

Contract Farming and Its Impact on the Productivity of Rice Farmers in Anambra State, Nigeria

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ABSTRACT

The importance of rice in achieving both food security and economic growth in Nigeria cannot be overemphasized. Yet, growth in productivity of rice in Nigeria remains low in comparison to the global average. The Nigerian government has involved the private sector and international organizations to drive productivity growth in rice production through contractual arrangement in order to close the gap between the production and consumption of rice, however, there is limited evidence on the effectiveness of these efforts to improve rice productivity growth. The impact of contract farming on the productivity of rice farmers in Anambra state was therefore evaluated in this study. Data was obtained from 240 (comprising of 90 contract rice farmers and 150 non-contract rice farmers) selected through multistage random sampling technique. Using total factor productivity and propensity score matching techniques, the study found that participation in contract farming arrangement among rice farmers was favourable to overall productivity of the farmers. On average, contract rice farmers had about 34% more productivity level than non-contract farmers observed through the different propensity score matching methods. Expansion of contract arrangement among rice farmers is encouraged as a measure to increase overall productivity and bridge the supply gap in the rice sub sector.

Keywords: Average treatment effect, Contract farming, Propensity score matching, Rice farmers, Rice production,

Introduction

Contract farming is seen as a tool for development to contribute to achieving macro-economic development objective of pro-poor growth and food security. Eaton and Shepherd (2001), referred to contract farming as a forward agreement for the production and marketing of agricultural commodities often at predetermined prices between primary producers (farmers) and processing and/or

marketing firms (buyers), organisations or other intermediaries. It is a conditional agreement on production and marketing of agricultural commodities between farmers and contractors (Andrew, 2013). The agreement can be either market-specification, resource provision and/or production-management. Therefore, there are no specific construct for the design and operation of agricultural contract

farming arrangement. Therefore, most contract structures are designed for specific situations.

Contract farming dates back to the 19th century in the United States where it was used for processing crops and fruits, sugar production in Taiwan (Warning and Hoo, 2000) and at least to the 1940s in Latin America for poultry banana, and soya production by multinational companies (Prowse and Thirion, 2012). Also, contract farming arrangement exists and is still gaining popularity in developing countries; Kenya, Madagascar, Ethiopia and Senegal in horticultural crop production; Bangladesh, Thailand and India in poultry production and Vietnam for cotton, fresh milk, tea and rice production (Minot and Ronchi, 2015). However, in most of Africa, contract farming has been mostly associated with high-value perishable export crops such as cotton, paprika and tobacco produced in Mozambique and Zambia (Prowse and Thirion, 2012). In Southern and Eastern Africa, staple crops like yams, plantain and rice are contracted (Kutawa, 2016). Contract farming arrangement also exists in Nigeria specifically in the rice sector as recorded in Makurdi, Benue state where small scale rice farmers are contracted by agribusiness firms (Olomola, 2010). Such arrangements exist because of the high rate of rice consumption yet the rice sector is characterized by small farm holdings with low productivity and income owing to the inefficient production systems, aging farming population and heavy dependence on the use of traditional technologies (Okodua, 2017).

Lately, the concept of contract farming has obtained a favourable response among policymakers, development planners, extension agents and researchers as one of the modern farming methods that could develop agricultural entrepreneurs and help overcome the difficulties involved with traditional production systems. These difficulties include input and output market failure, high production cost and low competitiveness in international market. Contract farming arrangements enable farmers have access to many agricultural services including provision of inputs at subsidized rate, access to extension services and technical assistance that would otherwise be inaccessible. By reducing risk, uncertainty and transaction costs, it links farmers to markets and stimulates agricultural production in the face of globalization (Adjognon and Naseem, 2012). Contract farming is seen as a solution to several constraints that limit the productivity and income of small-scale farmers in developing countries.

