Impact of Collective Marketing by Cocoa Farmers' Organizations in Cameroon

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Abstract

The aim of this study is to evaluate the impact of collective marketing by FO on cocoa farmer's price in Cameroun. This evaluation is done through the non-experimental method of impact evaluation which uses the techniques of "Propensity Score Matching". Data used come from 2006 IITA (International Institute of Tropical Agriculture) cocoa baseline survey conducted between March 15 and April 15, 2006 and concern 601 cocoa farmers in Centre region in Cameroon during the 2005/2006 season. Results show that collective marketing has a positive and statistically significant effect on the net price received by farmers. This effect is estimated at 44 FCFA per kilogram of cocoa sold collectively, that means 8% increase on the individual sale price. The main recommendation is to promote the development of FO and collective marketing within FO. The development of FO requires a government policy to support the creation of FOs and by extension the effects of collective sales. Development of collective marketing can be done through creation of credit systems by FO to encourage farmers who sell to individual buyers under the constraint of credit received. This probably would increase significantly the share of supply captured by FO.

Key words: Collective marketing, Farmers' organization, farmer's price, cocoa

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I. Context and Problem Statement

Smallholder's access to the market is a permanent concern for development actors in developing countries. Indeed, various studies proved that the smallholder remains poorly connected to the agricultural market (Key and al. 2000; Gabre-Madhin 2001; Gabre-Madhin 2009). One of the solutions to improve their access to the market involves promoting collective marketing trough farmers organizations (FOs). However, it is noted that very few studies have so far been carried to point out the importance of FOs in the collective marketing of members' products in developing countries.

In Cameroun, after liberalisation, some farmers' organizations (FOs) appeared but only in some regions. In the "Centre" region, former State-owned cooperatives have completely disappeared. FOs primarily stand thanks to development projects such as the *Sustainable Tree Crop Program (STCP)* based at International Institute of Tropical Agriculture (IITA). In the "Southwest" region, former cooperatives (such as the *Southwest Farmer Cooperative Union* based in Kumba) have been passed over to cocoa buyers (who are often producers). Though they present themselves sometimes as FOs, these "commercial CIG[3]s" and "buyer cooperatives", which are pre-financed by legal buyers or exporters, they are in fact purchasing structures acting on behalf of buyers. In the absence of projects to support producers' initiatives, no FOs has been able to emerge in the Southwest region.

The apparition of FOs in the Centre Region of Cameroon can be explained as ain attempt to fill the gap left by State in supplying farmers with inputs and marketing operations. But, According to Folefack and Gockowski (2004), only 40% of cocoa farmers in the Center region effectively take part in collective sales organized by FOs. One can thus wonder why in spite of the existence of FOs in the Center region, some of the cocoa farmers attend to the collective marketing while others do not. This implies our central question which justifies our study is the following: **what is the impact of collective marketing through FOs on cocoa farmer's price in Cameroun?** This question refers to the control of functional and operational costs of cocoa market in Cameroun through collective sales by FOs. Many studies which highlight the effects of collective marketing on farmers are generally biased (Bernard and Al 2008b). The impact analysis which arouses the interest of many economists has an important methodology debate. The particularity of this study is to try to isolate this bias by comparing cocoa farmers in Cameroun who sell collectively with those who sell individually

[3] Common Initiative Group

(Both in the region where FOs are established and in the region without FOs) and which have some common characteristics.

II. Objectives of the study

In this study, we seek to highlight the impact of collective marketing by FOs on the price received by cocoa farmers of Centre region in Cameroun. Indeed, this study seeks to evaluate the effect of collective sales on the farmer's price through the non-experimental method of impact evaluation which uses "Propensity Matching score" techniques. To the best of our knowledge, just few empirical studies have so far analyzed the impact of rural organizations on farmers' marketing.

III. Literature Review of FOs

The farmer organizations are organizations or federations of organizations, based on adhesion and which are managed by elected or appointed leaders who are responsible in the General Assembly or the Administration Board. They can take various legal forms, such as co-operative or association[4]. Their functions can be classified in three categories (World Bank, 2008):

i**) the organizations specific to a product**, which are focused on the economic services and the defense of interests of their members with regard to a product in particular, cocoa, coffee or cotton;

ii) **the pressure organizations,** which aim at representing the interests of farmers, such as national unions of farmers;

iii) **Organizations with multiples aims**, which meet various economic and social needs of their members, often in the absence of local public authorities or efficient public services.

In the industrialized countries, FOs were of an essential contribution to agriculture family success. These organizations still represent the dominant form of production organizations'. In the United States, dairies cooperative control approximately 80% of the production of dairy products; in particular in California, most of farmers is gathered in cooperatives (World Bank,

[4] An association is a non-profit organization of services, information and representation of their members. In certain countries, the professional organizations are presented in the form of "companies" rather than like associations.

