# Does contract farming improve smallholder income? The case of avocado farmers in Kenya

Mercy Maiwa Mwambi
*Department of Agribusiness and Agricultural Economics,
Egerton University, Nakuru, Kenya*
Judith Oduol
*Tree Products and Markets, World Agroforestry Centre, Nairobi, Kenya*
Patience Mshenga
*Department of Agribusiness and Agricultural Economics,
Egerton University, Nakuru, Kenya, and*
Mwanarusi Saidi
*Department of Crop, Horticulture and Soil Science,
Egerton University, Nakuru, Kenya*

## Abstract

**Purpose** – Contract farming (CF) is seen as a tool for creating new market opportunities hence increasing incomes for smallholder farmers. Critics, however, argue that CF is likely to pass risks to small scale farmers, thus favouring large scale farmers at the expense of smallholder farmers. The purpose of this paper is to examine the effect of CF on smallholder farmers' income using a case study of avocado farmers in Kandara district in Kenya.

**Design/methodology/approach** – The study uses data collected from 100 smallholder avocado farmers in Kandara district in Kenya and employs an instrumental variable model (Probit-2SLS) to control for endogeneity in participation in the contract and examine the effect of CF on household, farm and avocado income.

**Findings** – The results indicate that participation in CF is not sufficient to improve household, farm and avocado income. Question remains regarding efficient implementation of CF arrangements to promote spill over effects on other household enterprises.

**Research limitations/implications** – The research was carried out using farmers in Kandara district in Kenya as a case study, findings might therefore not reflect the status of CF in all countries.

**Originality/value** – The paper contributes to the growing debate on the effect of value chain upgrading strategies such as contracting on smallholder farmers' welfare. The form of contracting studied in this paper differs from the standard contracts in that the key stakeholders (producers) are loosely enjoined in the contract through officials of their groups.

**Keywords** Impact, Sub-Saharan Africa, Household income, Avocado, Contract farming, Smallholder

**Paper type** Research paper

## 1. Introduction

To the extent that about 70 per cent of the population in Sub-Saharan Africa live in rural areas and depend on agriculture for their livelihoods (Nnadi *et al.*, 2012), improving smallholder farmers' access to markets both locally and internationally

could be one of the strategies to achieving the eight millennium development goals. Kenya in particular has 90 per cent of smallholder farmers in all but the arid regions engaging in the production of horticultural products (Mutuku *et al.*, 2004). Yet, fewer than 2 per cent produce directly for export (Bawden *et al.*, 2002). The low participation in the export market has been attributed to challenges related to increased consumer demand for high-quality products owing to the rising number of supermarkets in developed countries (Dolan *et al.*, 2002; Henson *et al.*, 2008) and food safety regulations.

Smallholder farmers can be empowered to take advantage of new market opportunities for high-value agricultural products which have emerged as a result of increasing global consumption of these products, particularly vegetables and fruits (Temu and Temu, 2006). With most of the world's rural poor engaging in agriculture, encouraging smallholders' access to global export markets for high-value products is vital in increasing incomes and hence alleviating poverty, which is predominant in Sub-Saharan Africa.

The production and supply of high-quality products often require financial investments which most smallholder farmers cannot afford. Smallholders further face other challenges including poor infrastructure (Omosa, 2006), lack of access to up-to-date market information, and difficulty in accessing technical advisory services and agricultural inputs (World Bank, 2008). Additionally, engagement in agricultural activities requires post-harvest facilities for the supply of quality produce. Lack of these amenities limits smallholder farmers' participation in markets that offer profitable returns (World Bank, 2008).

Several measures have been put in place to enhance farmers' access to such markets. For instance, globalization and the use of internet have created new opportunities for smallholders to improve their position in the international market place. However, it has been noted that globalization favours large scale farmers who are considered reliable business partners and generate lower transaction costs (World Bank, 2008). The Government of Kenya has also played a regulatory role through the Horticultural Crops Development Authority and with the support of extension officers to improve smallholders' participation in the horticultural export market through enhanced adoption of improved technologies and hence increased productivity. However, lack of multi-skilled extension agents has led to piece-meal extension service delivery to clients usually faced with multiple problems, resulting in low rates of technology adoption (Republic of Kenya, 2012). With the inefficiency of government extension services, the private sector is being viewed as an alternative pathway of promoting smallholder farmers' access to technology and training, which is a key to increasing productivity and hence sufficient marketable surplus (Daniel and Hanson, 2013).

Contract farming (CF) is one of the schemes involved in enhancing backward and forward market linkages in horticultural production in Sub-Saharan Africa in general, and in Kenya in particular. While there is evidence that CF can have a positive impact on farmers' welfare (Miyata *et al.*, 2009; Olomola, 2010; Wainaina *et al.*, 2012), there is paucity of empirical evidence on its impact on the welfare of smallholder farmers, especially when the producers are loosely enjoined in the contract through representation by officials of their groups and an intermediary. We contribute to the literature gap by examining the effect of participation in CF on smallholders' income using a case study of smallholder avocado farmers in Kandara district in Kenya.

