Vol. 14(1), pp. 11-19, January-March 2022
DOI: 10.5897/JDAE2021.1316
Article Number: D9A626268856
ISSN 2006-9774

http://www.academicjournals.org/JDAE

ACADEMIC JOURNALS
expand your knowledge

Journal of Development and Agricultural Economics

Full Length Research Paper

Contract farming and farmers' well-being: The case of yam farmers in the Mion district of the Northern Region of Ghana

Ibrahim A. Yakubu, Hudu Zakaria* and Samuel S. K. Allotey

Department of Agricultural Innovation Communication, Faculty of Agriculture, Food and Consumer Sciences, University for Development Studies, Tamale, Ghana.

Received 24 October, 2021; Accepted 12 November, 2021

This study assesses contract farming effect on the well-being of yam farmers in the Mion district of the Northern region of Ghana. Through descriptive survey design 400 smallholder farmers in the district were surveyed with interviews and focus group discussion used to collect data from the sampled farmers. Descriptive statistics, factors analysis and Propensity Scores Matching were used to analyze the data. The propensity scores matching result indicates that farmers who participated in contract farming were more productive compared with non-participants. Participation in contract farming was found to have positive and significant effect on yam farmers' perceived well-being. In comparison with non-participants, yam farmers who participated in contract farming perceived themselves to have better wellbeing in terms of increased income, improved access to health and nutrition, improved food security, reduced poverty, reduced vulnerability, ability to pay for ward education and physical assets ownership. It is recommended that the MOFA and the District Assembly should facilitate farmers' access to contract farming schemes and other financial services to help farmers improve their productivity and better wellbeing.

Key words: Contract farming, yam farming, northern region, yam productivity, agricultural financing.

INTRODUCTION

Yams (*Dioscorea* spp.) are annual or perennial climbing plants with edible underground tubers. Yam belongs to the genus *Dioscorea* (family Dioscoreaceae) and only about half a dozen of the estimated 300-600 species available are grown for human consumption; some are grown for medicinal purposes (Seal et al., 2014). Yam is an important food commodity and it constitutes about 13% of the food budget of urban dwellers in and (MoFA, 2016). Yams store relatively longer in comparison with other tropical fresh produce and therefore stored yam represents stored wealth, which can be sold all-year-round by farmers or marketers (Amponsah et al., 2015). Therefore, yam supply in Ghana is relatively stapled in the face of rising demand due to urbanization. This has

*Corresponding author E-mail: hzakariahudu@uds.edu.gh/azakariahudu@gmail.com.

led to increase production of yam across the country. But lack of capital and adequate financing opportunities needed to purchase inputs and fund production activities is constraining smallholder farmers' ability to improve on their productivity and cash in on the increasing consumer demand for yam and yam products. The participation of smallholder farmers in modern supply chains is considered a crucial contributor to rural economic development and poverty reduction (Rob and Cattaneo, 2021).

However, smallholder farmers' market access is usually limited due to inefficiencies in input and output markets, and farm production is associated with high levels of risk. Market failures and risks lead to an underinvestment in inputs, technologies, and higher-value crops (Jones et al., 2019). Contract farming has emerged as an institutional response to market failures, with the potential to reduce risk, increase smallholder investments in inputs and technologies, and thus contribute to higher productivity and income (Mwambi et al., 2016). Contract farming has become an increasingly popular institutional tool to ensure the quality and quantity of inputs or raw materials for processors, exporters, distributors and supermarkets (Ragasa et al., 2018). At the same time, contract farming may help farmers overcome production constraints such as financial constraints, poor access to inputs or lack of technical and managerial capacity or assure markets for their harvest (Gramzow et al., 2018). As a result, contract farming arrangements are considered a win-win strategy for both buyers and farmers especially in developing and transitional countries that experience a variety of market imperfections and poor public institutions (Ncube, 2020; Oya, 2012). The emergent of contract farming is in response to developing countries government liberalization policies which failed to guarantee access to basic farming requirements including technologies, credit and inputs along with other essential services (Ncube, 2020).

However, there is no consensus in literature about the argument that contract farming arrangements are win-win strategy for both buyers and farmers. Others highlighted the fact that on one hand contract farming guaranteed regular supply of quality agricultural raw materials to buyers while on the other hand ensuring regular access to financial resources, inputs, and technology, and guarantee market to farmers (Rob and Cattaneo, 2021; Ncube, 2020; Ragasa et al., 2018; Mwambi et al., 2016). However, others argued that contract farming often failed to address market inefficiencies and farmers are most often shortchanged in input and out price negotiations which make their lives worst-off (Khan et al., 2019; Achaw, 2010).

