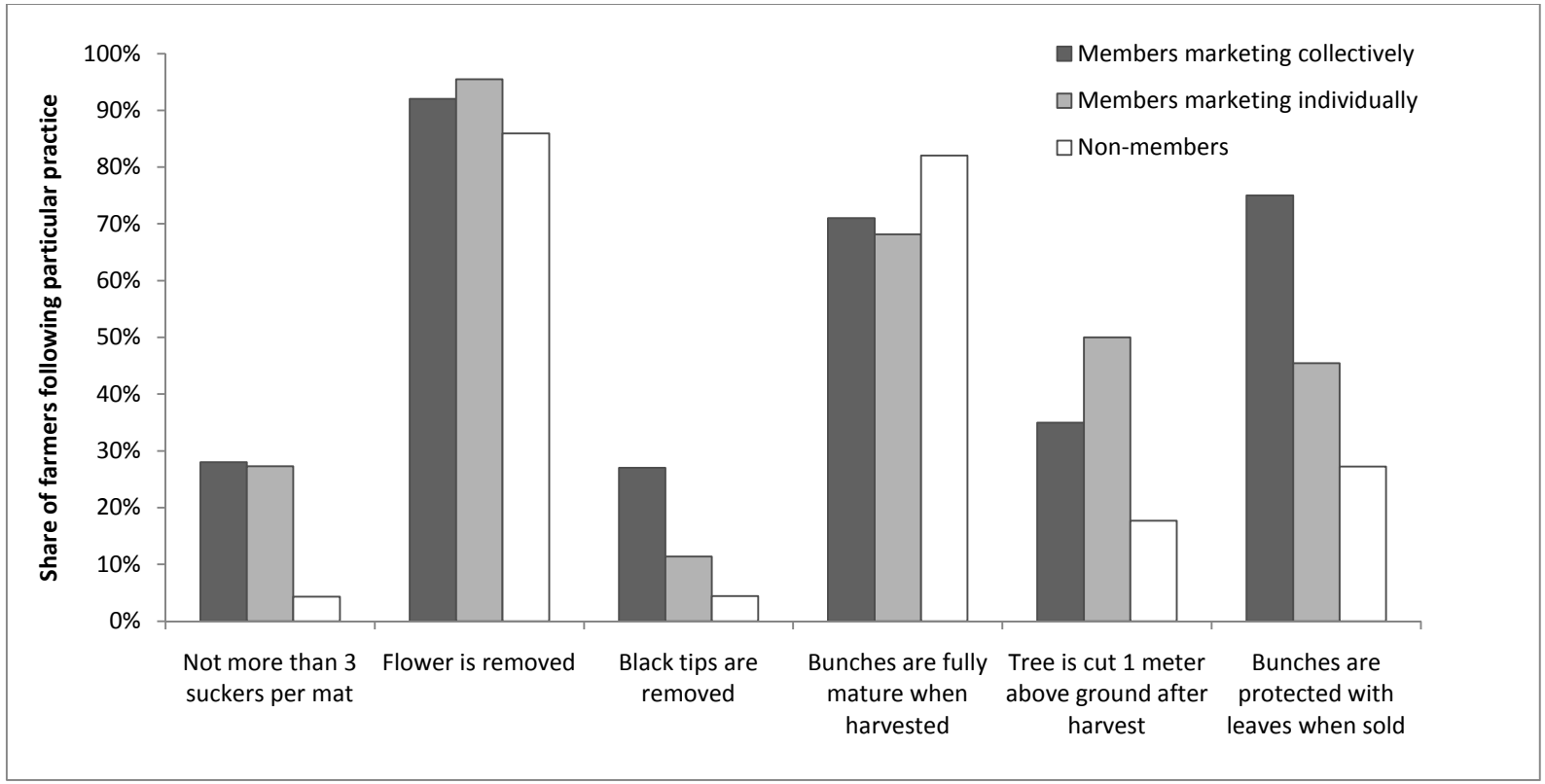


Figure 2: Differences in banana plantation management



Tables

Table 1: Farmer characteristics

Variable	Description	Members		Non-members		Farmers in control regions	
		Mean	S.D.	Mean	S.D.	Mean	S.D.
Land holding	Total land owned by household in acres	3.22	(2.988)	2.25	(3.566)	1.79	(1.407)
Property title	Household has property title for land (yes=1, no=0)	0.76	(0.427)	0.64	(0.481)	0.56	(0.499)
Lagged banana area	Size of banana plantation 5 years ago	0.17	(0.320)	0.10	(0.169)	0.09	(0.153)
Equipment	Value of agricultural equipment in 1,000 KES	173.16	(354.200)	43.41	(105.952)	67.25	(154.632)
No. of cattle	No. of cattle owned by household	2.39	(1.778)	1.55	(1.388)	1.93	(1.593)
Donkey cart	Household owns donkey cart (yes=1, no=0)	0.54	(0.499)	0.32	(0.469)	0.40	(0.491)
Motorized	Household owns car, pick-up or motorbike (yes=1, no=0)	0.19	(0.396)	0.05	(0.221)	0.06	(0.232)
Age	Age of household head in years	55.99	(13.029)	51.59	(15.615)	52.42	(14.910)
Education	Head has primary education or above (yes=1, no=0)	0.81	(0.396)	0.67	(0.471)	0.67	(0.473)
Female head	Female headed household (yes=1, no=0)	0.15	(0.362)	0.20	(0.399)	0.15	(0.360)
Household size	Number of household members	4.70	(2.086)	4.43	(1.901)	4.49	(1.822)
Phone	Household owns mobile phone (yes=1, no=0)	0.92	(0.279)	0.70	(0.460)	0.78	(0.414)
Social participation	Household participates in other groups (yes=1, no=0)	0.85	(0.362)	0.71	(0.456)	0.81	(0.393)
Credit	Household has access to credit (yes=1, no=0)	0.94	(0.238)	0.82	(0.382)	0.88	(0.330)
Road distance	Distance to nearest paved road in km	2.07	(2.557)	1.66	(2.627)	2.81	(4.844)
Employed	Household member has non-farm employment	0.35	(0.478)	0.31	(0.463)	0.30	(0.461)
Self-employed	Household member has non-farm self-employment	0.41	(0.494)	0.31	(0.463)	0.26	(0.443)
	No. of observations	201		137		106	

Table 2: Determinants of group participation (probit results)

	Coefficient	S.E.	Marginal effect
Land holding	0.120*	(0.0706)	0.0456
Land holding squared	-0.00538	(0.00489)	-0.0020
Property title	-0.109	(0.192)	-0.0411
Lagged banana area	0.571	(0.680)	0.2174
Lagged banana area squared	-0.332	(0.456)	-0.1264
Equipment	0.00107*	(0.000637)	0.0004
Donkey cart	0.303*	(0.162)	0.1143
Motorized	0.0631	(0.322)	0.0238
No. of cattle	0.0590	(0.0574)	0.0225
Age	0.0821**	(0.0385)	0.0313
Age squared	-0.000602*	(0.000343)	-0.0002
Education	0.117	(0.224)	0.0447
Female head	0.0534	(0.225)	0.0202