The rest of the paper is structured as follows. Section 2 establishes a link between CF and household income and provides background information on the structure and organization of CF in the study area. In Section 3, we present the analytical framework

adopted in the study and describe the source and type of data used. The results are presented and discussed in Section 4 while in Section 5, we conclude and provide policy implications deriving from the study.

## 2. CF and smallholder income: a review

CF is defined as an agreement between a farmer and a purchaser established in advance of the growing season for a specific quantity, quality and date of delivery of an agricultural output at a price or price formula fixed in advance (Setboonsarng, 2008). According to Eaton and Shepherd (2001), there are five models that can be adopted in CF arrangements, namely, nucleus, informal, centralized, multipartite and intermediary model. The centralized model involves a centralized processor and/or buyer procuring from a large number of small scale farmers. The cooperation is vertically well integrated and most of the time several services such as pre-financing of inputs, extension and transport are provided. The nucleus estate model is a variation of the centralized model where the contractor not only sources from independent farmers but also has its own production facilities (an estate plantation). Multipartite model involves a company working with other institutions or NGOs. This type is particularly helpful when establishing a new venture. Once the cooperation between the firm and the farmers is working well, the link between the parties can be circumvented and so the multipartite slowly develops into a centralized model. Informal arrangements vary between casual oral agreements and regularly repeated marketing transactions but are characterized by the absence of written contracts.

The intermediary model has intermediaries who organize everything on behalf of the final buyer starting with input supply, extension service, payment of the farmers and transportation of the final product. Intermediaries handle several thousands of outgrowers. This is the type of model employed in avocado marketing in Murang'a where the Avocado Growers Association of Kenya (AGAK) acts as an intermediary between the farmer groups and the contractor (Vegpro Kenya Limited).

The subject of smallholder farmers' participation in CF is principal for policy makers seeking to promote rural economic growth and development. In the preceding years, policies focused on macroeconomic and sectoral policies that ignored market failures constraining smallholders' supply response (Barrett and Carter, 1999). This led to the emergence of microeconomic and institutional policies, which were mainly contractual arrangements that boosted smallholder participation in agricultural value chains (Barrett *et al.*, 2012). Specifically, contractual arrangements involving processors, agro-exporters and farmers organized in groups, are increasingly seen as a means of overcoming the market imperfections that led to the failure of macroeconomic and sectoral adjustment policies (Gow, 2000). Yet, smallholder farmers' involvement in agricultural value chains and access to markets that offer profitable returns is limited (Barrett *et al.*, 2012).

Participation of smallholders in CF, which in turn impacts their welfare in various ways, is influenced by socioeconomic and institutional factors. For example, smallholders are constrained in terms of productive resources like water for irrigation and land, which often limit their production. Similarly, smallholders' limited access to production technologies and support services like credit, extension education and information on uncertainties regarding risks associated with new technologies deter their participation in such schemes (Coulter *et al.*, 1998; Barrett *et al.*, 2012). Depending on the nature of the contract, CF may affect smallholder farmers' welfare through a number of pathways. First, contracts that have interlinked services such as

training, credit and technical advice including market information aim at alleviating constraints on smallholder productivity, thereby increasing marketed surplus. In this way, CF acts as an institutional solution to market failures in the markets for credit, insurance and information (Grosh, 1994; Key and Runsten, 1999). Second, CF is a strategy for fostering smallholder participation in restructured markets and value chains, thereby increasing and stabilising smallholder incomes (Bellemare, 2012). Third, contracts that allow prices of outputs as well as the terms to be decided in advance may reduce risks associated with price fluctuations (Baumann, 2000; Eaton and Shepherd, 2001), thereby providing incentive mechanisms for smallholders to allocate resources efficiently and maximize returns on factors of production (Du *et al.*, 2013; Saenger *et al.*, 2013).

The welfare impact of smallholder participation in CF on income has been controversial. On the one hand, it has been found to significantly improve the income of smallholder farmers (Miyata *et al.*, 2009; Olomola, 2010; Bellemare, 2012; Wainaina *et al.*, 2012) and on the other hand, have limited gains (Glover and Kusterer, 1990). Consequently, some authors contend that the effect of CF on the livelihoods of smallholder farmers is context specific and depends on the nature of the contract as well as the type of enterprise in question (Gow, 2000). Positive impacts have been reported in cases where contracts provide credit, farm inputs and the technology necessary for increasing production of non-traditional lucrative crops and reduce marketing risk (Glover, 1984; Williams and Karen, 1985). Yet others argue that some contracts favour large scale farmers and consequently poorer growers may be left out of the development process (Runsten, 1992; Little and Watts, 1994). When farmers invest in specific assets and become over dependent on their contract crops, they may lose bargaining power *vis-à-vis* the firm, forcing them to accept less favourable or exploitative contract terms (Warning and Key, 2002). Over reliance on cash crops can make households more vulnerable to price fluctuations. Hence, participation in CF may subsequently lower household incomes.