Contract farming is hailed by many researchers and development practitioners to be passive progress for the agricultural revolution in developing countries, improving the chances of farmers in regional and international markets (Soluri, 2021; Maertens and Veide, 2017). While contract farming arrangements have the potential to address market failures and improve technology adoption, productivity and welfare of farmers, it also has the potential of constraining farmers' market diversification and profit maximization (Liverpool-Tasie et al., 2020).

Notwithstanding, the mixed results, contract farming as a form of agricultural financing is widely practiced among small and medium agricultural producers (Khan et al., 2019; Behera et al., 2021; Bijman et al., 2011; Bellemare and Novak, 2017). Contract farming is increasingly becoming the most preferred alternative to many farmers because the arrangement can offer them both an assured market and access to production inputs (Singh and Thakur, 2021). The trend towards contract farming is also evident in sub-Saharan Africa (SSA) where the institutional arrangement is considered a mechanism for helping farmers to overcome pervasive market failures. Indeed, recent estimates based on multi-country surveys suggest that about 5% of smallholder farmers in SSA are involved in contract farming arrangements (CFAs) and the number is increasing (Khan et al., 2019). In Ghana, government and donors often used contract farming as a strategy for increasing the adoption of new agricultural technologies and developing value chains (Poulton and Macartney, 2012).

Farmers often engage in contract farming to enable overcome financial constraints in their productions and to be assured of market for their produce. However, there is plethora of mixed empirical evidence on the effects of contract farming on farmers' productivity, income and wellbeing. While some studies showed positive effects of contract farming on farmers' wellbeing, others found negative effects. A study by Bidzakin et al. (2019), found positive effect of contract farming on rice farmers' income. Similar result was found in Barthelemy et al. (2016). Azumah et al. (2017) also demonstrated the positive effect of contract farming on farmers' efficiency. However, Biggeri et al. (2018) argued on the early positive impact of contract farming on farmers' wellbeing found in many empirical evaluations. Also Hung-Anh et al. (2019), found inconsistent payments and low contract prices associated with contract farming as having negative effects on farmers' wellbeing. Similarly, Fernández et al. (2020) found negative effect of contract farming on farmers' profit. Nordjo and Adjasi (2019) also found significant association between farmers' indebtedness and participation in contract farming.

In recent times, agribusiness firms, agricultural marketers and individuals have engaged in providing pre-financing arrangement through contracting farming to enable yam farmers meet their production cost and improve on their productivity (Behera et al., 2021; Bijman et al., 2011; Bellemare and Novak, 2017). Yam farmers in the Mion district have been engaged in contract farming arrangement with yam marketers for many years.

Some of the contractual arrangements are informal in which yam farmers make arrangement with women yam sellers who provide them with money to purchase inputs and the farmers in turn sell their produce to them at an agreed price. Records from the Department of Agriculture in the Mion district indicated that while some yam farmers in the district have voluntarily existed from the contracting farming arrangement, new farmers have joined the scheme. It is unclear as to the effect of the contract farming on farmers' productivity and wellbeing. In contributing to the debate on the effect of contract farming on smallholder farmers' wellbeing, this study assessed the effect of contract farming on the wellbeing of smallholder yam farmers in the Mion district of the Northern Region of Ghana.

METHODOLOGY

The study was conducted in the Mion district of the Northern Region of Ghana. The district created in 2012 is one of the major yam growing areas in Ghana. The district has a generally dry climate, with only one rainy season that runs from May to October. Annual rainfall fluctuates between 750 and 1050 mm with a mean temperature of 35°C (GSS, 2014). The district is largely agrarian with 90% of its labour force engaged in mainly subsistence agriculture producing mainly yam, maize, rice and soybeans.

Research design, sampling techniques, data collection and analysis

The main objective of the study was to assess the effects of contract farming on yam farmers' wellbeing; as such descriptive survey design was employed in carrying out the study. Based on the Feed the Future Ghana District Profile Series (2017) and the records from the District MOFA Office (2017) the total population of yam farmers in the district was estimated as 51,109. Through the application of Cochran's (1977) sample size determination formula a sample size of 400 farmers was found appropriate for the study.

Ten (10) yam producing communities in the district, where contracting farming schemes have been operating for some time now, were purposively selected for the study. The communities are Kayong, Sang, Zanduli, Sakpeh, Sambu, Paanting, Dabogni, Zakpalsi, Tensung and Bofoyili. From the list of yam farmers in each sampled community, stratified random sampling techniques were applied to stratify the farmers into those who were engaged in contracting farming arrangement and those who have never participated in contract farming though they would have like to participate. From the list simple random techniques were applied to select 239 participants of contract faming and 161 non-participants based on proportional representation.