Household size	0.000964	(0.0449)	0.0004
Phone	0.649***	(0.229)	0.2533
Social participation	0.285	(0.196)	0.1107
Credit	0.591**	(0.269)	0.2317
Road distance	0.163**	(0.0724)	0.0619
Road distance squared	-0.0148**	(0.00712)	-0.0056
Employed	0.104	(0.175)	0.0394
Self-employed	0.243	(0.176)	0.0913
Constant	-4.536***	(1.033)	
Observations	338		
Pseudo R-squared	0.202		

Note: *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

Table 3: Balancing test results

		Mean			% reduct	t-test	
Variable	Sample	Treated	Control	%bias	|bias|	t	p>|t|
Land holding	Unmatched	3.16	2.08	36.0		3.40	0.00
	Matched	2.82	2.46	11.9	67.0	1.39	0.17
Land holding squared	Unmatched	18.67	13.35	6.6		0.61	0.54
	Matched	14.33	9.01	6.6	0.0	1.55	0.12
Property title	Unmatched	0.77	0.64	30.0		2.82	0.01
	Matched	0.74	0.68	13.5	55.0	1.14	0.25
Lagged banana area	Unmatched	0.15	0.10	26.3		2.50	0.01
	Matched	0.15	0.12	16.8	36.2	1.45	0.15
Lagged area squared	Unmatched	0.07	0.03	20.3		1.95	0.05
	Matched	0.07	0.04	15.4	24.1	1.38	0.17
Equipment	Unmatched	148.61	48.96	44.4		4.28	0.00
	Matched	79.77	80.47	-0.3	99.3	-0.05	0.96
Donkey cart	Unmatched	0.54	0.37	33.2		3.14	0.00
	Matched	0.48	0.54	-12.9	61.2	-1.08	0.28
Motorized	Unmatched	0.18	0.05	42.6		4.08	0.00
	Matched	0.11	0.06	15.0	64.8	1.41	0.16
No. of cattle	Unmatched	2.39	1.75	39.5		3.74	0.00
	Matched	2.22	2.46	-14.9	62.4	-1.17	0.24
Age	Unmatched	56.20	52.23	27.9		2.63	0.01
	Matched	55.97	54.66	9.2	67.0	0.87	0.39
Age squared	Unmatched	3328.90	2960.40	22.7		2.14	0.03
	Matched	3311.90	3136.70	10.8	52.5	1.01	0.31
Education	Unmatched	0.81	0.68	28.3		2.67	0.01
	Matched	0.78	0.77	3.6	87.1	0.32	0.75
Female head	Unmatched	0.15	0.19	-9.3		-0.88	0.38
	Matched	0.15	0.17	-5.2	44.8	-0.44	0.66
Household size	Unmatched	4.64	4.42	11.5		1.09	0.28
	Matched	4.72	4.76	-2.2	81.2	-0.19	0.85
Phone	Unmatched	0.90	0.75	39.4		3.70	0.00
	Matched	0.88	0.92	-10.0	74.5	-1.06	0.29
Social participation	Unmatched	0.86	0.78	20.6		1.94	0.05
	Matched	0.86	0.85	3.6	82.7	0.33	0.74
Credit	Unmatched	0.95	0.88	25.0		2.34	0.02
	Matched	0.95	0.98	-10.3	58.8	-1.36	0.18
Road distance	Unmatched	2.07	2.05	0.4		0.04	0.97
	Matched	2.08	1.95	3.9	-779.1	0.36	0.72
Road distance squared	Unmatched	10.93	17.61	-15.8		-1.48	0.14
	Matched	0.07	0.04	15.4	24.1	1.38	0.17
Employed	Unmatched	0.35	0.32	6.3		0.59	0.55
	Matched	0.35	0.37	-3.8	38.9	-0.32	0.75
Self-employed	Unmatched	0.40	0.30	19.5		1.84	0.07
	Matched	0.39	0.38	1.9	90.4	0.15	0.88