The mode of interaction between farmers, buyers and other stakeholders involved in the contractual arrangement determines the efficacy of a contract scheme. Where CF has not been successful, cases of poor coordination among parties, unfavourable terms and conditions and post determination of prices which are dictated by export markets have been reported (Da Silva, 2005). Consequently, this has resulted in adverse selection, moral hazards and violation of contracts. Eaton and Shepherd (2001) affirm that with effective management, CF can be a means to develop markets and bring about the transfer of technical skills in a way that is profitable for both the contractor and the farmer. While a number of studies have looked into the impact of formal contracts on smallholders' welfare, the question as to whether or not less binding contracts with limited interlinked services such as the one depicted in Kandara can translate into welfare gains for the participants remains largely unexplored. Our study attempts to bridge the aforementioned literature gap using a case study of smallholder avocado farmers in Kenya.

## 2.1 Structure and organization of CF in Kandara
According to Snodgrass and Sebstad (2005) the avocado cluster in Kandara was formed to address challenges facing smallholders' participation in lucrative markets for high-value fruit tree value chains[1]. The challenges included lack of market information, limited access to inputs, limited access to resources and/or weak incentives for upgrading, weak vertical and horizontal linkages within the value chain,

lack of trust among producers, brokers, and exporters and the introduction of stringent new rules and market standards following increasing consumer concerns about food safety (Snodgrass and Sebstad, 2005; USAID, 2008). Given the critical role of the avocado value chain in contributing to household income and foreign exchange, coupled with the growing demand for avocado in the export markets, donors such as the United States Agency for International Development teamed up with local business organizations to streamline the chain and improve Kenya's ability to compete in the European Union market. Some of the value chains upgrading strategies implemented include improving the local variety through grafting or top working and changing the governance structure of the value chain to improve the quality of the fruits and forge new and closer relationships between buyers and suppliers (USAID, 2008). The initial linkage involved the formation or strengthening of existing producer groups, the provision of embedded spraying services by the exporter and negotiated memorandum of understanding between producer groups and the exporter.

To improve the competitiveness of the avocado value chain, the Kenya Business Development Services (KBDS) engaged new actors and facilitated closer relationships between lead firms (exporters) and avocado smallholders. The KBDS mobilized farmers in Kandara district to form groups of 25-30 members in 2003 to facilitate the farmers' access to technical training and enhance compliance with the European global gap (EurepGap) standards. In addition, the groups were formed to enable farmers to benefit from economies of scale owing to the small size of their farms and hence the few number of trees owned by the farmers. The groups were seen as a means to meeting the contractor's requirements since the contractor could not buy fruits from individual farmers with fewer than 300 trees, as fewer trees implied high bulking costs for the contractor. East Africa Growers and Kenya Horticultural Exporters were some of the lead firms that were linked with farmer groups through a contract. In addition to buying the produce, the lead firms provided interlinked services like training, packaging, grading, transport and spraying. However, the contract between the farmers and the lead firms collapsed in 2008, partly because of insufficient quantities of fruits and failure by the firms to recover the cost of services provided to the farmers.

The collapse of the contract gave rise to an intermediary body (AGAK), which was formed with a view to organizing the farmers and streamlining coordination of the chain. Following registration of the AGAK in 2008, another contractor called Vegpro (K) Limited was sourced for the farmers in 2009 and the terms of the contract negotiated by the AGAK in collaboration with the officials of the farmer groups. Officials of the farmer groups represent the views of the farmers in the annual general meetings as well as in the negotiation of prices, while members of the groups are only loosely bound by the contract. The farmer groups coordinate smallholder farmers to achieve economies of scale, which benefits both the farmers and the contractor. The groups are crucial in fostering farmer relationships and reducing side-selling through peer pressure.

The main feature of the intermediary model found in Kandara is the formal subcontracting by the lead firm to intermediaries. In addition, a limited range of services is provided in this model as is popular for production requiring fair-trade and organic certification (Prowse, 2012). The contractor supports training, provides packaging materials and caters for the cost of transporting the produce from designated collection points. Unlike in most contracts, the current contractor does not provide credit and input facilities. Another key feature of the contract is the lack of prior agreement on the prices and the quantities to be delivered to the contractor, as the

quantities purchased and the prices are determined by market forces. This therefore exposes farmers to price and production risks and is likely to have adverse effects on their income.

The AGAK has its own informal arrangements with the farmers, which include facilitation of trainings and enhancing contract enforcement by building trust among group members. It also performs roles such as liaising with the contractor and is actively involved in receiving and making payments to the farmer groups through their bank accounts. To market avocado through AGAK, a farmer must be a member of a farmer group that is registered with the association. Registration fee costs KES1,000 per group, which can be paid in instalments using the produce. In addition, the association deducts 50 cents for each piece of avocado sold by the members which is used for maintenance of AGAK's activities.