Data was collected using personal and key informant interviews, questionnaire administration, focus group discussions and observation. The key informants for the study were some selected yam farmers in the district, yam marketers operating contract farming schemes, operators of agribusiness firms engaged in contracting farming and extension officers working with yam farmers. Focus group discussions were held in all the ten sampled communities with an average of nine (9) participants per each. The focus group discussion was used to collect data on nature and types of contract farming schemes operating in the district, types of pre-financing arrangement, nature of agreements between farmers and contract farming schemes and effects, and challenges of contract farming.

Nine (9) subjective wellbeing indicators developed by the Economic Co-operation and Development (OECD, 2018) were applied in assessing the wellbeing scores of the yam farmers surveyed. Respondents were asked to rate their level of agreement on how participation in contract farming had affected their wellbeing status using a five-point Likert scale 1 to 5. The wellbeing index was generated using the factor analysis method which reduces the attributes and minimizes multicollinearity. Wellbeing index, which was derived from the subjective wellbeing scores, was regressed against contract farming participation and other variables. Furthermore, analysis of the effects of contract farming participation on yam yields was addressed using propensity scores matching and treatment effects model.

Y_1 = (Yam yield) (1)

Following Random Utility Theory (RUT) a farmer's decision to participate in contract farming is analyzed within a random utility framework. The outcome variable (Yam yield) is considered as a linear function of binary variable for contract farming participation along with a vector of some other explanatory variables (X):

$$Y_h = \lambda X_h + \gamma V_h + \mu_h \quad (2)$$

where Y_h is the outcome variable, V_h is a binary variable for contract farming participation, λ and γ are vectors of parameters to be estimated and μ is the error term. However, from Equation 2, since γ measures the effect of contract farming participation (treatment variable) on yam (outcome variable), then, a yam farmer should be randomly assigned to the group of participants or non-participants. However, contract farming is rarely randomly assigned. Though, participation in contract farming leads to self-selection based on intended benefits. In other words, it translates the fact that in Equation 2, μ is correlated with V or Z. Equation 2 which does not take into account the self-selection and might lead to a biased estimation. The Propensity Scores Matching (PSM) is employed in this study in order to deal with selection bias.

In order to assess the actual effect of participation in contract farming on yam farmers (Yam yield), the method of matching based on propensity scores is applied. In such study, it requires the establishment of the requisite counterfactual that represents what would have happened should yam farmers not participate in contract farming.

The establishment of this counterfactual often poses problems where before participation remains missing. Under such circumstances appropriate estimation of the counterfactual is established by way of a comparative group that does not participant in contract farming. In the negotiation process of contract farming, participants were selected purposively rather than at random, the problem of ''selection bias'' is often encountered in assessment studies. Hence, assessing the effect of participant in contract farming based on a ''with and without'' approach "yam yield" inaccurate results (Friedlander and Robins, 1995) and any attempt to net out actual study effect must factor in the underlying selection process.

The case of participation in contract farming is open to all yam farmers in the catchment areas. Based on the participation in contract farming, the PSM framework is used for estimating the effects of yam farmers' participation in contract farming on yam yield. Effects through this outcome variable is obtained by matching an ideal comparative group (non-participants farmers) to the treatment group (participants farmers) on the basis of propensity scores (P-scores) of X. X is the set of observable characteristics

that determine participation in contract farming. By so doing the selectivity bias is greatly eliminated.

To develop the PSM framework, let Y_i be the outcome variable of a yam farmers I, such that Y_{1i} and Y_{0i} represent yam farmers outcome with and without participating in contract farming, respectively. A dummy variable Ii represent participation in contract farming by yam farmers i, where Ii = 1 if the yam farmer has participated in contract farming and I_0 = 0, otherwise. The outcome observed for yam farmer i, Yi is defined by the switching regression (Quandt, 1972).

$$Y_i = I_i Y_{1i} + (1 - I_i) Y_{0i} \tag{3}$$

The effect of participation in contract farming on yam yield is given by:

$$\Delta_i Y_I = Y_{1i} - Y_{0i} \tag{4}$$

where $\Delta_i Y_i$ represents the change in the outcome variable of yam farmer i, resulting from participation in contract farming. A yam farmer cannot be both ways, therefore, at any time, either Y_{1i} (participant yam farmers) or Y_{0i} (non-participant yam farmers) is observed for that yam farmer. This gives rise to the selectivity bias problem (Heckman et al., 1998). The framework assumes heterogeneity in effect of outcomes.

