

Full Length Research Paper

Impact of the business services for farmers' organizations (ESOP) contract farming model on paddy producers' well-being in Dangbo District of Benin

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Received 13 September, 2016; Accepted 15 November, 2016

The importance of rice is increasing in peoples' diets in Benin, but access of locally-produced rice to domestic and foreign markets remains limited due to low quality products and unreliable supply chains. Contract farming for rice processing and exportation promises to ensure secure market access, and lift paddy farmers up from poverty. This study aimed to identify the determinants and assess the impact of participation to the "Business Services for Farmers' Organizations" (ESOP) contract farming model on producers' well-being. Sixty paddy producers (30 participants and 30 non-participants), were randomly selected and interviewed in three villages of Dangbo district in Southern Benin. A logistic regression model and the Average Treatment Effect (ATE) method were utilized to elicit the determinants and assess the impact. Size of household, paddy producer price, producer's experience, yield of paddy and access to credit appeared to be the main determinants of producers' participation in the ESOP model, leading to a significant (at 5% level) increase in annual net income and food consumption score, respectively by 42.51 and 24.35%. Therefore, the ESOP model had a significant positive impact on producers' well-being. Therefore, not ignoring some observed competition shortfalls, we recommend a large-scale dissemination of the model, with dedicated attention to paddy producer price, technology, training and credit support as critical levers for policy intervention. Businessmen should be trained to provide key marketing services that enhance contract farming in a competition environment, and advocacy should be undertaken towards the government and credit agencies for the required support to farmers.

Key words: Impact, contract farming, ESOP model, net income, food security, paddy rice.

INTRODUCTION

Rice is the third food for almost half of the world population after maize and wheat (Chalmin, 2009). Its

importance is growing in Sub-Saharan Africa, particularly in West Africa where its consumption steadily increased

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increased by 9.6% annually from 8.3 to 13.2 million tons between 2001 to 2006. Rice has become staple food for 20 million people in about 40 countries (WARDA, 2006) and a real competing food to other cereals in the diets. Yet, rice production increased only by 6.1% per year and met only 49% of the needs in 2006 (FAO, 2009).

Considered in the past as food for end-of-year or other occasional celebrations in Benin, rice is now consumed daily in urban as well as rural areas (CCR, 2004; Konnon et al., 2014). Its consumption increased from 69 206 to 110 800 tons between 2003-2010, and is expected to reach about 178 000 tons in 2018 (SNDR, 2011). About 47% of the demand is met by domestic production, the rest being met by imports (Vigné, 2011). Through the Agricultural Mechanization Program (PPMA) and the Emergency Food Security Support Project (PUASA), the Benin Government with the support of development partners, recently engaged in rice production intensification. Annual domestic production then reached 20 000 tons, an achievement never observed so far until 1995 (ONASA, 1999). It progressed to 67 000 tons in 2005 (FAO, 2006) and 234 145 tons in 2014 (MAEP, 2015), that is, 13.82% annual growth over that period.

However, market access for locally-produced rice remains limited due mainly to low quality products and unreliable supply chains (Naseem et al., 2013). Contract farming for rice processing and exportation promises to ensure secure market access and lift paddy farmers up from poverty. Therefore, the government has installed two modern/industrial paddy rice unhusking/processing factories in Malanville (in the country's upper north) and in Glazoué (in the center).

These factories are managed by SONAPRA, the former cotton state monopoly. There are also private semi-industrial paddy rice processing units, which are operating besides village private mills that produce indigenous parboiled rice (Ekpodilè and Honfoga, 2015). Among the promoters of semi-industrial units is the "Business Services for Farmers' Organizations" (ESOP), a local NGO dedicated to improving rice quality and linking farmers to profitable market outlets. These units are installed in Dangbo district (Oueme Valley), Tchetti (Savalou district, Collines department) and Lalo (Lalo district, Couffo department). They buy paddy rice from farmers under a contract farming agreement which specifies, among other conditions, a unique producer price (150 FCFA/kg in 2015) and the volume of paddy rice farmers should supply.

In Dangbo district, paddy rice represents annually about 11% of total cultivated area (MAEP, 2016). Rice and other flood recession or wetlands crops are mainly destined to the market, especially via cross-border trade with Nigeria at Ilara and Ifangni borders. However, ESOP does not sell its dry white rice in Nigeria because only parboiled rice produced by indigenous women and processed by village mills is demanded by Nigerians.

This study focused on ESOP, rather than the

government's industrial units, in order to analyze its private contract farming model wherein the service outputs to farmers are expected to improve. These include:

1. Provision of input credit (seeds, fertilizers, pesticides) before production starts and lean season credit (all to be repaid in kind (bags of paddy rice) at harvest), training on rice production, and
2. Market outreach to farmers by buying their paddy rice to supply a private processing unit at the conditions specified in the contract: quality, delivery timelines, price, and volume concurrent with input credit repayment. It values both supply-side and demand-side services for a performance integrated rice market.

The study aims to identify the determinants of paddy rice producers' participation in ESOP contract farming model and the impact of such participation on farmers' well-being (net income and food and nutritional security). Indeed, the policy perspective of this investigation is that contract farming is considered as a means to stabilize farmers' income and strategize agricultural development (Sriboonchitta and Wiboonpoongse, 2008).

To what extent can the ESOP model be encouraged? According to the contract, no parallel selling is allowed. ESOP guarantees the purchase of paddy volume initially agreed in the contract. Input credit is serviced to farmers on that basis, and is deducted at harvest accordingly. In case production exceeds that volume, ESOP promised to still buy the balance at the agreed price, and sometimes at a slightly higher price. The question arises then as to why more than half of its members violated the contract and sold paddy to open market competitors. Beyond occasional market circumstances of 2015, there is need to know the determinants of farmers' participation to the ESOP model and the latter's effects on their well-being, with the view to promote beneficial crop marketing programs and reduce poverty in rural areas.