There is abundance of empirical studies of contract farming arrangements on fruits, vegetables, poultry and horticulture production; for example, Kutawa (2016) examined the determinants of participation in tomato contract farming arrangement while Arumugam *et al.* (2011) studied the determinants of Fresh Fruits and Vegetables (FFV) Farmers' Participation in Contract Farming in Peninsular Malaysia, Simmons *et al.* (2005) studied the impact of contract farming in poultry, maize seed, and rice seed in Indonesia while Wainaina *et al.* (2014) assessed the impact of contract poultry

production. However, limited evidence exist on the impact of contract farming in the staple foods sector in sub-Saharan Africa and Nigeria in particular. Hence, this study assessed the impact of contract farming on rice farmers' productivity in Anambra state. The specific objectives were to:

- i. Estimate the productivity level of the rice farmers.
- ii. Evaluate the impact of contract farming on the productivity of participants.

Materials and Methods

Data and data source

The study was carried out in Anambra state, located in the South-Eastern part of Nigeria with Awka as its capital and made up of 21 Local Government Areas (LGAs). Rice is produced in eight LGAs of the state and these include; Anambra West, Anambra East, Ayamelum, Awka North, Ogbaru, Ihiala, Orumba North and Orumba South as shown in Figure 1. For this study, however, three-local government areas (Anambra East, Awka North

and Ayamelum) were randomly selected from the rice-producing areas which had favorable agro-climatic condition to support commercial rice production and the existence of contract farming arrangement in these areas. Primary data was collected for this study from cross-section of rice farmers participating in contract farming arrangement and non-participants in the study area using a structured questionnaire through a multistage sampling technique. In the first stage, three local government areas were selected randomly from a list of rice-producing local government areas (Figure 1). The second stage involved random selection of five towns from each of the selected local government area. The third stage was a random selection of sixteen rice farmers from each town selected. In all, two hundred and forty respondents comprising of one hundred and fifty non-contract rice farmers and ninety rice farmers participating in contract farming arrangement were sampled. Data was collected on rice farmers' socio-economic characteristics, output price and input cost.

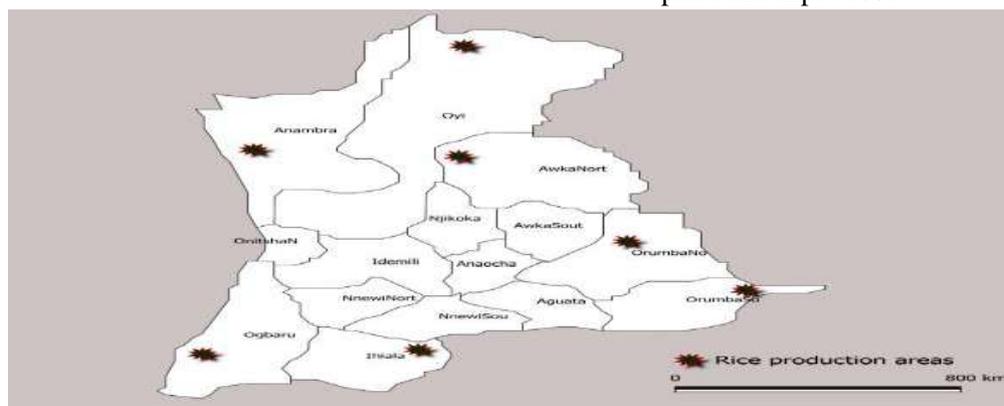


Figure 1: A map of Anambra state showing rice-producing Local Government areas from where respondents were sampled

Source: Authors' creation from ESRI shapefile database (2020)

Model specification

Estimation of productivity levels

The model for the Total Factor Productivity (TFP) index specified by Key and McBride (2003) and Rahji (2007) are as follows;

$$P_i = \frac{Q_i}{C_i} \\ = \frac{Q_i}{\sum_a^m c_l x_l} \quad (1)$$

Where P_i , Q_i and C_i are the total factor productivity, quantity of rice produced and total variable cost incurred by farmer i in the production of Q rice units. Total variable cost on the other hand is a summation of variable random assignment of treatments as in randomized experiments, the PSM method estimates the impact of a treatment (in this case, participation in contract arrangement by rice farmers) contingent on the similarity between the treated (contract farmers) and the untreated or control population (non-contract farmers). To obtain the treatment effects, the PSM follows three steps.