The heterogeneity assumption is important because, practically all yam farmers who participated in contract farming cannot benefit equally as a result of differing characteristics. The most commonly used evaluation parameters are averages (Heckman et al., 1998). The two means are common in the effect analysis framework effects. These are average treatment effect (ATE) and the average treatment effect on treated (ATT).

In the case of participation in contract farming, ATE estimates the effects of yam farmers' participation in contract farming on yam yield of the whole population without regard to only participants in contract farming but the ATT estimated yam farmers participation in contract farming effects conditional on yam farmers' participation in contract farming. It is the latter which this study seeks to estimate and it is represented as:

$$ATT = \left[E\left(\Delta_i \middle| I_i = 1\right)\right] = E\left[Y_{1i} - Y_{0i} \middle| I_i = 1\right] = E\left[Y_{1i} \middle| I_i = 1\right] - E\left[Y_{0i} \middle| I_i = 1\right]. \tag{5}$$

From Equation 5, E [Y_{0i} / I_i=1] is the missing data representing the outcomes of yam farmers' participation in contract farming in the absence of contract farming opportunities. One way to estimate the missing data is to use outcomes of a non-participating group. By using the outcomes of a non-participant farmer, Equation 5 can be rewritten as:

$$\left[E\left(\Delta_i \middle| I_i = 1\right)\right]_= E\left[Y_{1i} \middle| I_i = 1\right] - E\left[Y_{0i} \middle| I_i = 1\right]. \tag{6}$$

Without controlling for the unobservable heterogeneity, Equation 6 can be shown to consist of a bias in addition to the effect estimate. Subtracting and adding E [Y_{0i} / I_i=1] to the right-hand side of Equation 6 gives:

$$= E\left[Y_{1i} \middle| I_i = 1\right] - E\left[Y_{0i} \middle| I_i = 0\right] - E\left[Y_{0i} \middle| I_i = 1\right] + E\left[Y_{0i} \middle| I_i = 1\right]$$

$$= \underbrace{E\left[Y_{1i} - Y_{0i} \middle| I_i = 1\right]}_{\text{Bias}} + E\left[Y_{0i} \middle| I_i = 1\right] - E\left[Y_{0i} \middle| I_i = 0\right] \tag{7}$$

Rearranging Equation 7 gives:

$$= E\left[\Delta_i \middle| I_i = 1\right] + \left\{ E\left[Y_{0i} \middle| I_i = 1\right] - E\left[Y_{0i} \middle| I_i = 0\right]\right\} \tag{8}$$

Thus, a bias of the magnitude shown in Equation 8 results when non-participant yam farmers are selected for comparison with participants yam farmers, without controlling for the non-random participation in contract farming (Cobb-Clark and Crossley, 2003). The PSM method takes care of the bias, so that estimated participation effect is largely consistent. The method identifies and matches yam farmers within the yam farmers' participation that are similar in observable characteristics' X_i, to those of non-participants yam farmers. This is done by deriving propensity scores from a binary logit estimation of participation in contract farming model (Dehejia and Wahba, 2002). A binary logit model can be represented as:

$$\Pr\left(I_i = 1 \middle| X\right) = \frac{1}{1 + e^{-\beta X}} = \Pr\left(X\right). \tag{9}$$

where X is a vector of explanatory variable including yam farmers' demographic characteristics which are deemed to influence participation in contract farming; Pr (X) is the propensity scores.

Based on the propensity scores of participants and non-participants farmers, the nearest neighbor matching and Kernel matching methods are used to select the best non-participants farmers for participation in contract farming. Rosenbaum and Rubin (1985) noted that, since exact matching is rarely possible, an issue of closeness must be considered. Matching therefore uses the expected outcomes of the participants' yam farmers (participation in contract farming), conditional on the propensity scores to estimate the expected counterfactual of the non-participants yam farmers (Cobb-Clark and Crossley, 2003). The relation holds, only when the assumption of closeness of propensity scores is valid (common support assumption).

$$\left\{ E\left[Y_{0i}\right], I_i = 1, X_i = x\right\} = \left\{ E\left[Y_{0i}\right], I_i = 0, X_i \approx x\right\} \tag{10}$$

The ''conditional independence'' or ''exogeneity'' assumption must hold for this relation to be true. Rosenbaum and Rubin (1985) revealed that once appropriate common support is established the conditional impendence assumption becomes valid. They proved that, if outcomes without participation (Y_{0i}) are independent of participation in contract farming (I_i) given X_i = x, the participants are also independent of participation (I_i) given their propensity scores [P(X)]. In PSM participation in contract farming characteristics are used to estimate a single value (P-score) which serves as the basis of comparison rather than the characteristics themselves. The latter could be very laborious; hence PSM solves the ''curse of dimensionality''. Once common support is established for the participants, the heterogeneity impact (ATT) of the participation in contract farming on yam yield can then be estimated using Equation 10.

$$ATT = \left[E\left(\Delta_i \middle| I_i = 1\right)\right] = \frac{1}{I_i} \sum (Y_{0i}) I_i = \frac{1}{I_i} \sum \Delta_i I_i. \tag{11}$$

Nearest neighbor matching (NNM)

A case in the control group is matched to treated case based on the

Table 1. Matching methods to measure the effects participation in contract farming on yam yield.