LITERATURE REVIEW

Numerous definitions of contract farming are available in the literature. One among the best is: "a contractual arrangement for a fixed term between a farmer and a firm, agreed verbally or in writing before production begins, which provides resources to the farmer and/or specifies one or more conditions of production, in addition to one or more marketing conditions, for agricultural production on land owned or controlled by the farmer, which is non-transferable and gives the firm, not the farmer, exclusive rights and legal title to the crop." (Prowse, 2012).

From this definition, three main components or areas of commitment in a contract farming arrangement can be distinguished (Eaton and Shepherd, 2001):

1. Market provision: The farmer and the contractor commit themselves respectively to supplying and purchasing a specific agricultural commodity;
2. Resource provision: The buyer commits itself to providing credit inputs and technical advice to the farmer;
3. Management specifications: The farmer in turn agrees to follow recommended production methods, input regimes, and cultivation and harvesting specifications.

Contract farming offers numerous opportunities for farms: It can allow access to a reliable market; can provide guaranteed and stable pricing structures; and most importantly, can provide access to credit, inputs, production and marketing services (seed, fertilizer, training, extension, transport, and even land preparation). On a larger note, contract farming can open doors to new markets for a farm's production, stimulate technology and skill transfer (particularly for higher-risk crops, which resource-poor farmers might typically avoid), and it can support farmers in meeting vital sanitary and plant health standards (Prowse, 2012).

The main opportunity and farmers' advantage known to contract farming is the promise of higher incomes. Other important benefits exist that explain why farmers join contract-farming initiatives. Among them, stability and technical knowledge were revealed by Masakure and Henson (2005), Guo et al. (2006) and Bijman (2008). Prowse (2012) highlighted that contract farming can also provide many additional benefits and opportunities: It can increase on-farm diversification; technical assistance and knowledge transfer can spill over onto adjacent fields and into nearby villages; by-products from contract farming can be used for other farming activities; it can simplify marketing decisions, thus improving efficiency; it can stimulate the broader commercialization of smallholder farming; and, finally, contracts can be used as a form of collateral for credit.

In spite of these potential benefits, the practice and outcomes of contract farming have varied widely. This led to expressed fears of one-buyer's exploitation of small-scale farmers in contract schemes due to the unequal balance of power between the contractor and the small-scale farmer (Glover, 1987, Sivramkrishna and Jyotishi, 2008). Likewise, farmers' sequestration and unfair contract implementation leading to reduced freedom and opportunities have been pointed out. Cases are reported where farmers dreaming of stable incomes find that contracts lead to debt and getting used by large agribusiness companies. Farmers cover both investment and the losses (Fernquest, 2012). A common proposal to upgrade farmers' position is to support the creation of farmers' organizations (Glover, *ibid*; Sivramkrishna and Jyotishi, *ibid*.). The efficiency of farmers' organizations depends however on how well they function, how the contract negotiations between the farmers and the company (buyer) are conducted and in what context (Prowse, 2012). In this stream of ideas, contract-farming

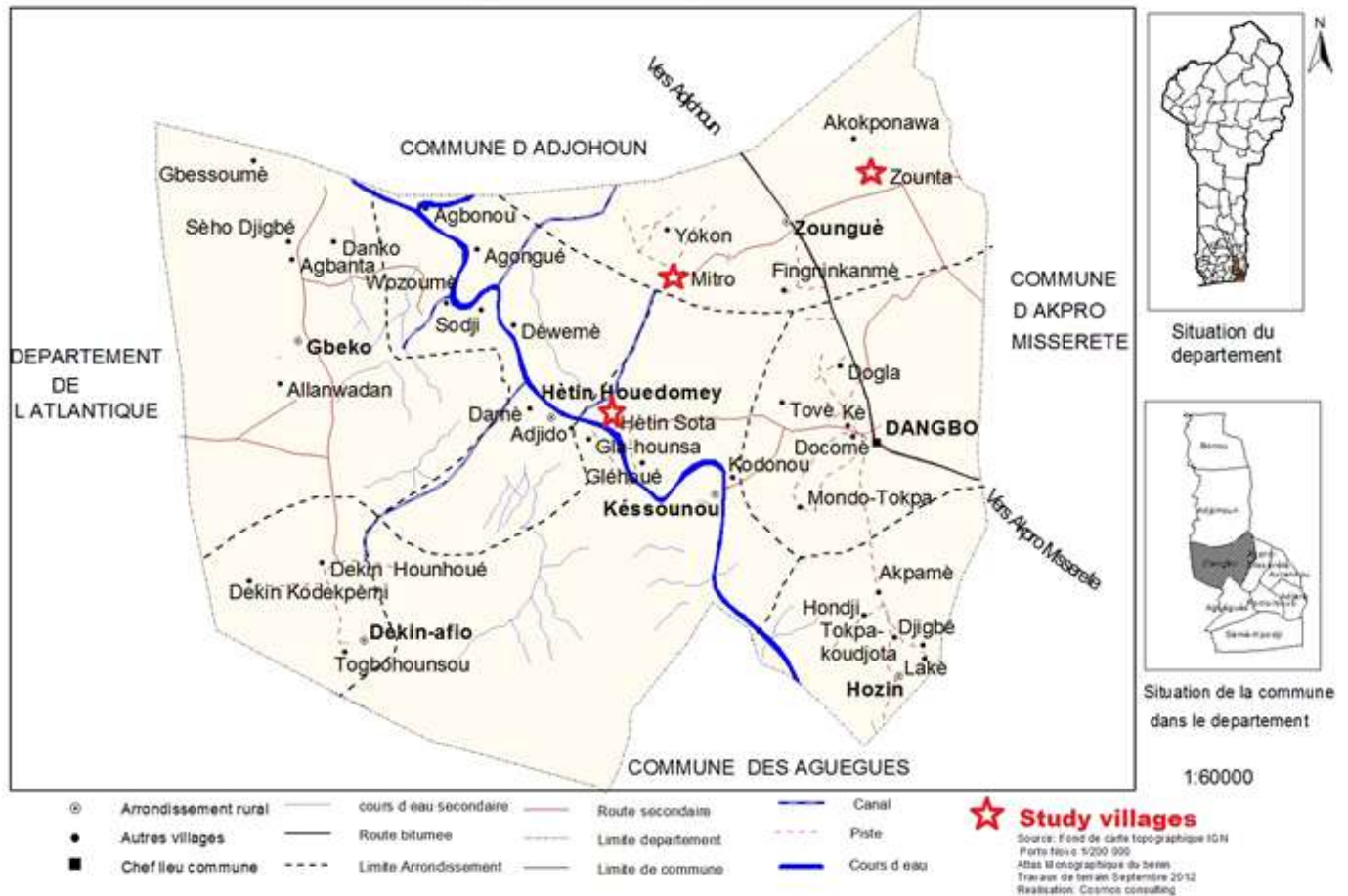
is recently put forward as an institutional innovation that can reduce transaction costs in food supply chains and solve market imperfections in linking smallholder farmers to markets (Oya, 2012; Swinnen and Maertens, 2007).