2008). In France, 9 farmers over 10 belong to a cooperative, whose market shares are 60% for inputs, 57% for products and 35% for transformation (Mauget and Koulytchizky, 2003)[5]. In European Union, one counts approximately 30,000 cooperatives which gather in more than nine million farmers (Bernard, 2008a). These cooperatives control 50% of inputs market and 60% of products market.

However, in the majority of developing countries, the historical facts show that emergence of the FOs still fragile (World Bank, 2008).

In years 1960, many governments of developing countries launched development cooperative programs. These cooperatives were controlled on the whole by the government. Consequently, the farmers regarded them as a continuation of public service and not as institutions belong to them. This type of cooperative was seldom profitable (case of UCCAO and SOWEFCU in Cameroun). The political interferences and the involving of elites have resulted to bad performances and discredited the cooperative movement.

Since the middle of years 1980, the agricultural policies of sub-Saharan Africa countries is engaged in the general and imperative of structural adjustment programs, prolonged and amplified in years 1990 by the increasing liberalization of marketing exchanges. Thus, the period of 1990-2000 marked an important phase in the structuring of African rural actors. In several African countries, one observed two often articulated processes (Pesche, 2005): (i) increasing of FOs at the local scales (village or infra-villages) and (ii) dynamic building FOs. Today there exist several cooperative movements in Africa. In sub-regional plan, there exist 'Réseaux des Organisations Paysannes et Professionnelles d'Afrique de l'ouest' (ROPPA) for West Africa, Eastern Africa Farmers Federation (EAFF) in East Africa and Plateforme Régionale des Organisations Paysannes d'Afrique Centrale (PROPAC). These African country movements result from a setting in network of national organizations, around national and sub-regional stakes. With the withdrawal of State through the structural adjustment programs, these rural organizations were solicited and "have the responsibility" to manage the consequences of the withdrawal of State from many functions of support to the agriculture which it ensured up to that time. "Transfers of responsibilities" to the rural organizations were thus carried out as regards supplying inputs, marketing products, management of irrigated perimeters, agricultural council and training, etc. The effects of FOs in the development of

[5] **Mauget, R., Koulytchizky, S., 2003**. « Un Siècle de Développement des Coopératives Agricoles en France » dans Touzard, JM. & Draper, J.-F., Les Coopératives Entre Territoires et Mondialisation, Paris, L'Harmattan.

agricultural sector can be discussed as well at the national level (influence on public policies) as at the local level. Thus, certain FOs were incontestable successes as regards sectoral policies. Significant results were also obtained by FOs in certain countries: It is in particular about the exemption of the customs taxes for certain inputs (Ivory Coast), the widening of the farmers role in the examination of international offers for cotton inputs (Mali, Benin, etc), the allowance of rates interest on agricultural credit (Senegal) etc. In many African countries, the rural organizations are more and more often associated by public authorities and donors to debates which relate to agriculture and thus profit from an undeniable official credibility. In addition, one of the principal characteristics of current dynamic associative in agricultural sector is undoubtedly the emergence and the reinforcement of farmers' organizations which are built on a sectoral base or more global base.

At continental level, one can take the case of the Association des Producteurs de Coton Africains (APROCA).

At national level, on the one hand we have the "ridge" organizations structured around a given product: i) Union nationale des producteurs de coton du Burkina-Faso (UNPC-B) ; ii) Organisation des producteurs de coton du Cameroun (OPCC) ; iii) l'Union Régionale des Coopératives de la Côte d'Ivoire (URECOCI) ; iv) Confédération nationale des producteurs de cacao du Cameroun (CONAPROCAM). In other hand, we have farmers national organizations of various products: i) le Mouvement Fédération des Unions de Producteurs (FUPRO) ; ii) l'Unions sous-préfectorales des producteurs (USPP) au Benin ; iii) au BurkinaFaso on a la Confédération paysanne du Faso (CPF) ; iv) Mviwata in Tanzanie ; v) Ghana Cooperative Council (GCC) ; vi) Uganda National Farmers Federation (UNFFE) ; vii) Union Nationale des Coopératives du Sénégal (UNCAS).