Matching algorithm	Number of treated	Number of control	Yam yield			Standard error	t-stat
			Matched treated	Matched control	ATT		
Nearest neighbor	239	161	3,513.570	1662.875	1,850.695	154.284	1.28**
Kernel based	239	161	3,513.570	1662.875	1,850.695	145.346	1.29**

***Significant at 1%, **Significant at 5% and *Significant at 10% of significance levels.
Source: Field Survey Data (2021).

closest propensity score. Each person in the treatment group chooses individual(s) with the closest propensity score to them. The radius matching is using not only the closest nearest neighbor within each caliper, but all the individuals in the control group within the caliper.

Each yam farmer in the treatment group is matched to a weighted sum of individuals who have similar propensity with greatest weight being given to farmers with closer scores. This was done by using Kernel Based Matching (KBM). KBM uses weight averages of all cases in the control group to estimate counterfactual outcomes. The weight is calculated by the propensity score distance between a treatment case and all control cases. The closest control cases are given the greatest weight.

Data gathered through focus group and key inform interviews analysis was done based on the thematic areas of research interest. The analysis was done by first getting familiar with the data collected, this is achieved by going over the tapes and materials over and over again to identify patterns. The research then identifies connections and patterns, and themes by looking for common answers to the research question. The final results were presented in a form of direct quotation and in text write up.

RESULTS AND DISCUSSION

Effects of contract farming on-farm yield

In establishing the causal effects of farmers' participation in contract farming on yam yield, Propensity Scores Matching (PSM) model was applied. The 239 yam farmers who were participants of contract farming scheme were treatment group and 161 non-participants were the control group. The Average Treatment on Treated (ATT) was estimated using the Nearest Neighbours Matching (NNM) and Kernel Based Matching (KBM) algorithms. The result PSM is presented in Table 1. The PSM result indicates that yam farmers who participated in contract farming arrangements had a significant effect on the units of yam tubers harvested per acre. As shown in Table 1, the average unit of yam tubers harvested per acre by participants of contract farming was found to be 16.8 calabashes more than non-participants. Here, two matching indicators, the nearest neighbor and the kernel based matching algorithms were used as robustness checks. The qualitative narrative gathered from the focus group discussions and key informant interviews supported this result. Participants were of the view that they need money to buy inputs, especially labour, seed yam and tractor services, to enable them get high yields. With contract farming they are able to get the needed funds to pay for these inputs which enable them get better yield.

Both the Nearest Neighbor matching method and Kernel Based matching method identified 161 comparable control yam farmers from the non-participants. The average yam tubers estimated using the Kernel Based matching algorithms is same as that of the Nearest Neighbor matching algorithms. Both matching methods indicate that participation in contract farming plays an important role in increasing yam yield in the area. Comparing the results across the different matching methods indicate that the estimated contract farming participation effects is robust. The results imply that contract farming participants achieved 16.8 calabash unit of yam tubers more than the non- participants. This result is in agreement with Ragasa et al. (2018), who reported that farmers' participation in contract farming, lead to increase in yield per acre. Similarly, Dubbert (2019), found a statistically significant relationship between farmers' participation in contract farming and crop yield. Vicol et al. (2021) in their study proposed that giving farmers good contract deals would lead to increase crop yield.

Effects of contract farming on yam farmers' wellbeing

Here, presents the effects of yam farmers' participation in contract farming on wellbeing. This study used the subjective approach to help understand wellbeing from the perceptions of yam farmers. The motive was to find out what the wellbeing status of the yam farmers was from their own assessment.

Table 2 presents the indicators and responses for the wellbeing measurement according to the perceptions of yam farmers in the study. Nine subjective wellbeing indicators measured on a 5-point Likert scale were considered for the process. The results in Table 2 revealed that most 125 (31.3%) and 163 (40.8%) of the yam farmers perceived that contract farming had extremely high and high, respectively influence on their income level. However, on the perceived effects of

Table 2. Wellbeing measurement.