There is a growing body of recent empirical literature, based on case-studies from around Africa, that witnesses positive welfare effects of contract-farming such as higher productivity, higher profits and higher net farm incomes, less price variability and higher income stability, increased farmers' subjective wellbeing, and productivity spillover effects to other crops. About 60% of Kenyan tea production is supplied by the Kenya Tea Development Agency (KTDA), which operates one of the largest contract farming schemes in the world. It was a parastatal enterprise when created in 1964, managing 19 thousand small-scale tea growers in the country by providing them technical assistance, planting materials, and inputs on credit.

In 2000, the KTDA was converted into a private enterprise owned by the tea factories, which are in turn owned by the small-scale tea growers, whose numbers had increased to 200,000. By 2009, the KTDA had 54 tea factories and 562 thousand tea growers. It continues to provide extension services and inputs on credit, deducting the costs at the time of sale, and processing and exporting the tea (Minot, 2011). In Malawi, small-scale production is managed by the Smallholder Tea Authority (STA), a parastatal formed in the 1960s. Today STA provides more than 8000 small farmers with free seedlings, technical assistance, and inputs on credit. It offers one payment at harvest and another payment after the tea has been auctioned, the amount being determined by the auction price (Kumwenda and Madola, 2005). There are a few empirical studies that document successes of contract-farming in staple food sectors. Bellemare (2010) showed that contract-farming in the rice sector in Madagascar has a positive impact on farm income. Arouna et al. (2015) also found that contracting increases income in the rice sector in Benin.

A more particular case is cotton which is grown in 33 countries of sub-Saharan Africa, but the largest producers are Burkina Faso, Nigeria, Tanzania, Benin, Mozambique, Zimbabwe, and Mali (Minot, 2011). Currently, it is grown under a variety of institutional forms (Tschirley et al., 2009), although the main feature is state-controlled or parastatal contract farming. In Benin and Togo, the cotton contract-farming has evolved through several reforms aimed at increasing transparency in pricing policies, other terms of contract and public subsidy offerings. Yet, they cannot be cited as contract farming success stories (PASA/MAEP, 2013).

Overall, integrated supply chain management in traditional non-food export crops is the general formula. Other evidence comes from high-value supply chains, mostly fruits, vegetables and products of animal origin destined for export markets or supermarket retail in urban high-value market segments for example; Maertens and



Swinnen (2009) and Dedehouanou et al. (2013) for vegetable production in Senegal, McCulloch and Ota (2002) for horticulture production in Kenya, Minten et al. (2009) for vegetable production in Madagascar, Rao and Qaim (2011) for vegetable production in Kenya and Barrett et al. (2012) for fruit and vegetables in Madagascar and Mozambique. Private firm-led contract farming in the staple foods' sectors is yet to be technically documented.

METHODOLOGY

The study area

The study was conducted in Dangbo district, in the Oueme Valley of Southern Benin. The district is located between 6°32' and 6°39' Latitude North and 2°28' and 2°34' Longitude East, with a sub-equatorial climate characterized by 2 rainy seasons (April to July, October to November), 2 dry seasons (August to September, December to March) and 900 to 1600 mm average rainfall over about 80 days/year. It covers 340 km² embedding ferrallitic soils and vertisols, particularly suitable for growing vegetables (PDC, 2013) (Figure 1). Agriculture is the main economic occupation of

75% of the labor force comprised of 51 117 people in 10 098 households. It provides 85% of their income. Available agricultural land is about 30 000 hectares, of which only 20% are cultivated each year to grow rain-fed crops (maize, cassava, niebe, groundnuts, sweet potato, cocoyam) and counter-season/flood recession crops (pepper, leafy vegetables, tomato, okra, sweet potato, green (fresh) maize, beans, cassava, paddy rice). There are also palm oil plantations owned by large-scale farmers or landlords. The district does cross-border trade with Nigeria, and local contract farming may be disturbed.

Sampling and data collection methods

ESOP-VO in Dangbo district was selected because it has been functioning steadily since 2007, which offers the possibility to harness greater experience in collective action and contract farming with ESOP, and to compare producers who adhered to ESOP model (hereafter called participants) with non-participants. For this purpose, a survey was conducted in November 2015 with a sample of 60 paddy rice producers, including 30 ESOP participants and 30 non-participants.