The first step in the PSM was the estimation of propensity scores (i.e. the farmers' probability of participation) based on similar characteristics using Logit model. The model is specified as follows:

$$P \left[(X) \equiv \Pr \left(D = \frac{1}{X} \right) \right] \\ = E \left(\frac{D}{X} \right) \quad (2)$$

Where $D = \{0, 1\}$ is the indicator of exposure to treatment, in this case, participation in contract farming and X is the vector of pre-treatment characteristics such as age, household

input cost for inputs such as seeds, fertilizer, labour and marketing cost represented by the sub and superscripts $\in a - m$ where x_l and c_l are the quantities and price per units of each variable input l .

Propensity Score Matching (PSM)

To estimate the impact of contract farming participation, the propensity score matching method (PSM), a non-parametric method used to estimate causal treatment effects (Caliendo and Kopeining, 2008) was adopted. In the absence of

size, educational level, gender, farming experience, farm size, extension officers visit, cooperative membership, age² and farming experience². These pre-treatment variables are considered as determinants of selection into contract arrangement and were chosen based on literature and guidelines in Caliendo and Kopeining (2008) and Dehejia and Wahba (1999).

The second step involved choosing a matching algorithm. One of the main ways of controlling for bias that arises from selection on unobservable in binary treatment effects is propensity score matching. Three different matching techniques including the nearest neighbour matching (NNM), calliper or radius matching (RMM) and kernel-based matching (KBM) methods were applied to match rice farmers according to their propensity score. NNM method is the most straight forward matching method where non-treated individuals that are very close to the propensity

score of treated individuals are chosen as partners. The kernel matching and radius matching methods on the other hand were used as complementary models to ensure that the strength of method used does not bias the estimates of the impact analysis. KBM uses information from all control group households and a weighting function to construct the

After matching, a test of covariate balancing was done on different matching methods to determine the quality of propensity score matching. The true parameter τ_{ATT} of participation impact is only identified if the

After matching, the most prominent evaluation parameter known as Average treatment effect on the treated (ATT), which focuses explicitly on the effects on those for whom the programme is intended was calculated. ATT is the difference between expected outcome values with and without treatment for those who participated in

Where $Y_i(1)$ denotes potential outcomes when the i^{th} farmer participates in contract farming arrangement and $Y_i(0)$ implies otherwise. D_i denotes the contract participation, where 1= participate and 0 = otherwise. The mean difference between observables and control is written as;

counterfactual outcome and reduces variance while the RMM uses information only from the nearest neighbours within the caliper distance and reduces bias (Caliendo and Kopeinig, 2008). Kernel based matching was done using epan (kernel type) and a bandwidth of 0.10, while radius matching used a caliper distance of 25% (0.25) points.

outcome of treatment and control under the absence of contract are the same. This is written as:

$$\begin{aligned} E[Y_i(0)/D_i = 1] - E[Y_i(0)/D_i = 0] \\ = 0 \end{aligned} \quad (3)$$

treatment, (Caliendo and Kopeinig, 2008). It is given by:

$$\begin{aligned} \tau_{ATT} &= E(\tau/D_i = 1) \\ &= E[Y_i(1)/D_i = 1] \\ &\quad - E[Y_i(0)/D_i \\ &= 1] \end{aligned} \quad (4)$$

$$\begin{aligned} E[Y_i(1)/D_i = 1] - E[Y_i(0)/D_i = 1] \\ = \tau_{ATT} + \varepsilon_i \end{aligned} \quad (5)$$

Where ε is the selection bias given as:

$$\begin{aligned} \varepsilon_i &= E[Y_i(0)/D_i = 1] \\ &\quad - E[Y_i(0)/D_i \\ &= 0] \end{aligned} \quad (6)$$

Results

Socio-economic characteristics of rice farmers

The characteristics of the rice farmers involved in contract arrangement as well as those not participating in these bilateral relationships are presented in Table 1. There are more female rice farmers (52.08%) than the male counterparts but this distribution appeared skewed in favour of male farmers with respect to their decisions to participate in rice contract farming arrangement. With more than 60% of the non-contract farmers being females, only about 37% of females make up the population of contract farmers. There appeared not to be any differences in household demographic structures with respect to average household sizes among contract and non-contract farmers. The household size ranging 6-8 persons per household and mean household size of 7 persons per household indicating availability of labour. The mean age of rice farmers in the study area was 40 years. While a larger (51.11%) proportion of the contract farmers were within the age brackets of 40 to 49 years, on the contrary, younger farmers with ages less than 40 years were the majority of the non- participants in the contract arrangement. Similar to the household size structures, the educational attainments of both contract and non- contract farmers appeared similar.