Wellbeing indicator	Level of agreement				
	Extremely High (1)	High (2)	Moderate (3)	Low (4)	Extremely Low (5)
Increase income	125 (31.3)	163 (40.8)	57 (14.2)	41 (10.3)	14 (3.5)
Improved access to health and nutrition	159 (39.8)	88 (22.0)	42 (10.5)	64 (16.0)	47 (11.8)
Improved food security	0 (0.0)	269 (67.3)	59 (14.8)	1 (0.3)	71 (17.8)
Reduced poverty	0 (0.0)	235 (58.8)	27 (6.8)	59 (14.8)	79 (19.8)
Reduced vulnerability	103 (25.8)	216 (54.0)	24 (6.0)	29 (7.2)	28 (7.0)
Employment (Farm expansion)	157 (39.3)	73 (18.3)	41 (10.3)	51 (12.8)	78 (19.5)
Status in the Community	0 (0.0)	0 (0.0)	284 (71.0)	49 (12.3)	67 (16.8)
House ownership	24 (6.0)	102 (25.5)	37 (9.3)	237 (59.3)	0 (0.0)
Improve access to better child education	59 (14.8)	106 (26.5)	188 (47.0)	41 (10.3)	6(1.5)

Source: Field Survey Data (2021).

contract farming on yam farmers health and nutrition status, about 159 (39.8%) and 88 (22.0%) of the yam farmers felt that contract farming had an extremely high and high, respectively influence on their health and nutrition status. Majority 269 (67.3%) of yam farmers felt that participation in contract farming had a high influence on their food security status. Generally, allow farmers to acquire the needed input for their farm work leading to increasing crop yield (Osabohien et al., 2018). As such, an increase in yield would guarantee a constant household food supply. A majority, 235 (58.8%) of the yam farmers felt that that participation in contract farming had a high influence on reducing their poverty status. While, nearly, 216 (54.0%) of the yam farmers felt that participation in contract farming had a high influence on reducing their vulnerability status.

The results further revealed that 157 (39.3%) and 73 (18.3%) of the yam farmers felt that participation in contract farming had extremely high and high, respectively influence on their ability to expand their farms. Also, 284 (71.0%) of the yam farmers felt that participation in contract farming had no influence on their status within the community. Majority 188 (47.0%) of the yam farmers felt that, participation in contract farming had a moderate influence on their ability in paying their ward's school fees. On education, this result was expected because, in most rural communities, children are usually sent to publicly funded schools. Finally, majority 237 (59.3%) of the yam farmers felt that participation in contract farming had a moderate influence on their ability to own a house.

Based on the perception of the yam farmers' well-being, the key informant from Sambu, who was the best yam farmer of the district in 2016, have this to say about the effect of their participation in contract farming on their wellbeing:

"*Our participation in contract farming have helped improved our well-being. Our income level has increased ever since we started participating in contractual yam farming. This has helped us to acquired and provide the basic needs to our families. Our participation in contract farming had made it possible for us to always pay our wards school fees and provide educational materials for our children.* …" (Key informant interview; Sambu, Northern region, Ghana; January, 2021)

This demonstrates farmers' positive perceptions about the effect of contract farming on the wellbeing. In general respondents perceived their participation in contract farming as something positive regarding its contribution to their wellbeing.

Exploratory factor analysis

Table 3 presents the results from the exploratory factor analysis with Varimax with Kaiser Normalization rotation. This was used to reduce the number of wellbeing indicators assessed by respondents to one (an index of wellbeing). This method helped in using just one generated wellbeing variable which was an index in the regression model which eliminated the problem of multicollinearity. This index explained 58.65% of the variance.

Regression results on the effects of contract farming on wellbeing

The dependent variable wellbeing index was generated from a factor's analysis with a continuous variable, while participation in contract farming was a dummy variable, thus (0=non-participation and 1= Participation). This study adopted a multivariate regression because the wellbeing index was a continuous variable. The other

Table 3. Exploratory factor analysis.

Wellbeing indicator	Factor solution	
	Unrotated factor solution	Rotated factor solution
Increase income	-0.074	-0.050
Improved access to health and nutrition	-0.023	-0.015
Improved food security	0.117	0.074
Reduced poverty	0.359	0.250
Reduced vulnerability	-1.023	-0.828
Employment (Farm expansion)	0.494	0.437
Status in the Community	0.347	0.321
House ownership	0.320	0.290
Improve access to better child education	0.141	0.158
Eigenvalue	1.681	
Proportion of variance explained by factor (%)	58.655	

Source: Field Survey Data (2021).

Table 4. Effects of contract farming on yam farmers' wellbeing.