The villages were randomly chosen from a list of villages known to have been selling paddy rice to ESOP since at least three years. This is a reasonable time for assessing the model's impact. The universe of participants per village was the total number of tontine

Table 1. Breakdown of the study sample per village.

Villages	Mitro		Zounta		Hétin		Total	
	Universe	Sample	Universe	Sample	Universe	Sample	Universe	Sample
Participants	15	06	20	06	48	18	83	30
Non-participants*	42	06	62	06	120	18	224	30
Total	67	12	85	12	200	36	307	60

* Obtained using the estimated share of non-participants in total paddy supply, relatively to participants.
Source: Survey data, November 2015.

members. The number of participants randomly selected per village for the sample was the desired total number of participants (30) times the proportion of ESOP tontines existing in the village (proportions were 1/5, 1/5 and 3/5 for Mitro, Zounta and Hétin villages respectively). Tontine is a form of autonomous mobilization of funds among a group of 15-20 paddy rice producers for a sustainable contract farming implementation with ESOP. The latter provides to the tontine a season credit in kind (seeds and other inputs) which is reimbursed in kind (bags of paddy) at harvest according to a given harvest/input ratio.

The universe of non-participants per village was obtained using the estimated share of non-participants in total paddy supply, relatively to participants' number and share in the supply. The number of non-participants in the sample was deliberately the same as for participants, with the view to avoiding sampling bias in frequency distribution and means of study variables. Non-participants were selected in the same villages using the "boule de neige" or snowball sampling method/technique, whereby the first person (of a specific nature/status – here non-participant) who is contacted and interviewed gives the name of the next (with similar characteristics) to be interviewed who also does the same until the desired number of interviewees is reached.

Finally, the universe was estimated at 307 paddy rice producers, of which a sample of 60 interviewees was drawn from, that is a sampling rate of 19.5% (Table 1). A structured questionnaire was used for the interviews with participants and non-participants. Data collected include the following: Socioeconomic characteristics of paddy farmers, rice-based cropping system, various buyers they sell paddy to, marketing costs, and food consumption frequency by food groups. The latter and their respective weights in diets are described in Table 2.

Empirical framework and key variables' estimation methods

Measuring food and nutritional security

Rice producers' food and nutritional security was measured using the Food Consumption Score (FCS), which is a composite indicator that takes into account food diversity, frequency of consumption and the nutritional inputs of various groups of foods eaten by a household (WFP, 2009). It is considered as reflecting food availability, access to food and food utilization or consumption patterns at household level, and was validated as such as an appropriate proxy of food and nutritional security (WFP, 2009: 215). In this study, FCS is calculated from the sample as follows:

$$FCS = \sum P_i X_i = P_{\text{staples}} X_{\text{staples}} + P_{\text{pulses}} X_{\text{pulses}} + P_{\text{veg}} X_{\text{veg}} + P_{\text{fruits}} X_{\text{fruits}} + P_{\text{proteins}} X_{\text{proteins}} + P_{\text{dairy}} X_{\text{dairy}} + P_{\text{sugars}} X_{\text{sugars}} + P_{\text{fats}} X_{\text{fats}} + P_{\text{cond}} X_{\text{cond}}$$

Where:

Pi = Weight of the food group (see food list and weights in Table 2)

Xi = Average number of times per week foods in each group are consumed in the household (≤ 7 days)

The scale of FCS value is 0 to 112. According to WFP (2009), the household score is compared with pre-established thresholds that indicate the status of the household's food consumption. WFP finds the following thresholds to be applicable in a wide range of situations: Poor food consumption: 0 to 21; Borderline food consumption: 21.5 to 35; Acceptable food consumption: > 35.

Estimating net income of paddy commercialization

Net income (NI) is household net returns from paddy commercialization. It is the value of paddy sales net of marketing costs. NI = Quantity of paddy sold*(selling price – market gate cost price). The market gate cost price includes paddy production cost and marketing costs from farm to ESOP purchasing point. Marketing costs include all post-harvest costs supported by the farm household: Assembling, grading and packaging; handling, transportation, warehousing, various commissions and duties, unofficial payments and losses.

Estimating the impact

Theoretical background: A valid measure of the impact of ESOP contract farming model would be to compare the outcomes (income for example) of farmers receiving ESOP support with the presumed outcomes that the same farmers would have had if they did not get that support. Assessing the impact of any intervention thus requires making an inference about the outcome that would have been observed had the program participants not participated. Following Heckman et al. (1997) and Smith and Todd (2001), let Y_1 be the mean of the outcome conditional on participation, that is the treatment group, and let Y_0 be the outcome conditional on non-participation, that is the control group. The impact of participating in ESOP contract farming model is the change in the mean outcome caused by participating in ESOP model, which is given by:

$$\Delta Y = Y_1 - Y_0 \quad (1)$$

Where ΔY is the impact for a given farmer: The main problem of evaluating this individual treatment effect arises because for each farmer, only one of the potential outcomes either Y_1 or Y_0 can be observed, but Y_1 and Y_0 can never be observed for the same individual simultaneously. This leads to a missing-data problem, which is the heart of the impact assessment problem (Smith and Todd, 2005). The unobservable component in Equation 1, be it Y_1 or Y_0 , is called the counterfactual outcome. For the participants (treated group), their counterfactual would be the performance level in the absence of ESOP contract farming model. While for the non-participants (control or untreated group), their counterfactual would

Table 2. Weights used to estimate Food Consumption Score by food group.