	Unmatched	Matched
Median bias	24.287	9.201
Pseudo R-squared	0.173	0.064
P-value of LR	0.000	0.232

Table 4: Average treatment effects on the treated (ATTs)

	Collective marketing				Individual marketing			
Outcome	Non-members	Members	ATT (%)		Non-members	Members	ATT (%)	
Banana plot size (acres)	0.22	0.40	80	***	0.22	0.34	51	***
Plot size increase past 5 years (acres)	1141.04	973.74	-15	***	0.09	0.11	18	***
TC adoption	0.19	0.72	284	***	0.18	0.66	267	***
Average output price per kg (KES)	8.01	9.31	16	***	7.37	7.74	5	
Average output price per bunch (KES)	194.84	249.69	28	***	183.86	190.30	4	
Banana yield (kg/acre)	14.56	13.03	-10		14.14	10.15	-28	***
Average bunch weight (kg)	25.49	26.87	5		26.02	25.99	0	
Share of bananas sold	0.64	0.70	9	*	0.65	0.61	-6	
Family labor (hours/acre)	962.62	647.01	-33	***	1019.24	590.00	-42	***
Hired labor (hours/acre)	178.41	326.72	83	***	166.01	359.98	117	***
Total labor (hours/acre)	1141.04	973.74	-15		1185.25	949.97	-20	
Manure (1000 kg/acre)	10.68	12.15	14		10.56	12.65	20	
Pesticide & fertilizer costs (1000 KES/acre)	0.48	2.19	361	***	0.52	2.37	359	***
Total cash outlay (1000 KES/acre)	3.77	7.48	99	***	3.49	7.89	126	***
Banana gross margin (1000 KES/acre)	116.95	122.67	5		101.91	64.75	-36	***
Total banana income (1000 KES)	23.57	44.89	90	***	21.70	27.10	25	
Share of banana income in total income	0.10	0.17	64	***	0.09	0.11	18	
Total household income (1000 KES/year)	274.24	345.82	26	*	282.98	275.97	-2	
No. of participants with match		96 of 116				44 of 55		

Note: *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

Table 5: Robustness of ATT results

	Collective marketing						Individual marketing					
	1. Base model		2. Reduced model		3. Extended model		1. Base model		2. Reduced model		3. Extended model	
Outcome	ATT (%)		ATT (%)		ATT (%)		ATT (%)		ATT (%)		ATT (%)	
Banana plot size (acres)	80	***	57	***	84	***	51	***	72	***	45	*
Plot size increase past 5 years (acres)	137	***	110	***	140	***	18	***	2	***	-17	***
TC adoption	284	***	356	***	230	***	267	***	525	***	360	***
Average output price per kg (KES)	16	***	19	***	12	***	5		3		-10	
Average output price per bunch (KES)	28	***	36	***	36	***	4		11		2	
Banana yield (kg/acre)	-10		-3		-5		-28	***	-35	***	-29	***
Average bunch weight (kg)	5		8	**	10	***	0		6		9	
Share of bananas sold	9	*	11	**	15	***	-6		4		-2	
Family labor (hours/acre)	-33	***	-22		-23		-42	***	-42	***	-43	*
Hired labor (hours/acre)	83	***	65	**	34		117	***	106	*	18	
Total labor (hours/acre)	-15		-5		-10		-20		-15		-25	
Manure (1000 kg/acre)	14		25	*	12		20		38	*	22	*
Pesticide & fertilizer costs (1000 KES/acre)	361	***	298	***	368	***	359	***	1099	***	248	*
Total cash outlay (1000 KES/acre)	99	***	38		-9		126	***	63		-42	
Banana gross margin (1000 KES/acre)	5		25	*	17		-36	***	-43	***	-41	***
Total banana income (1000 KES)	90	***	116	***	113	***	25		28		-6	
Share of banana income in total income	64	***	72	***	58	***	18		2		-17	
Total household income (1000 KES/year)	26	*	30	**	29	*	-2		34	*	7	
No. of participants with match	96		107		97		44		49		46	

Note: *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.