Wellbeing	Coefficients	Std. Err.	P-value
Farm size	0.01357	.0391295	0.350
FBO Membership	0.17486**	0.2299319	0.005
Extension	-0.01306	0.3135323	0.140
Credit	0.00620	0.2431747	0.330
Market	-0.18388	0.3609707	0.510
Quantity of yam harvested	0.00008**	0.0000743	0.008
Participation	0.12803**	1053384	0.007
Farming experience	0.35088**	0.1237868	0.005
Other source of income	0.30207	0.2487172	0.225
Number of obs.	400		
LR Chi^2 (6)	16.06		
Prob > Chi^2	0.0786		
Pseudo R^2	0.6010		
Log likelihood	267.57096		

*10% significant, **5% significant, and ***1% significant.
Source: Field Survey Data (2021).

independent variables included in the model were: Farm size, FBO Membership, Extension, Credit, Market, Farming experience, other source of income, Quantity of yam harvested and Participation in contract farming. The regression results (Table 4) show that FBO Membership, Quantity of yam harvested and Participation all influenced the wellbeing of yam farmers.

The results of the regression analysis as presented in Table 4 show that FBO membership, Farming experience, Quantity of yam harvested and Participation in contract farming are significant at 5% in influencing wellbeing. Thus, apart from participation in contract farming, FBO memberships, experience in yam farming and quantity of yam harvested all positively influence farmers' perceived wellbeing.

Participation in contract farming was found to have positive and significant effect on yam farmers' perceived well-being with a coefficient of 0.12803. This implies that yam farmers who participated in contract farming were more likely to higher perceived wellbeing score compared with non-participants shown in Table 4. According to Ton et al. (2018) and Ruml and Qaim (2020), participation in contract farming has a direct relationship with the increased yield and income status of farmers. Also, Bellemare and Bloem (2018), reported a positive relation between vegetable farmers' participation in contract

farming and wellbeing.

CONCLUSION AND RECOMMENDATION

The propensity scores matching results indicates that farmers who participated in contract farming produce significantly higher per unit compared with non-participants. Participation in contract farming was found to have positive and significant effect on yam farmers' perceived well-being. In comparison with non-participants, yam farmers who participated in contract farming perceived to have better wellbeing in terms of increased income, improved access to health and nutrition, improved food security, reduced poverty, reduced vulnerability, ability to pay for ward education and physical assets ownership.

It is recommended that the MOFA and the District Assembly should facilitate farmers' access to contract farming schemes and other financial services to help farmers improve productivity and better wellbeing. Also, the District Assembly should institute measures to regulate the activities of informal contract farming schemes to help safeguard farmers. MOFA should facilitate financial and market linkage services to yam farmers to enable diversify their sources of funding and markets for better pricing and profitability.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

REFERENCES

Achaw MA (2010). The impact of large-scale pineapple companies on rural livelihoods in the Akuapim South Municipality of Ghana. Master's thesis University of Oslo Blindern, Norway, 2010.

Amponsah SK, Akowuah JO, Adu-Kwarteng E, Bessah E (2015). Design and construction of improved yam storage structure using locally-available materials.

Azumah SB, Donkoh SA, Ansah IGK (2017). Contract farming and the adoption of climate change coping and adaptation strategies in the northern region of Ghana. Environment, Development and Sustainability 19(6):2275-2295.

Behera HC, Kodirekkala KR, Sinha AA (2021). Small and Marginal Farmers' Participation in Potato Contract Farming in West Bengal, India. Journal of Asian and African Studies 00219096211025074.

Bellemare MF, Bloem JR (2018). Does contract farming improve welfare? A review. World Development 112:259-271.

Bellemare MF, Novak L (2017). Contract farming and food security. American Journal of Agricultural Economics 99(2):357-378.

Bidzakin JK, Fialor SC, Awunyo-Vitor D, Yahaya I (2019). Impact of contract farming on rice farm performance: Endogenous switching regression. Cogent economics and Finance 7(1):1618229.

Biggeri M, Burchi F, Ciani F, Herrmann R (2018). Linking small-scale farmers to the durum wheat value chain in Ethiopia: Assessing the effects on production and wellbeing. Food Policy 79:77-91.

Bijman J, Muradian R, Cechin A (2011). Agricultural cooperatives and value chain coordination. In Value chains, social inclusion and economic development: Contrasting theories and realities, ed. A.H.J. (Bert) Helmsing, Sietze Vellema pp. 82-101. Routledge.

Cochran WG (1977). Sampling Techniques. 3rd Edition, John Wiley & Sons, New York.