One main disadvantage of this arrangement is the possibility of information asymmetry resulting from the involvement of an intermediary in the negotiation of contract terms. Information asymmetry may act as a disincentive and encourage farmers to renege on the contract (Saenger *et al.*, 2013). The situation is exacerbated by the lack of proper enforcement mechanisms such as written contracts between the contractor and the producers. The main contract enforcement mechanism used by the group members is group policing and byelaws, which attempt to prevent contract violation by excommunicating or fining the members who are found to default on the contract. However, the byelaws are difficult to enforce because the contracting firm does not provide any inputs to the producers or make the terms of the contract clearly known to the producers. In the majority of the cases, the producers seem not to be fully aware of the terms of the contract or the pricing and grading mechanism employed by the contractor. Generally, there is weak enforceability when the contract is breached. Breach of contract occurs when the buyer refuses to accept produce, delays payments or arbitrarily raises quality requirements. Farmers also fail to honour the contract by side-selling, especially when payments are delayed. Other risks include the possibility of the association losing control over the production because of side-selling occasioned by uncertainty about the terms of the contract. Similarly, the association can lose control over prices paid to farmers and fail to ensure compliance with the quality standards imposed by the contractor.

## 3. Data and analytical framework
### 3.1 Analytical framework
Impact studies requiring attribution of the effect of specific interventions on specific outcomes face two major challenges related to the impossibility to observe a counterfactual and selection bias due to placement of the programme or selection of the participants into the programme (Ravallion, 2001; Cameron and Trivedi, 2005; Imbens and Wooldridge, 2009). Impact assessment studies therefore use Randomised Control Trials (RCTs) to obtain experimental data and estimate the impact using ordinary least squares. Where observational data are lacking quasi-experimental designs such as propensity score matching are exploited to construct controls. Nevertheless, matching methods while adept at capturing observable characteristics may have serious methodological draw backs when selection bias is due to unobservables. Yet, there is substantial evidence to suggest that participation in agribusiness programmes such as CF are likely to be influenced by unobservable traits such as entrepreneurial ability, risk aversion, technical ability and social networking skills, which may be correlated with the outcome of interest, in this case income (Oseni and Winters, 2009;

Maertens, 2009; Barrett *et al.*, 2012; Bellemare, 2012). Therefore, systematic differences in the distribution of the outcome variable between the treated and the non-treated may reflect not only the effect of the treatment, but also differences generated by the selection process (Abadie, 2003). Although RCTs may be a good source of instruments, cases of non-compliance that are characteristic of participation studies as well as lack of external validity render it unfeasible (Barrett *et al.*, 2012). To circumvent the aforementioned challenges, instrumental variable approach may provide a solution as long as a valid instrument can be identified.

Instruments are generally constructed from programme design (e.g. if the programme of interest was randomised, or from exogenous rules in determining who was eligible for the programme), as well as from other exogenous shocks that are not correlated with the outcomes of interest (Khandker *et al.*, 2010). Although participation in CF was based on being a member of a group that was registered with AGAK, individual farmers within the groups could choose to sell to the contractor or not. According to the focus group discussions (FGDs) and in-depth interviews held with the farmers, the decision to participate or not to participate was found to be related to access to information about the terms of the contract. We, therefore, use proximity to AGAK officials as an instrument and estimate Probit-2SLS to control for unobservable characteristics that maybe correlated with participation in the contract. Proximity to AGAK is used as an instrument since farmers who are close to these leaders have a high likelihood of complying, because they get reliable information on CF.

To estimate the effect of CF on income, we use potential outcomes approach and adopt a framework that is similar to that outlined by Rubin (1974) and described in Angrist and Imbens (1991). Suppose that we are interested in the effect of some treatment, in our case, participation in CF, which is represented by the binary variable $D$, on some outcome of interest $Y$, such as income. As in Rubin (1974, 1977), we define $Y_1$ and $Y_0$ as potential outcomes that an individual would attain with and without being exposed to the treatment. Treatment parameters are defined as characteristics of the distribution of $(Y_1, Y_0)$ for well-defined sub-populations. $D$ is an indicator with treatment, in our case individuals participating or not participating in CF. The categorical variable $D$ takes the values 1 and 0, respectively when the treatment is or is not received. That is, we observe $D$ and $Y = Y_D = Y_1 D + Y_0 \cdot (1-D)$ for a random sample of individuals. In our study, $Y_1$ represents the potential income attained by a farm household that participates in CF while $Y_0$ represents income attained by households who do not participate in CF. The treatment effect of participation in CF on income is then naturally defined as $Y_1 - Y_0$. However, an identification problem arises from the fact that the receipt and non-receipt of treatment are mutually exclusive states for an individual and thus we cannot observe both potential outcomes $Y_1$ and $Y_0$ for the same individual, we only observe $Y = Y_1 \cdot D + Y_0 \cdot (1 \cdot D)$. Since one of the potential outcomes (the counterfactual) is always missing, we cannot compute the treatment effect $Y_1 - Y_0$, for any individual. Therefore, we rely on comparisons between different individuals and compute average treatment effects (ATE). Three ATEs, namely, average treatment effect on the treated (ATET), average treatment effect on the untreated and ATE, can be estimated, depending on the policy question to be addressed. Where assignment to and receipt of the treatment is randomised, the estimation of the ATE parameters involves obtaining simple mean differences between the treated and the untreated. However, since in our study, farmers were likely to self-select into the CF programme because of unobservable characteristics, we need to control for selection bias in participation using an instrumental variable $z$, defined by Imbens and Angrist (1994) to

be a variable unrelated to the responses $Y_0$ and $Y_1$ and correlated with the treatment $D$. Thus, selection into the programme is assumed to depend on the same factors affecting the outcome plus $z$ that does not directly affect the outcome except via the treatment variable.