In general, most rice farmers (56.7%) had attained primary education and these attainment level cut across both categories of farmers. With regards to farming experiences, both contract farmers and non-contract farmers had similar distribution of experiences. Most of the farmers in both groups could be considered relatively young in rice farming with years of farming ranging from 6 to 15 years in about 58% of participants and more than 75% of non-participants. However, on average contract farmers had more farming experience of about 14 years compared to 13 years among non-contract farmers. A majority (87.9%) of the rice farmers acquired land either by lease or rent while only about 12% of the farmers sampled owned their lands either through inheritance or purchase. The distribution of land ownership was found to be similar among contract and non-contract farmers. On average, each of the rice farmers had access to agricultural information through extension agents about 3 times in the last growing season. However, contract farmers had more contacts than the non-contact farmers in a ratio of about five to one. The mean number of times of extension contact among the contract farming participants was 5 while that of the non-contract farming participants was 1. This was also evidenced in the distribution of more than 94% of the farmers having more than three contacts compared to only about 17% of non-participants having such contacts.

Table 1. Distribution of rice farmers by their socio-economic characteristics

	Participants		Non-participants		Pooled	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Gender						
Female	33	36.67	92	61.33	125	52.08
Male	57	63.33	58	38.67	115	47.92
Household size						
3 – 5	13	14.44	24	16.00	37	15.42
6 – 8	56	62.22	97	64.67	153	63.75
9 – 11	21	23.33	29	19.33	50	20.83
Mean ± SD	7.1 ± 1.57		6.97 ± 1.54		7.02 ± 1.55	
Age (Years)						
30 – 39	42	46.67	87	58.00	129	53.75
40 – 49	46	51.11	59	39.33	105	43.75
≥ 50	2	2.22	4	2.67	6	2.50
Mean ± SD	40.01 ± 5.09		39.35 ± 5.06		39.6 ± 5.07	
Educational status						
Non-Formal	2	2.22	5	3.33	7	2.92
Primary	52	57.78	84	56.00	136	56.67
Secondary	35	38.89	55	36.67	90	37.50
Tertiary	1	1.11	6	4.00	7	2.92
Farming Experience						
6-15	52	57.78	113	75.33	165	68.75
16-25	37	41.11	31	20.67	68	28.33
26-35	1	1.11	6	4.00	7	2.92
Mean ± SD	14.32 ± 5.10		13.43 ± 5.16		13.77 ± 5.15	
Land Ownership						
No	79	87.78	132	88.00	211	87.92
Yes	11	12.22	18	12.00	29	12.08
Extension officer visit						
<3	0	0.00	124	82.66	124	51.66
3-6	85	94.45	23	15.34	108	45.00
>6	5	5.55	3	2.00	8	3.34
Mean ± SD	5.23 ± 0.85		1.08 ± 1.94		2.64 ± 2.59	

Productivity level of rice farmers

A summary of the different levels of productivity among farmers as measured by the

total factor productivity (TFP) is presented in Table 2. The results show that in general, the average returns per variable input utilized in

rice production was about 4.25 times the cost incurred in production. The estimates further suggest that the average returns were higher among contract farmers with a mean productivity level of 5.3 compared to 3.63 for non- contract farming participants. This estimate shows that the average productivity across both groups varies by about 46 percentage points. While most of the contract farmers (about 31%) fell into the category of TFP ranging 5.6-7.5, a larger proportion (more than 53%) of the non-contract farmers were within the zero to 3.5 productivity category.

Although a significant percentage (30%) of the contract farmers also had low productivity level below 3.5, these were nowhere comparable to the fraction of non-contract farmers within same category. On the other hand, while more than 45% of the contract farmer had productivities exceeding 5.5, only about 13% of the non-contract farmers achieved the same feat. The result shows an obvious dichotomy between productivities across both groups and a potential for contract farming to increase productivity of engaged farmers, although this is not conclusive yet at this point of the study.