Food items	Food group and standard variable name	Weight
Rice, pasta, bread /sorghum, millet, maize, fonio, potato, yam, cassava, white flesh sweet potato, taro and / or other tubers	Main staples: cereals, starchy tubers and roots (staples)	2
Beans, cowpeas, peanuts, lentils, nut, soy, pigeonpea and /or other nuts	Pulses: legumes and nuts (pulses)	3
All vegetables and leaves: carrot, red pepper, pumpkin, orange sweet potatoes ^a , spinach, broccoli, amaranth and / or other dark green leaves, cassava leaves, etc	Vegetables (veg)	1
mango, papaya, apricot, peach, lemon (NB: do not include oranges) ^b	Fruits rich in Vitamin A (fruits)	1
Beef, goat, poultry, pork, eggs, chicken, duck, other birds, insects, fish	Animal protein: Meat, fish and eggs (proteins)	4
Fresh milk / sour, yogurt, cheese, other dairy products (Exclude margarine/butter or small amounts of milk for tea /coffee)	Milk and dairy products (dairy)	4
Sugar, honey, jam, cakes, candy, cookies, pastries, cakes and other sweet (sugary drinks)	Sugar (sugars)	0.5
Vegetable oil, palm oil, shea butter, ghee, margarine, other fats / oil	Oils and Fats (fats)	0.5
tea, coffee / cocoa, salt, garlic, spices, yeast / baking powder, tomato / sauce, meat or fish as a condiment, condiments including small amount of milk / tea coffee	Condiments/Spices ^c (cond)	0

^a OSP is strictly a tuber but very rich in Vit A and therefore must be included in this orange vegetable group; ^b Oranges, despite their colour, are not rich in vitamin A; ^c By definition eaten in very small quantities, not considered to have an impact on overall diet (Source: World Food Programme (2008)).

be the level of performance, had they participated in ESOP contract farming. Indeed, the challenge here is that it is difficult to assess counterfactuals, thus some studies used the performance level of the control group as counterfactual. This has been proved to result in biased estimates of the effect of the treatment. Therefore, in order to eliminate selection bias, there is the need to compare the performance levels of treated and control groups which are statistically identical (Rosenbaum and Rubin, 1983; Khandker et al., 2010). Rosenbaum and Rubin (1983) suggested the use of Propensity Score Matching (PSM) approach to deal with selection bias. The PSM approach is based on the idea that by matching the outcome (performance levels) of treatment and control respondents who are similar in observable characteristics, selection bias would be eliminated. The PSM is used to correct for the estimation of effects of the program, controlling for the existence of these confounding factors based on the idea that the bias is reduced when the comparison is performed using treated and untreated or control respondents who are as similar as possible. Based on the foregoing discussion, the PSM was chosen as a proven tool for this study.

The PSM approach follows two steps. First, a binary model is used to estimate the probability of participating or being treated

(propensity score) on observable characteristics. Propensity score is a conditional probability estimator and any discrete choice model such as logit or probit can be used as they yield similar results (Caliendo and Kopeinig, 2008). In this study a logit model is used, and is specified as:

$$P(x) = P(D = 1/X) = F(\beta_1 X_1 + \dots + \beta_i X_i) = F(\beta X) = e^{X\beta} \quad (2)$$

between zero and one, X represents all observables characteristics (Covariates) which influence treatment (participation in ESOP contract farming model), β is the parameter of interest to be estimated. Given that the propensity score is a balancing score, the probability of being treated conditional on X will lead to distribution of respondents' covariates X such that these covariates X will be the same for treated and control groups.

Assuming all information relevant to the participation in ESOP contract farming model and the well-being are observable, then the propensity score will produce valid matches which can be used to estimate the model's impact of ESOP on the well-being of paddy rice producers at the second stage of analysis. This is done by

matching two groups of respondents on the basis of predicted propensity score. The PSM estimator for the Average Treatment effect on the Treated (ATT) can be written in general as:

$$ATT = E_{P(X)}[E(Y_1/D_i = 1, p(X_i)) - E(Y_0/D_i = 0, p(X_i))]/D_i = 0] \quad (3)$$

Where $E_{P(X)}$ is the expectation with respect to the distribution of propensity score in the entire population, D is participation indicator which is equal to one (1) if a farmer participated in ESOP contract farming model and zero (0) if otherwise, Y_1 is the outcome for an individual if the person is a participant, Y_0 the outcome for an individual if the person is a non-participant.

Various methods (matching procedures) have been proposed in the literature. Kernel-matching estimator using PSM algorithm is used in this study. Indeed, Morgan and Winship (2007) argued that Kernel-matching, introduced by Heckman et al. (1998), appears to be the most efficient and preferred algorithm. In a regression framework, the treatment effect model is given by:

$$Y = \alpha + \beta b_i + cX_i + e_i \quad (4)$$

Where Y is the outcome (Net income from commercialization, and food and nutrition security indicator), b_i is the propensity score of the i^{th} farmer, X_i is a vector of control variables such as farmer characteristics (or independent variables), and β measures the impact of participation.

Study's empirical model specification

The dependent variable for the logistic regression model is participation in ESOP ($Ad=1$ if yes, $Ad=0$ if no).

$$P(x) = P(Ad = 1/X) = F(\beta_1 X_1 + \dots + \beta_n X_n) = F(\beta X) = e^{x\beta}$$

Where: X_i = Age, Education, Experience, Size of household, Weight of paddy area in cropping system, Yield, Producer price, Marketing costs, Village dummy. The description, justification and prediction of coefficient sign of each explanatory variable are given below.

Age of producer: It is the number of years since the producer was born. The youth may show some propensity to implement innovation or adopt new technologies for the sake of discovery, whereas the opposite may hold for aged people who will be reluctant if they experienced too many failures in the past (Glèlè et al., 2008). On the contrary, when age is considered to go with capital/wealth accumulation, the youth may be less willing to adopt than elders (Sall et al., 2000). The sign for age coefficient is therefore unpredictable.