An instrumental variable that satisfies the stated conditions results in the following structural system of (two) equations:

$$y_i = \mu_0 + w_i ATE + x_i \beta + \mu_{0i} \tag{1}$$

$$w_i^* = \eta + q_i \delta + \varepsilon_i \tag{2}$$

$$w_i = \begin{cases} 1 & \text{if} \quad w_i^* \geqslant 0 \\ 0 & \text{if} \quad w_i^* \leqslant 0 \end{cases} \tag{3}$$

$$q_i = (x_i, z_i) \tag{4}$$

where Equation (1) is the outcome equation, while Equations (2) and (3) are selection equations and Equation (4) is the exclusion restriction. Apart from the binary endogenous regressor (participation), we control for heterogeneity due to farm and household idiosyncratic factors in the outcome equation. We estimate three outcome equations using household, avocado and farm incomes as the dependent variables. The effect of CF on total household income provides an insight into the multiplier or spill over effects of enterprise-specific value chain interventions. In keeping with reallocation of resources among multiple enterprises in smallholder farming systems, CF was deemed to have multiplier or spill over effects beyond avocado and farm income. On the other hand, the effect of CF on avocado income is critical in understanding the pathway through which CF impacts on household income. Some of the control variables used in the model include age, education level and gender of the farm manager (household head), access to credit, size of labour force, land size, number of productive trees of avocado, number of income sources, access to extension and proximity to the market for agricultural produce.

The ATEs are estimated using a new STATA routine called ivtreatreg developed by Cerulli (2012). Ivtreatreg routine is designed for estimating binary treatment models with heterogeneous treatment responses to treatment under observable and unobservable selection. When selection is suspected to be related to "genuine" unobservables (intrinsically unknown to the analyst), estimating Probit-2SLS is recommended where the Probit model is applied to obtain the predicted probability of participation ($w$) or the propensity scores. The probabilities are then used in the 2SLS as an instrument for $w$.

## 3.2 Data, study area and sampling
The data used in this study were derived from household surveys carried out in 2012 over 100 smallholder avocado farmers in Kandara division in Murang'a County. Information from the structured surveys was complemented with qualitative information from FGDs and in-depth interviews with the officials of two farmer groups as well as some selected members. Key informant interviews with the contracting firm as well as some AGAK officials provided useful insights into

the nature of the contract and the governance structure of the avocado supply chain in the country. Multistage stratified random sampling was used to select the respondents for the household surveys. Kandara district was purposively selected because it has the highest concentration of avocado and is the largest supplier of avocado for the export and local markets compared to other avocado producing zones in the country (Kabbucho, 2004; USAID Kenya, 2008).

In the selection of locations, existence of avocado farmer groups was considered crucial because farmers' engagement in CF in the area was tied to group membership. As a result, group members formed a sub-sample of the CF participants. Out of eight locations in the division, Muruka and Ngararia were selected purposively because they had the highest concentration of well-established avocado farmer groups that were registered with the AGAK. A total of seven out of ten groups was selected based on group size, group composition, i.e. gender representation, and group maturity. In total, 65 respondents were selected randomly from the seven groups proportionate to the size of the group to form the treatment group. A comparison group comprising 35 households with similar socioeconomic and biophysical characteristics as participants except membership in avocado groups and CF were randomly drawn from the same locality as the treatment group. Although most groups were registered in AGAK, 27 respondents from the treatment group did not comply with the terms of the contract and were found to be side-selling to other buyers, mainly intermediaries (brokers).

Household surveys were conducted through a structured questionnaire, which captured information on socioeconomic and demographic characteristics of the households, production and marketing of avocado, access to financial services (credit and savings), participation in and knowledge of CF and enabling environment such as the condition of infrastructure and access to extension services.

## 4. Results and discussion
### 4.1 Characteristics of the sampled households
Table I provides summary statistics of the sampled households by participation in CF. The results suggest that there are no significant differences in most socioeconomic and demographic variables except education where participants have significantly more years of education than non-participants. Concerning farm characteristics, avocado production is generally undertaken on a small scale owing to the small land size of about two acres, with farmers producing two main exotic varieties, namely, Fuerte and Hass, which are predominantly for export. Europe is the main export market for Kenya's avocado, with France being the largest buyer. On average, the sample households own a total of 13 productive trees, and seven and six Hass and Fuerte productive trees, respectively. The participants tend to have significantly more total productive trees as well as Hass trees than non-participants. Hass is the most preferred variety in the international market, because of its long shelf life and less vulnerability to physical damage and susceptibility to pests and diseases, which perhaps explains why farmers participating in CF have a significantly higher number of productive trees of Hass than do non-participants. The sample households participating in CF appear to receive significantly higher prices for Fuerte and Hass varieties than those received by non-participants, and Hass variety fetches higher prices on average (KES2.55) than Fuerte variety (KES1.55). Non-contract participants were found to rely on brokers as their main buyer and brokers paid lower prices, which rarely exceeded KES1 per avocado, yet they offer alternative markets to producers who are not able to meet the requirements set by the contractor. Cases of non-compliance among the group