Dehejia R, Wahba S (2002). Propensity Score-Matching Methods for Nonexperimental Causal Studies. The Review of Economics and Statistics 84(1):151-161.

Dubbert C (2019). Participation in contract farming and farm performance: Insights from cashew farmers in Ghana. Agricultural Economics 50(6):749-763.

Fernández JE, Alcon F, Diaz-Espejo A, Hernandez-Santana V, Cuevas MV (2020). Water use indicators and economic analysis for on-farm irrigation decision: A case study of a super high density olive tree orchard. Agricultural Water Management 237:106074.

Gramzow A, Batt PJ, Afari-Sefa V, Petrick M, Roothaert R (2018). Linking smallholder vegetable producers to markets-A comparison of a vegetable producer group and a contract-farming arrangement in the Lushoto District of Tanzania. Journal of Rural Studies 63:168-179.

Heckman J, Ichimura H, Jeffrey S, Todd P (1998). Characterizing Selection Bias Using Experimental Data. Econometrica 66(5):1017-1098.

Hung Anh N, Bokelmann W (2019). Determinants of smallholders' market preferences: The case of sustainable certified coffee farmers in Vietnam. Sustainability 11(10):2897.

Jones MR, Kondylis F, Loeser JA, Magruder J (2019). Factor market failures and the adoption of irrigation in rwanda. The World Bank.

Khan MF, Nakano Y, Kurosaki T (2019). Impact of contract farming on land productivity and income of maize and potato growers in Pakistan. Food Policy 85:28-39.

Liverpool-Tasie LSO, Wineman A, Young S, Tambo J, Vargas C, Reardon T, Celestin A (2020). A scoping review of market links between value chain actors and small-scale producers in developing regions. Nature Sustainability 3(10):799-808.

Maertens M, Vande Velde K (2017). Contract-farming in staple food chains: The case of rice in Benin World Development 95:73-87.

Mion Ministry of Food and Agriculture (MoFA) District office (2017). Annual Progress Report For 2016- Implementation of District Medium-Term Development Plan-(2014-2017).

MOFA (2016). Agricultural Sector Progress Report 2015. Ministry of Food and Agriculture (MOFA), GOG, Accra.

Mwambi MM, Oduol J, Mshenga P, Saidi M (2016). Does contract farming improve smallholder income? The case of avocado farmers in Kenya. Journal of Agribusiness in Developing and Emerging Economies.

Ncube D (2020). The importance of contract farming to small-scale farmers in Africa and the implications for policy: A review scenario. The Open Agriculture Journal 14(1).

Nordjo RE, Adjasi CK (2019). The impact of credit on productivity of smallholder farmers in Ghana. Agricultural Finance Review.

OECD (2018). Measuring Well-Being and Progress: Well-Being Research http://www.oecd.org/statistics/measuring-well-being-and-progress.htm(accessed on 20 August 2021)

Osabohien R, Afolabi A, Godwin A (2018). An econometric analysis of food security and agricultural credit facilities in Nigeria. The Open Agriculture Journal 12(1).

Oya C (2012). Contract farming in sub-Saharan Africa: A survey of approaches, debates and issues. Journal of Agrarian Change 12(1):1-33.

Poulton C, Macartney J (2012). Can public–private partnerships leverage private investment in agricultural value chains in Africa? A preliminary review. World Development 40(1):96-109.

Ragasa C, Lambrecht I, Kufoalor DS (2018). Limitations of contract farming as a pro-poor strategy: The case of maize outgrower schemes in upper West Ghana. World Development 102:30-56.

Rob VOS, Cattaneo A (2021). Poverty reduction through the development of inclusive food value chains. Journal of Integrative Agriculture 20(4):964-978.

Ruml A, Qaim M (2020). Effects of marketing contracts and resource-providing contracts in the African small farm sector: Insights from oil palm production in Ghana. World Development 136:105110.

Seal S, Turaki A, Muller E, Kumar PL, Kenyon L, Filloux D, Serge G, Lopez-Montes A, Iskra-Caruana ML (2014). The prevalence of badnaviruses in West African yams (*Dioscorea cayenensis*-rotundata) and evidence of endogenous pararetrovirus sequences in their genomes. Virus Research 186:144-154.

Singh A, Thakur S (2021). Contract Farming: Opportunities & Challenges. Ilkogretim Online 20(1).

Soluri J (2021). Banana cultures: Agriculture, consumption, and environmental change in Honduras and the United States. University of Texas Press.

Vicol M, Fold N, Hambloch C, Narayanan S, Helena, Niño HP(2021). Twenty-five years of Living under Contract: Contract farming and agrarian change in the developing world. Journal of Agrarian Change 22(1):3-18.