Education: It is the number of years the farmer has attended school since 1st class primary school. Oftentimes, education enables greater capacity for information analysis and therefore more rational decision-making, which is favorable to good change (Adékambi et al., 2010). Assuming the ESOP model implies positive change in rice farming and marketing, a positive sign is expected for the coefficient.

Experience: It is the number of years the producer already spent in paddy rice production. Like age, seniors in rice farming may or may not be willing to participate in ESOP model, owing to past

successes or failures with buying companies or independent buyers. The sign of the coefficient is therefore unpredictable.

Size of household: It is the number of persons living in the household. The greater this number, the more the head of household and other active members will be inclined to participate in ESOP to increase their income to adequately face subsistence and other charges for their well-being. A positive sign is expected for the coefficient.

Weight of paddy rice in cropping system: It is the percentage share of paddy rice area in total area cultivated. The greater this share, the more the producer would seek participation in ESOP for better valuing his harvests through a presumed secure and profitable marketing channel. A positive sign is expected for the coefficient.

Yield of paddy rice: It is the average per ha paddy rice production registered by the farm household over all his paddy rice plots in the 2013 to 2014 agricultural year. The higher the yield, the more the producer would seek participation in ESOP in order to get season credit for cultivating larger area and benefit a secure and profitable access to the market. The coefficient is expected to be positive.

Average paddy producer price: It is a weighted average of producer prices the farmer received when selling to ESOP and other channels, the weight being the quantity of paddy rice sold through each type of channel (ESOP and non-ESOP). The higher the producer price a buyer offers, the more will a farmer seek to participate in his channel. The coefficient is expected to be positive.

Credit: It is the loan amount per ha of all crops cultivated. The greater it is, the more will the farmer seek to increase area of high-value crops such as rice, and the more he will seek to participate in ESOP to get presumed better market benefits. A positive sign is expected for the coefficient.

Marketing costs: It is the sum of transportation, handling and assembly commission costs to take paddy harvests to ESOP buying points. It is calculated per ha of paddy cultivated. A negative sign is expected for its coefficient to account for farmer's fear that the producer price would not be high enough to cover these costs.

Dummy for paddy producer's village: It takes the value of 1 for more favorable rice producing zones (valleys, wetlands, swamps) and 0 otherwise (upland/plains). These sign predictions are summarized in Table 3. The treatment effect model is specified as in equation (4) above, and absolute and relative effects (impact of the ESOP model) are written as follows:

$$\begin{aligned} \text{Absolute effect} &= \Delta Y = Y_1 - Y_0 \\ \text{Relative effect (\%)} &= \Delta Y/Y = 100 \cdot (Y_1 - Y_0)/Y_0 \end{aligned}$$

Where:

Y = Value of the impact variable (here Net Income or Food Consumption Score)

Y_1 = Value of the impact variable with the treated or ESOP participants (ATT)

Y_0 = Value of the average treatment effect with both groups (ATE).

ATE = the average effect of the treatment for an individual drawn from the overall population at random. ATE, ATT (treated) and ATU (non-treated or control) are linked as follows:

$$ATE = N_1/N \cdot ATT + N_0/N \cdot ATU$$

Where N_1 is the number of participants, N_0 is the number of non-participants and N is total sample size. The statistical software STATA 10.1 was used to perform the above described analyses.

Table 3. Expected signs for coefficients of explanatory variables.

Variable	Expected sign for coefficient
Age of producer	?
Education	+
Experience of producer in rice production (number of years)	?
Size of household	+
Weight of paddy crop in farm household (share in total cultivated area)	+
Yield of paddy (kg/ha)	+
Average paddy producer price (FCFA/kg)	+
Credit (Amount per ha cultivated)	+
Marketing costs (FCFA/kg)	-
Dummy of village (1= valley/swamp zone ; 0 = plains)	+

? = not predictable (Source: Survey data, November 2015).

RESULTS AND DISCUSSION

Position of ESOP-VO in paddy rice marketing in Dangbo district

ESOP-VO is created in October 2006 and functions according to the contract farming model described in section 1. It implements an integrated value chain approach by providing efficient marketing services to selected farmers' organizations and by processing paddy with improved technology to ensure reliable market outreach for the product. However, the sample data indicate that ESOP-VO's position was weak in the paddy rice marketing network in Dangbo district in 2015. Indeed, ESOP accounted for only 27% in total volume of paddy purchased, and more than half (53.3%) of its members also sold paddy rice to competitors (Figure 2). Therefore, it was necessary to know the factors that critically influence farmers' participation in ESOP contract farming model, and whether the participants are better off. Key factors or determinants would include a few among household characteristics and farmers' assessment of contract implementation. Their identification is important for future policies on market access of agricultural products.

Household characteristics of sample paddy producers

Average values of above described explanatory variables are presented for participants and non-participants in the study sample, together with differences between the two groups, and their statistical significance are assessed using the Student's t test (Table 4). It appears that differences are not significant for most characteristics, except for a few ones including the variables to be observed as to how they are impacted by participation in ESOP. Therefore, the two groups are comparable, and effects of the latter variables can be calculated thereafter using the ATT/ATE method.

Determinants of participation to ESOP model and impact on paddy producers' well-being

The results of the propensity score matching (Table 5) indicate that most of the participants have similar characteristics as non-participants, and could therefore be compared.

The Average Treatment Effect analysis can then be performed. The results of the logit regression model of paddy producers' participation to the ESOP contract farming model are reported in Table 6. The value of Pseudo (McFadden) R-squared is 0.4161, implying that all the explanatory variables included in the model could explain about 41.6 percent of the probability of participation to ESOP contract model. The overall regression model is statistically very significant (P-value = 0.0001). The main determinants of paddy rice producers' participation in the ESOP contract farming model included size of household, average paddy producer price, producer's experience, yield of paddy and access to credit. Therefore, a dedicated attention should be given to producer price, production technology (yield), self-training (experience) and credit support as critical levers for policy intervention.