| Variable name | Description | Participants (n = 38) | Non-participants (n = 62) | Total (n = 100) |
|---|---|---|---|---|
| grpagak (instrument) | Proximity to AGAK official | 0.42 (0.5)*** | 0.48 (0.216) | 0.19 (0.394) |
| tothhincome_n (outcome) | Total household income | 115,554 (133,063.2)[a] | 84,346.37 (76,074.22) | 96,205.27 (102,053.9) |
| Farmincome (outcome) | Farm income | 71,016.37 (107,528.4)[b] | 53,989.34 (63,291.96) | 60,459.61 (82,816.34) |
| prodval_av_n (outcome) | Avocado income | 3,309.73 (7,584.56)** | 1,016.12 (4,103.74) | 1,887.7 (5,755.69) |
| *Household variables* | | | | |
| agehhead | Age | 63.24 (11.52) | 64.55 (10.52) | 64.07 (10.87) |
| gender_1 | Proportion of male farmers | 0.71 (0.46) | 0.61 (0.491) | 0.65 (0.479) |
| yrheduc_1 | Education | 8.79 (4.78)** | 6.57 (4.46) | 7.41 (4.69) |
| noeconprd | Economically productive members | 2.16 (2.10) | 2.08 (1.64) | 2.11 (1.82) |
| income_soc | Number of income sources | 2.684 (0.574) | 2.677 (0.566) | 2.68 (0.556) |
| *Institutional variables* | | | | |
| dextn | Distance to the nearest extension | 3.87 (2.99) | 4.30 (3.91) | 4.14 (3.58) |
| creditacc | Access to credit | 0.81 (0.393)*** | 0.62 (0.487) | 0.7 (0.460) |
| *Farm variables* | | | | |
| tacres | Farm size | 2.30 (1.80) | 2.02 (1.38) | 2.13 (1.86) |
| ptrees_ft | Fuerte productive trees | 6.16 (4.40) | 6.56 (4.61) | 6.41 (4.51) |
| ptrees_hs | Hass productive trees | 8.68 (5.26)** | 6.05 (5.63) | 7.05 (5.61) |
| totprt | Total productive trees | 14.84 (7.24)* | 11.85 (7.53) | 13.46 (7.21) |
| avprice_ft | Average price per piece of Fuerte | 1.98 (1.08)*** | 1.29 (0.56) | 1.55 (0.88) |
| avprice_hs | Average price per piece of Hass | 2.98 (1.25)** | 2.33 (0.71) | 2.55 (0.97) |

**Notes:** [a]1 USD = 80 KES. [b]Figures in parentheses are standard deviations. *,**,***Significant at 10, 5, and 1 per cent levels, respectively

members are reported to be high because the contractor does not offer instant payments like the brokers do or cater for the full cost of transportation from the farm. Consequently, farmers participating in the contract bear the cost of transporting the produce to the designated collection points unlike non-participants whose produce are purchased by the broker at the farm gate. Therefore, such an arrangement makes it difficult for farmers who face liquidity constraints to comply. This proposition is reinforced by the descriptive statistics in Table I, which suggest that a significantly higher number participants than non-participants had access to credit. With credit, farmers are likely to have access to productivity enhancing inputs such as fertiliser, seeds and pesticides, which are needed for the production of high-quality avocado that meet quality requirements set by the contractor.

In general, the sample households have diversified income sources to cushion them against production risks and consumption shocks. Maize production for subsistence and horticulture, particularly small scale fruit production for cash predominate the farming system in the study area. Apart from crop production, the households engage in livestock production and off-farm activities. Total household income, therefore, depends on the number of activities the household is able to engage in, which in turn is determined by availability of labour. The results indicate that there is no significant difference in the average household income, farm income and the number of income sources between the two groups. Nevertheless, significant differences are observed in the avocado income, which can be attributed to the differences in prices received by the two groups among other factors. As is expected, the three income variables are highly skewed, with the majority of the sample households, particularly those relying on farming earning relatively lower incomes per year.

### 4.2 Determinants of income and participation in CF

Table II provides regression estimates for the determinants of participation in CF as well as the determinants of household, farm and avocado income. The models are significant at 1 per cent level, thus suggesting that the instruments are good predictors of participation. According to the results, education, access to credit as well as proximity to AGAK officials increase the households' likelihood to participate in CF. Education increases the farmers' likelihood to participate in the contract through enhanced managerial ability and the capacity to make informed decisions. This finding is corroborated by empirical results from a study by Owuor (2009) where education was found to determine farmers' participation in micro-credit schemes.

In contracts where inputs or interlinked services are not provided by the contractor, credit plays a significant role in alleviating liquidity constraints that characterise smallholder systems in Sub-Saharan Africa where credit and insurance markets are generally missing or imperfect (Gine and Yang, 2009). In such circumstance, households that have access to credit are more likely to invest in the production of fruits that meet the buyer's quality requirements, which can earn them premium prices. Premium prices or bonuses have been shown to motivate farmers to participate in contractual arrangements (Somwaru and Makki, 2001; Saenger *et al.*, 2013).