Table 2. Distribution of rice farmers by level of productivity

Total factor productivity	Participants n=90		Non-participants n=150		Pooled n= 240	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
< 1.5	0	0.00	3	2.00	3	1.25
1.6 –3.5	27	30.00	80	53.33	107	44.58
3.6 –5.5	21	23.33	48	32.00	69	28.75
5.6 –7.5	28	31.11	18	12.00	46	19.17
> 7.5	14	15.56	1	0.67	15	6.25
Mean ± SD	5.27 ± 2.24		3.63±1.48		4.25 ± 1.96	

Impact of contract farming on rice farmers' productivity

The results of the quantitative comparative assessments between contract rice farmers and non-contract counterparts are presented in tables 3 and 4. The first stage in the impact assessment reported in table 3 explains the likelihood of participation in contract farming arrangement based on determinants of decision to participate in such arrangements.

Factors influencing of rice farmers' participation in contract farming

As shown in Table 3, several factors including age, gender, household demographics, educational attainment, level of awareness, as well as social and material welfare were found to be directly responsible for the likelihood that each potential farmer participates in contract farming arrangement. The model in general showed good fit with a likelihood ratio of -120.56 and χ^2 of 76.44. The explanatory variables included in the model showed that

about 24% of the variances in the probability of contract farming participation were explained by factors included in the model (although the R^2 is high for a logistic model, this is not very useful metric in determining model fit).

The probability that a rice farmer chosen randomly engages in contract arrangement decreases by 0.76% for every year age of the farmer. Similarly, household size was also negatively significant at 95% confidence level like the age. Contrary to expectations, an additional person in the household was found to decrease the probability of participating in rice contract farming by 0.25%. With respect to gender, the result showed that being male increased the likelihood of contract farming participation by 1.51%, significant at 1% level of significance. Awareness and social capital as represented with extension contacts and cooperative membership were found to align positively and significantly with contract farming participation at 99% confidence level.

Farmer's likelihood to engage in contract arrangement was found to increase by 0.28% as the number of contacts with extension workers increased by one more time while being a member of a cooperative had a higher probability of increasing contract farming participation by 1.17% compared to non-members. Before estimating the, the propensity score was estimated and a common support based on the propensity score was assessed. The estimated propensity score for assessing impact of contract farming participation, ranged between 0.02 and 0.97. Since the propensity score is a probability, therefore the average probability to participate in the treatment for all the individuals is 37.5% (data based on equation 1 - 6, notable presented). The region of common support further verified that there was a substantial overlap in the propensity score distribution between rice contract farming participants (treated) and non-participants (untreated), therefore satisfying the common support condition (Figure 2).

Table 3. Determinants of rice farmers' participation in contract farming

Variables	Coefficients	P-value
Age	-0.7581	0.008**
Household size	-0.2500	0.018**
Years of education	0.0692	0.129
Gender	1.5102	0.000***
Farming experience	-0.0633	0.693
Farm size	0.3248	0.148
Extension visit	0.2822	0.000***
Cooperative membership	1.1682	0.001***
Age ²	0.0087	0.014***
Farming experience ²	0.0004	0.935
Constant	15.0159	0.008

Pseudo $R^2 = 0.2407$, Log likelihood = -120.56, LR $\chi^2 = 76.44$. Legend: * $p < 0.10$ significant at 10%, ** $p < 0.05$ significant at 5%, *** $p < 0.01$ significant at 1%.