In Cameroun, the rural organizations pain to create a unique framework dialogue at the national level for all products. Indeed, one counts approximately 6400 FOs which are gathered at national level in three different structures which are fighting for the leadership:

i) Conseil des Fédérations Paysannes du Cameroun (CFPC); ii) Confédération Nationale des Organisations Paysannes du Cameroun (CNOP-Cam) and iii) Conseil National des Organisations Paysannes ds petits producteurs du Cameroun (CNOPROCAM). In addition, the evolutions noted as well in rural organizations as the associated institutions are specific to each product or group of products. In palm oil chain, the three public production units are: Société Camerounaise des Palmerais (SOCAPALM), PALMOL and Cameroon Development Corporation (CDC). In the cotton chain, the Société de Développement du Coton au

Cameroun (SODECOTON) considers FOs as forces in synergy for the success of its action. The FOs of coffee chain in the West are still gathered around the Union Centrale des Coopératives Agricoles de l'Ouest (UCCAO). With regard on cocoa chain, liberalization began in 1991 by dissolution of Office National de commercialisation des produits de base (ONCPB) on January 28, 1991, and the creation of Office National du Cacao et du Café (ONCC) concomitantly with the Conseil Interprofessionnel du Café et du Cacao (CICC) on July 12, 1991. One of the objectives of liberalization was to "professionalize" the operators of cocoa chain. On the one side, the tradesmen should organize themselves to be able to negotiate themselves of contracts with importers, to negotiate financings means with the banks and to ensure marketing of products in strict compliance with the international rules. On other side, producers should organize themselves to ensure of efficient negotiations with tradesmen through grouped sales, to control the quality of their products and to supply themselves in inputs by open market offer. Within this framework, the ONCC and the CICC had the role of guaranteeing the environment of this "professionalization" of actors. In parallel, the Société de Développement du Cacao (SODECAO) and the Programme Semencier Cacao Café (PSCC) were withdrawn gradually from the direct functions which they exerted in support of cocoa chain to transfer their duties (commercial, drying, storage, treatment, research/development, technical vulgarization/ technical advises) to famers organizations. Their activities were reduced only one minimum production of planting material, since the capacities to produce are not exploited whereas supply always remained much lower than the demand. Because of non-existence of organization gathering all the FOs in Cameroun, it is difficult to have statistics on FOs at national level. One can however obtain statistics on FOs by product (for FOs which have them). Thus for cocoa in Cameroun, CONAPROCAM gathers 27 federations of more than 600 FOs and count approximately 17000 cocoa producers.

In this new marketing configuration of smallholders with weak bargaining power vis-a-vis the buyers, farmers are directly exposed at the risks of fluctuation of international market. It is in this context that FOs develop to become gradually instruments of collective marketing. Today, cocoa FOs in Cameroun market approximately 20% of the national production (CTA, 2008).

To accompany liberalization, Cameroonian State gradually installed the legal framework necessary for creation and operation of FOs. Initially, the law N° 92/006 of August 14, 1992 relating to cooperatives organisations and Common Initiatives Groups. This law improves the

cooperative law of 1973 which envisaged a strong intervention of the State within the cooperatives. Then, the decree of Prime Minister N° 92/455/PM on November 23, 1992 laying down the modes of application of law 92. Finally, the decree of Prime Minister N° 2006/0762/PM of June 9, 2006 modifying and supplementing certain provisions of the decree of law 92.

Beyond the legal framework setting up the running of FOs in Cameroun, one can also note other contributions working for capacities building of FOs. This capacities building of FOs for the case of cocoa in Cameroun is particularly working as well as public authorities (PARI[6] project at MINADER) as ONG (STCP project at IITA). If PARI project has a long time work with the professionalization and the capacities building of FOs for all the farmers in Cameroon, STCP program was interested only in cocoa FOs. STCP program is the result of coordinated efforts of various actors (industry, FOs, public sector institutions such as research, and development agencies) to facilitate development and improvement of agricultural systems for smallholders concerned by tree crops in Africa. It started its activities in year 2000. It is a regional program managed by International institute of Tropical Agriculture (IITA). This regional program is carried out in five countries namely: Cameroon, Nigeria, the Ivory Coast, Liberia and Ghana. It is supported by a headlight project namely: Cocoa Livelihoods Program which is an initiative of World Cocoa Foundation in partnership with Bill & Melinda Gates Foundation, the Ministry of cooperation Economic and Development of Germany and chocolate industries in order to improve the living conditions of almost 200.000 cocoa farmer's families. The objectives of STCP are: i) increase incomes in rural environment in ecologically and socially responsible way; ii) promote agricultural policy, production, transformation and marketing of cocoa and oil palm; iii) to promote production and marketing of cocoa and oil palm sub-products; iv) develop the capacities of FOs to be as agricultural companies and agricultural industries; v) reinforce institutional capacities of FOs so that they can continue to offer services to their members. Concerning this last objective, STCP signed a partnership convention for capacities building of 12 cacao cooperatives

[6] Professionnalisation Agricole et Renforcement Institutionnel

IV. Principle and stake of impact evaluation

The impact evaluation became popular in several domains such as political sciences (Imai, 2005), sociology (Morgan and Harding, 2006), medicine (Rubin, 1997), statistics (Rubin, 2006; Rosenbaum, 2002), and obviously economics (Abadie and Imbens, 2006).