Turning to the determinants of income, the results suggest that participation in CF is not a significant determinant of any of the three types of incomes. Instead, the variation in household income is explained by idiosyncratic factors such as land size and number of income sources. To the extent that crop production is the main economic activity in the study area, land size determines the number of crop enterprises that a farm household can engage in, which in turn has an influence on the size of income. This finding is corroborated by the results on the determinants of farm income, in which land size is the only significant determinant. Besides crop production, households with diversified income portfolios are able to spread risks among the enterprises, thereby accumulating more capital for reinvestment. Further, the results show that holding other factors constant, avocado income is significantly higher in households closer to the markets, managed by men, and having more productive trees of Fuerte and Hass. Being in close proximity to the market confers an advantage to the households because they are likely to have many alternative market channels, and hence a stronger bargaining power and more profitable prices than households located in the periphery. High transaction costs associated with the search for information on prices and markets for outputs and inputs have been shown to reduce profit margins

| | Avocado income | | Farm income | | Total income | |
|---|---|---|---|---|---|---|
| | Participation | Income | Participation | Income | Participation | Income |
| Curcf | – | 0.578 (0.529) | – | 0.136 (0.346) | – | 0.368 (0.27)[a] |
| _ws_gender_1 | – | -0.602 (1.250) | – | 0.354 (0.801) | – | 0.444 (0.885) |
| _ws_agehead | – | -0.011 (0.348) | – | -0.173 (0.249) | – | -0.243 (0.261) |
| _ws_agehh_sq | – | -0.000 (0.003) | – | 0.001 (0.002) | – | 0.001 (0.002) |
| _ws_yrhedu~1 | – | -0.128 (0.122) | – | -0.022 (0.080) | – | -0.034 (0.086) |
| grpagak | 2.070 (0.477)*** | – | 2.055 (0.451)*** | – | 2.100 (0.461)*** | – |
| gender_1 | 0.010 (0.421) | 0.921 (0.453)** | 0.042 (0.411) | 0.243 (0.303) | 0.053 (0.413) | 0.269 (0.327) |
| agehhead | -0.173 (0.125) | -0.039 (0.154) | -0.150 (0.120) | 0.071 (0.108) | -0.158 (0.121) | 0.083 (0.113) |
| agehh_sq | 0.001 (0.001) | 0.000 (0.001) | 0.001 (0.001) | -0.000 (0.001) | 0.001 (0.001) | -0.000 (0.001) |
| yrheduc_1 | 0.079 (0.043)* | 0.068 (0.060) | 0.078 (0.045)* | 0.014 (0.040) | 0.078 (0.046)* | 0.035 (0.043) |
| dextn | -0.045 (0.052) | 0.047 (0.037) | -0.060 (0.047) | 0.025 (0.025) | -0.061 (0.047) | 0.027 (0.067) |
| mktktm | -0.021 (0.053) | -0.088 (0.040)** | -0.034 (0.050) | -0.023 (0.027) | -0.028 (0.052) | -0.040 (0.029) |
| creditacc | 0.886 (0.389)** | -0.031 (0.288) | 0.908 (0.385)** | 0.031 (0.200) | 0.935 (0.387)** | 0.068 (0.214) |
| noeconprd | -0.063 (0.114) | -0.010 (0.102) | -0.079 (0.108) | 0.055 (0.066) | -0.061 (0.112) | 0.043 (0.075) |
| tacres | – | – | -0.025 (0.100) | 0.149 (0.051)** | -0.022 (0.100) | 0.131 (0.054)** |
| income_soc | -0.203 (0.309) | -0.135 (0.233) | – | – | -0.191 (0.290) | 0.389 (0.167)** |
| ptrees_hs | 0.048 (0.029) | 0.072 (0.024)** | – | – | – | – |
| ptrees_ft | -0.020 (0.037) | 0.049 (0.027)* | – | – | – | – |
| _cons | 5.134 (4.186) | 8.373 (5.414) | 4.241 (3.926) | 7.789 (3.720) | 4.864 (4.057) | 6.543 (3.950) |
| Observations | 98 | 98 | 100 | 100 | 100 | 100 |
| LR $\chi^2$ (11) | 40.84*** | – | 38.46*** | – | 38.9*** | – |
| Pseudo $R^2$ | 0.317 | – | 0.289 | – | 0.293 | – |
| $R^2$ | – | 0.38 | – | 0.062 | – | 0.173 |
| Adjusted $R^2$ | – | 0.258 | – | -0.093 | – | 0.026 |

**Notes:** [a]Figures in parentheses are standard deviations. *, **, ***Significant at 10, 5, and 1 per cent levels, respectively

**Table II.**
Determinants of income and participation in CF

for farmers, particularly those located in remote areas (Hiroyuki *et al.*, 2010; Zanello *et al.*, 2012). The finding that gender of the manager significantly influences avocado income could be attributed to differential access to resources that are necessary for producing high-quality fruits for the export market as has been well documented in a number of studies in Sub-Saharan Africa (Quisumbing, 1995). Although avocado production was reported to be less capital intensive, activities such as grading, spraying and picking that could not be handled by women managers required capital for hiring labour. Similarly, men tend to dominate and control the production and marketing of high-value crops such as avocado where returns are high (Bolwig, 2012). In the case of avocado, men were found to control the sale of avocado of premium quality that fetches higher prices, which could explain the variation in avocado income by gender. While men ranked avocado as the most important enterprise, women ranked it second after maize and beans, implying that women managers are more likely to allocate more resources to maize and beans if they were confronted with a budget constraint.