Enhancing access to yield-increasing technology and training, and offering credit and attractive farm-gate prices are crucial for productivity increase, economies of scale and improved livelihoods for farmers. Meanwhile, group discussions with participants revealed that contract-farming implementation should also pay attention to other critical marketing services which ESOP competitors were prompt to provide to farmers. These services include proximity/farm gate buying, volume and frequency of purchase, flexibility on paddy quality, and immediate payment (at least partially) after paddy is collected. The latter service is particularly important, as ESOP could pay farmers only 1-3 months after purchase (37, 27 and 37%, respectively after 1, 2 and 3 months). Attention of contract-farming businessmen should be drawn on these services, while advocacy towards governments and credit

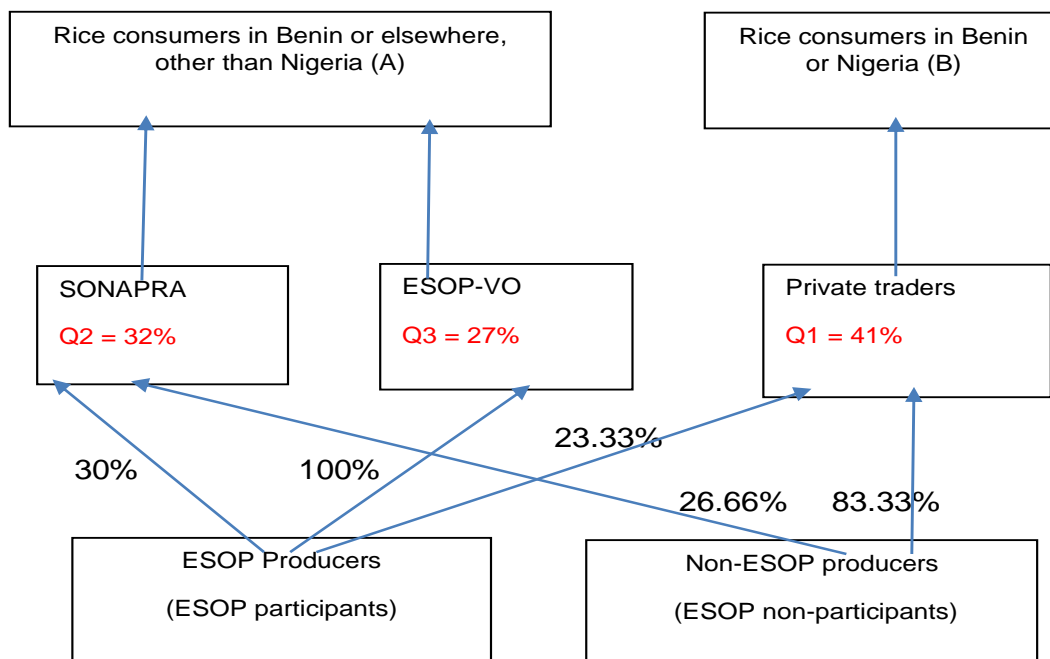


Figure 2. Paddy rice marketing network in Dangbo district (Source: Survey data, November 2015) (Legend: Percentages at the bottom are percentage of producers in each category selling to different buyers. The sum of percentages in each category exceed 100% as a result of multiple choice of buyers by certain producers; Q = Share in total volume of paddy supply; NB: Referring to the generic 'producers – middlemen – consumers', there are 5 channels in the paddy marketing network in Dangbo. From left to right, these channels are: Channel 1: ESOP Producers – SONAPRA – Consumers A; Channel 2: ESOP Producers – ESOP – Consumers A; Channel 3: ESOP Producers – Private traders – Consumers B; Channel 4: Non-ESOP producers (non-participants) – SONAPRA – Consumers A; Channel 5: Non-ESOP producers (non-participants) – Private traders – Consumers B.

Table 4. Differences in household characteristics between participants and non-participants.

Household characteristics	Participants	Non-participants	Difference	P > t
Age of producer (years)	42.1	40.33	1.73	0.472
Education (years)	2.27	1.70	0.567	0.47
Experience (years)	8.83	6.27	2.57**	0.040
Size of household (persons)	8.43	6.77	1.667**	0.020
Weight of rice in cropping system (%)	46.9	51.3	4.49	0.589
Yield of paddy (kg/ha)	2882	2863	19	0.962
Paddy producer price (FCFA/kg)	150.86	136.3	14.56***	0.002
Credit (FCFA/ha cultivated)	104938	43265	61673	0.277
Marketing costs (FCFA/kg)	24.8	27.5	2.67	0.521
Net paddy production income (FCFA/ha)	532027	303089	228938*	0.080
Food Consumption Score [#]	85.75	75.77	9.98***	0.000

Significance level: * 10%; ** 5%; *** 1%; # Range: 0-112 (Source: Survey data, November 2015).

agencies should be undertaken for the required support to farmers.

After the determinants of participation are identified, the

results of assessing the impact of producers' participation to ESOP on their net income and food security are then reported in Table 7. They indicate that participation

Table 5. Results of propensity score matching.

Common support			
Treatment assignment	Out of support	On support	Total
Non-participants	12	11	23
Participants	3	25	28
Total	15	36	51

Source: Survey data, November 2015.

Table 6. Parameters of the logit regression model of paddy producers' participation to ESOP contract farming.