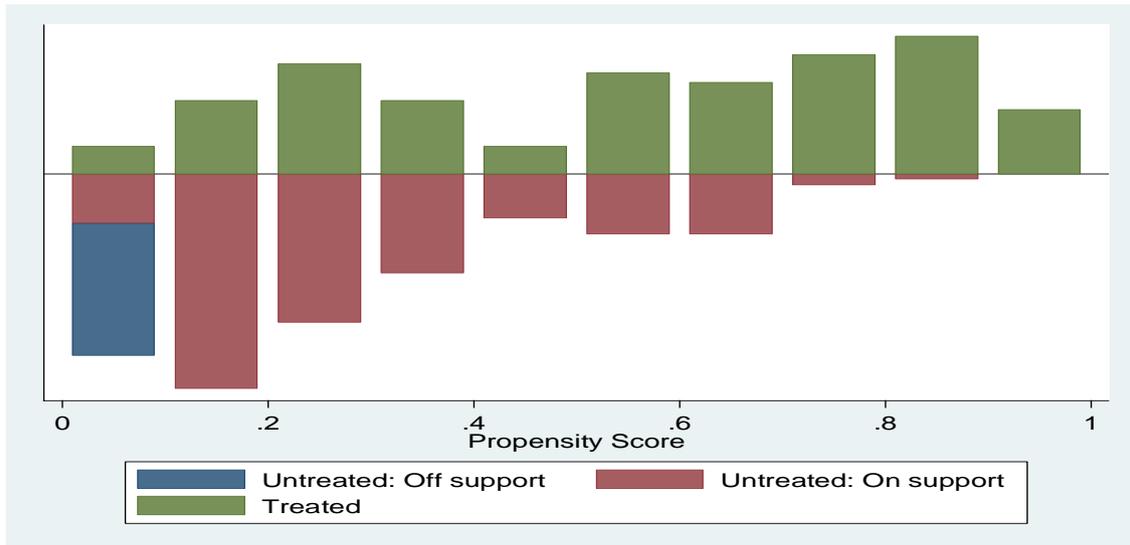


Figure 2. Propensity score distribution and common support
Treated = Contract farmers, Untreated = Non-contract farmers

Propensity score matching and test of covariate balancing.

Table 5 shows that there were significant differences in the mean values of the contract farming participants (treated) and non-contract farming participants (untreated) groups before matching in some variables; household size, years of education, gender, extension visit and cooperative membership showed significant differences at $p \leq 0.1$ between contract farmers and non-contract farmers. By implication, using

these unmatched samples would generate considerable differences in outcomes of the reference group which may not be attributable to participation in contract arrangement but to existing socio-economic characteristics. After matching, these differences in means were reduced considerably. All the methods used for the covariate balancing showed no significant differences among the variables between contract (treated) and non-contract (non-treated) groups (Table 5).

Table 5. Balancing of covariates before and after matching

CF= Contract farmers, NCF = Non-contract farmers, RM = Radius matching, NNM = Nearest Neighbor

Variables	Unmatched data			Matched data						
	Mean		p-value	Mean				p-value		
	CF	NCF		CF	RM	NN	KM	RM	NN	KM
Age	38.24	39.29	0.149	38.986	39.226	37.803	39.204	0.799	0.187	0.818
Household size	6.26	6.966	0.002***	6.493	6.439	6.493	6.499	0.851	1.000	0.984
Years of education	9.2	8.353	0.071*	9.042	8.789	8.789	8.983	0.668	0.676	0.922
Gender	0.633	0.387	0.000***	0.592	0.574	0.493	0.583	0.833	0.241	0.916
Farming experience	14.32	13.43	0.196	14.521	14.395	13.465	14.302	0.888	0.173	0.805
Farm size	1.962	1.815	0.128	1.958	1.935	2.056	1.956	0.845	0.378	0.990
Extension visit	2.922	1.387	0.000***	2.282	2.601	2.775	2.459	0.412	0.199	0.646
Coop. membership	0.489	0.187	0.000***	0.409	0.406	0.366	0.383	0.978	0.608	0.754
Age	1497.7	1568.6	0.220	1553.6	1566.8	1451.2	1566	0.862	0.147	0.871
Farming experience	230.81	206.93	0.308	238.46	235.19	195.38	231.81	0.916	0.101*	0.828

matching, KM= Kernel matching; * $p < 0.10$ significant at 10%, ** $p < 0.05$ significant at 5%, *** $p < 0.01$ significant at 1%

Estimates of the impact of contract farming on rice farmers' productivity using the Kernel matching method

The results of the impact of contract farming participation on farmers' productivity using the kernel matching method is presented in Table 7. The result shows that participating in contract farming arrangement increases the productivity of rice farmers in the study area by 1.358 and statistically different from zero at 1% significance level. The results generally goes in favour of contract farming, however,

estimations based on one-on-one comparison among contract and non-contract using unmatched sample of rice farmers overestimated the impacts of participation by about 20%. The ATT (the average treatment effect on the treated -which is the true estimate of interest) shows that participation in rice contract farming significantly the increased productivity of participating farmers by 1.36 at 1% significance level. The ATE (average treatment effect) was also positive at 1.61 indicating that contract farming was generally

favourable for any randomly identified rice farmer in the study area. Finally, the ATU (average treatment effect on the untreated) revealed that non-participants have potentially lost up to 29% of their productivity by not participating in the contract arrangement. The

estimated difference shows that non-contract farmers could increase their productivity by up to 1.75 by engaging in the contract arrangement. The value is higher than the observed impact on already participating farmer.