### 4.3 Impact of CF on income

Table III shows summarized results of the ATEs estimated for the impact of CF on household, farm and avocado income. The findings are fairly consistent across the three outcome variables. While participants in CF report higher incomes, the differences in the incomes of the two treatment groups are not significant, suggesting that the variation in the incomes cannot be attributed to the intervention. Although access to produce markets through contracting has been shown to have positive impacts on the welfare of the participants (see Ashraf *et al.*, 2008; Bolwig *et al.*, 2009; Miyata *et al.*, 2009; Bellemare, 2012; Bolwig, 2012), the results have been mixed at best. Contracts that have proved to be beneficial to the farmers and contractors are those that are managed effectively and both the parties are in a long-term relationship (Eaton and Shepherd, 2001). In this case, the contractor assumes part of the production and price risks and transfers some of the decision rights to the farmer (Key and Runsten, 1999). On the other hand, insignificant effects of CF have been associated with poor coordination of the contract (Da Silva, 2005), a situation that was evident in this study.

The intermediary model of contracting appeared to work against the producers, because terms of the contract were not known to the farmers. Instead, the intermediary seemed to negotiate for the terms without involving the key stakeholders, except through their officials. However, the contractual arrangement failed to recognize that production and marketing decisions were made individually by the farmers rather than collectively in the group. Similarly, to the extent that critical aspects of the contract, such as the pricing and grading mechanisms, were not fully explained to the producers, cases of breach of contract and side-selling were inevitable. Porter and Phillips-Howard (1997), Kirsten and Sartorious (2002) and Kottila and Rönni (2008) observe that contracts are less likely to thrive under conditions of mistrust resulting from

| | Farm income | Avocado income | Total household income |
|---|---|---|---|
| atet | 0.378 (0.830) | 0.176 (0.867) | 0.148 (1.623) |
| atent | 0.698 (0.894) | 0.112 (1.060) | 0.067 (2.917) |

**Table III.**
Effect of CF avocado, farm and total income

information asymmetry, which characterized the type of contracting considered in this study. The lack of effective enforcement mechanisms appeared to exacerbate the situation, because the group officials relied on the members to report on their colleagues who attempted to default on the contract. Because there was no binding contract between the producer and the contractor, the loophole could have been easily exploited by the farmers, especially where expected gains from the contract were deemed to be low. Likewise, since the prices offered and the quantities purchased by the contractor depended on the market forces, participation in the contract did not appear to confer any advantages to the farmers in terms of risk sharing. Indeed, it was noted that whenever there was a glut in production locally and price fluctuations in the export market, there were high rates of rejection of the fruits by the contractor and only small quantities of the fruits were sold at a premium price, while the remaining fruits fetched inferior prices, thus lowering incomes. Ideally, the type of CF investigated in this study appears to have failed to serve the intended objective of contracting, because the producers were the sole bearers of the production and marketing risks.

## 5. Conclusion and policy implications
Our study aimed at contributing to the current debate on the extent to which value chain upgrading strategies such as CF can improve smallholder farmers' welfare. Using a case study of smallholder avocado farmers in Kenya, the results demonstrate that participation in CF is not sufficient to increase smallholder farmers' income in circumstances where terms of the contract are not clear to the producers. Consequently, the necessary conditions that influence participation in CF such as knowledge, which is gained through education, access to credit and certainty about the terms of the contract need to be considered to make CF attractive and beneficial to the buyer and the producers.

Although empirical evidence is necessary to corroborate this proposition, anecdotal evidence from the case studies and key informant interviews suggest that contractual arrangements are likely to help structure markets and provide producers with market options that offer better prices, but the arrangements need to be accompanied by clear terms and conditions. For instance, issues regarding grading and pricing as well as mechanisms governing the terms of the contract need to be clearly defined and understood by the buyer and the seller. Thus, one key lesson emerging from this study that may be useful to development practitioners who are keen on improving smallholder farmers' welfare by establishing market linkages through contracting is that the nature of the contract matters. Where the negotiation does not directly involve the producers, unclear terms of the contract are likely to negate the benefits associated with contracting, as cases of side-selling to other buyers offering lower but instant payments may be high, which may lead to insignificant welfare impacts. With effective management and proper coordination of the contract, interlinked services like credit, which is necessary for accessing inputs and services (e.g. picking, grading and spraying) that are critical for producing high-quality fruits that fetch premium prices can be arranged between the buyer and the producer. This is likely to result in a win-win situation for both parties. Although our results appear to suggest that the nature of the contract determines the welfare impacts of participation in the contract, there is a need for further research on the topic using case studies from a wider geographical area as well as different enterprises.

**Note**

1. Value chain and supply chain are used interchangeably in this paper.

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**Corresponding author**
Mercy Maiwa Mwambi can be contacted at: mercymwambi2008@yahoo.com