Explanatory variable	Coef.	Std. Err.	Z	P > Z
Age of producer	-0.0520323	0.0561788	-0.93	0.354
Education	0.2453051	0.1599805	1.53	0.125
Experience	0.2309199*	0.1289254	1.79	0.073
Size of household	0.4381011**	0.1611228	2.72	0.007
Weight of paddy rice in cropping system	-0.0454571	0.0313818	-1.45	0.147
Yield of paddy	-0.0006496*	0.0003637	-1.79	0.074
Average paddy producer price	0.0991566**	0.035115	2.82	0.005
Credit	0.0000147*	8.30e-06	1.77	0.077
Marketing costs	-0.0511094	0.0352307	-1.45	0.147
Village dummy	0.0833442	0.9745401	0.09	0.932
Constant	-13.10294	5.916509	-2.21	0.027

Significance level: ** 5%; * 10% (Source: Survey data, November 2015) (N = 51; LR chi2(10) = 44,64; Prob > chi2 = 0.0001; Log likelihood = -24.283129; Pseudo R² = 0.4161.

Table 7. Effect of participation to ESOP on paddy producers' net income and food security.

Impact variable	Observed impact			
	ATE	ATT	Relative effect (%)	Student t-value
Net paddy production income (FCFA/ha)	150898.80	215046.50	42.51	2.24
Food Consumption Score	9.98	12.41	24.35	2.50

ATE = Average treatment effect (all sample); ATT = Average treatment effect on the treated (Source: Survey data, November, 2015).

allowed an average increase in net income by 150 898.8 FCFA among all sample producers (ATE) and by 215046.5 FCFA among ESOP participants (ATT). The relative gap (42.51%) between ATT and ATE is positive and significant at 5% level, meaning participation had a significant effect on producers' net income. This increase would certainly allow them to improve their livelihoods. Likewise, the relative effect on food security score was significant at 5% level and as high as 24.35%, that is, a significant improvement in participants' food security.

Policy relevance, validation and limitations of the results

Policy relevance and validation

The study results revealed the positive influence of

identified determinants on participation, and the positive impact of the latter on farmers' income and food security. They indicate that properly designed and well-implemented contract farming model has the potential to improve farmers' well-being.

They are congruent with those of Zamasiya et al. (2014) who used the Heckman's Probit model to identify the determinants of soybean market participation by smallholder farmers in Zimbabwe, and found that improved technology and market information positively influenced farmers' participation. Usually market information is a prerequisite for farmers' access to credit and training opportunities. With a similar model, Teshome et al. (2013) also found that access to credit and information were critical determinants of farmers' adhesion to financial savings venture in Ethiopia. Experience, as we found to be important in farmers' decision to participate in ESOP model, goes with

exposure to information and training. Boz (2015) found that it positively and significantly influences goat farmers' adoption of innovations and management practices.

Therefore, agricultural trade policies would need to consider promoting such contract farming interventions. Adequate incentives such as business-channeled input subsidies, tax waivers and support to farmer cooperatives' negotiations with international buyers will be required. Regarding the positive impact of participation, the results confirm the findings of Bellemare (2010) and Arouna et al. (2015). They oppose however those of Sivramkrishna and Jyotishi (2008) and Fernquest (2012), who mentioned exploitative traps in contract farming and little or negative impacts on farmers' income. Our results (that is, positive impacts on income and food security) may be explained by private management (that is, ESOP model, especially attractive prices) vs. public management of contract farming (e.g. SONAPRA in the cotton sub-sector), as Prowse (2012) witnessed. Nevertheless, delinquent private buyers may appear if no governmental watchdog exist.

Overall, contract farming should be a dynamic agreement that is fed by innovations from the business environment, especially from other buyers' strategies. Policies aiming to lift farmers from poverty should draw lessons from this, and promote competitive ventures in contract farming.

CONCLUSION

The study findings indicate that the main determinants of paddy rice producers' participation in the ESOP contract farming model included size of household, average paddy producer price, producer's experience, yield of paddy and access to credit. Participation had a very significant positive impact on producers' well-being, specifically their net income and food security.

Yet, while participants got these well-being indicators improved through that contract farming, they also sold paddy in parallel channels, thereby harnessing other critical competitors' services (proximity buying, volume and frequency of purchase, flexibility on paddy quality, immediate payment) which ESOP didn't offer. However, it is contract violation that participant farmers sold large harvest volumes in alternative channels. Very often, these farmers face cash pressure and other constraints (for example, cost of paddy transportation to ESOP buying points, failure to supply high quality paddy) and therefore sell their harvests to private traders in spot markets at non-rewarding prices.

Therefore, while alerting on those competition shortfalls and the required organizational reforms in the ESOP buying policy, we recommend in the meantime a wider dissemination of ESOP contract farming model among paddy farmers' cooperatives in similar areas. In that perspective, a dedicated attention should be paid to

paddy producer price, production technology, training on value-chain principles and credit support as critical levers for policy intervention. Producers' cooperatives and pro-poor non-governmental organisations (NGOs) should accordingly undertake advocacy towards the government and businessmen in the framework of innovative contract farming partnerships.

Limitations

For the identification of determinants of paddy rice producers' participation in contract farming, the score of participation should have been used as a limited continuous dependent variable, instead of the binary (0/1) participation used in the logistic regression model. This would have enabled to take into account partial or low score participation, and to apprehend the incremental effect of the determinants as the score increases and factor it in the impact assessment. For example, ESOP contract implementation had rigid specifications on rice varieties to be grown and other rice quality attributes which all participants could not comply with, leading most of them to sell part of their harvests to competitors. Obviously, all participant farmers do not have the same perception of the contract's advantages or application level of its details. Unfortunately, enough resource was not available to conduct such an in-depth survey on farmers' assessment of the contract implementation and elicit their actual level of participation.

Conflicts of interest

The authors have not declared any conflict of interests.

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