Table 7. Estimates of the impact of contract farming on rice farmers' productivity using the Kernel matching method

Sample	Contract farmers	Non-contract farmers	Difference	t-stat
Unmatched	5.268	3.635	1.634	6.81***
ATT	5.356	3.998	1.358	4.18***
ATU	3.694	5.446	1.752	
ATE			1.610	

* $p < 0.10$ significant at 10%, ** $p < 0.05$ significant at 5%, *** $p < 0.01$ significant at 1%

Discussion

This study estimated using the propensity score matching method, the impacts of contract farming participation among rice farmers on rice productivity. The result of the socio-economic analysis reveals that both participants and non-participants have similar characteristics with only slight observed differences. The mean age of rice farmers in the study area was 40 years indicating that the farmers are in their economic productive age, although both males and females were involved in rice farming, there were on average more women than men. This is similar to the findings of Onumadu and Oshahon (2014) but differ from that of Obi-Egbedi and Bankole (2017) who reported a male-dominated rice farming subsector in Ogun state. Mean household size of seven persons is a positive indication of availability of family labour and tends to reduce

the cost of hiring labour for rice production. This is in accordance with the finding of Obi-Egbedi and Bankole (2017) who reported an average household size of six persons per household. This shows that both male and female have their share in rice production, this might be as a result of high level of labour required in rice farming and the demand for it. The majority of the rice farmers in the study area were young farmers of economic active age as was observed in the study of Onumadu and Oshahon (2014) who reported an age distribution of 30-50 years among rice farmers in Ayamelum LGA Anambra state. In general, most rice farmers (56.7%) had attained primary education and these attainment level cut across both categories of farmers, with this they could understand the terms and conditions of the contractual agreement. According to Kutawa (2016), educated farmers are more likely to

participate in contract farming arrangement since they can read and understand contract terms and conditions. The rice farmers that participated in this study are literate as evidenced from their level of education. Data on farming experience showed that these farmers are experienced in rice farming. Onumadu and Oshahon (2014) shared the same view with rice farming experience of 6-15 years among rice farmers in Ayamelum LGA Anambra state. Majority of the farmers do not own their land; they largely depend on land rental or lease to be able to qualify for contract farming arrangement. Land constrain may most likely pose a threat to participation in rice growing activities in general and contract arrangement in particular. This may also hinder sufficient improvement in crop productivity as sufficient land area that could favour large scale rice production and to meet up with the requirement for participating in contract farming may be lacking. Most contract farmers had contact with extension agents compared to their counterpart. Kutawa (2016) stated that extension service support is also an advantage of being a member of a cooperative which is a criterion for contract farming participation. This implies that participants of contract farming are exposed to agricultural information and technical services than their counterpart. Rice farmers under contract farming arrangement were more productive than the non-contract rice farmers. This is attributed to the benefits of contractual arrangement which

non-contract rice farmers do not have access to. This implies that participation in contract farming results in yield-enhancing effect and this stems from increased access to timely inputs, improved production technologies, credit, technical support and advisory services that contract farming guarantees the contract farmers, (Kutawa, 2016). An increase in productivity of participants by 1.358 is statistically different from zero at 1% significance level. This finding is in line with Awotide *et.al.* (2015) who reported a desired increase of rice productivity in Nigeria generated by contract farming. This is consistent with the finding by Maertens and VandeVelde (2017) that participation in rice contract farming results in a significant increase in rice productivity in Benin. The findings by Kutawa (2016) that contract farming can positively impact productivity of tomato in Northern Nigeria is in line with the result.

Conclusion

Productivity level was high among contract rice farmers compared to the non-contract rice farmers. The impact of contract farming on the rice farmers' productivity was positive and significant as observed by the value of the average treatment effect on the treated (ATT). Therefore, contract farming arrangement should be reviewed, extended to other food crops while ensuring that agreements are strictly adhered to for more positive impact.

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