Impact evaluation on a population is an ex-post evaluation which enables us to determine whether their participation to a given program has effects or not on one or more given result variables. In the theory, the importance of impact evaluation was highlighted by Donald Rubin in 1974. Impact evaluation consists of identifying causal effect of a participation in a given program. Thus, a program has an impact if it is possible to prove that it helped to improve the state of participants compared to the state of non-participants. Thus, a strong impact evaluation must allow to estimate counterfactual effects, i.e. what would have happened if the program did not exist. Since it is difficult to observe each participant in the program individually in the situation where he would not have followed the program, it is necessary to build a group of control which will be used as reference group. It is thus necessary to use data on individuals who did not participate in the program, but who have almost the same characteristics as the participants. This makes it possible to highlight the average effect of participating in the program on the participants and on each participant (Heckman, Lalonde, Smith, 1998). This method presents empirical difficulties. Indeed, the alternative situation to the design (the " counterfactual ") is difficult to define (Heckman, Smith, 1996). This can be explained by the fact that individuals of the control group can also participate in other equivalent programs as those provided by the studied design. This difficulty reinforces the necessity to better understand the mechanism of design. Moreover, the control group is built with the objective that on the average, the individuals have identical characteristics to those of participants. But it also presents heterogeneous elements unobserved by the evaluator which can have an influence on their probability of participating in the evaluated program. This is the problem of selectivity bias. It makes the identification and correction of selection mechanisms to the design participation necessary, since one could produce bias estimations of participation effects to the program by directly comparing the situations of the two groups (participants and not participants to the program) (Heckman, 1979) if one does not consider these selectivity bias. To avoid these difficulties, the method of “Propensity Score Matching” which is one of the impact evaluation methods is used.

V. Methodology

The impact evaluation can be done through two types of methods: experimental method and non-experimental method. Experimental method consists of setting up in a random way two groups of the studied population: one before the program and other after the program. Thus the impact is measured by comparing the results of two groups. The experimental method is regarded as more robust but its implementation is very difficult or impossible[7]. Therefore one generally uses non-experimental method. This method consists in building a group of control resembling as much as possible the treated group (in terms of characteristics observed). The construction of control group can be done through four different techniques: pairing (matching) or the "Propensity Matching Score", exploitation of longitudinal data (diff-in-diff), the model of selection and method with instrumental variables.

In this study, we opted for the use of "propensity Score Matching " technique to build the group of control. The importance of this method is to avoid modeling of the selection process in the design based on too heavy assumptions. The "propensity score matching" (PSM) is also chosen because it makes possible to remove bias due to observable individuals characteristics. We use the techniques of the Propensity Score Matching to identify the effects of collective marketing on cocoa farmer's price in Cameroun. It is important to note that the question of collective marketing effects on cocoa farmer's price is closely linked to the cocoa farmer's price stabilization facing world market instability. This influences in a decisive and exogenous way the cocoa farmer's price. This can also substantially decrease the significance of PSM method, when it is not taken into account in the analysis. Indeed, FOs as some stabilization offices of other cocoa producer countries, do not have any control on international cocoa market trends. To be significant for comparison between inter and intra groups (experimental group and control group), this method integrated instability of international cocoa market price by the variable "Monthly Variation Coefficient of international cocoa market prize (CIF[8] price) for the corresponding monthly cocoa farmer's

[7] This impossibility is related to the fact that impact analysis method of a given program is generally done after the program was implemented. However, to be effective, experimental method must be set up and part of data collected before the program. Since it is not generally the case, it is obviously impossible after the program to observe each participant in the situation where it wouldn't have followed of program. It is the case of our data which are out of cross-sections data and which are collected after the program.

[8] Cost, Insurance and Freight

price". The methodology will consist in presenting firstly the modeling framework, then the analysis method and finally the sampling strategy.

V.1 Modeling framework of "Propensity Score Matching"

The propensity Score Matching (PSM) is a refined technique of pairing for economic impact. This technique consists in building a group of statistical comparison founded on the probability of participating to the program. $P(X) = \Pr(d = 1/X)$.

The technique of PSM which originality belongs to Rosenbaum and Rubin (1983) enables us to solve the problem of dimensionality[9] of direct pairing by showing that, under certain assumptions, pairing on the basis of P (X) is as good as direct pairing on the whole of X.

V.1.1 Method principles

This method assumes that differences between both populations, treated and untreated populations come from their individual characteristics and the treatment. If one neutralizes the differences according to the characteristics, then there remains only the effect of the treatment. The participation in the program is represented by a random variable. For each individual i, we have $\begin{cases} T_i = 1 \ if \ \ individual \ \ participate \ \ \ in \ the \ program \\ T_i = 0 \ if \ \ no \end{cases}$

The effectiveness of the program is measured by the result variable which, Y_i known as a latent variable:

$$\begin{cases} Y_{Ti} \ \ if \ \ individual \ \ \ receives \ traitement \ T = 1 \\ Y_{NTi} \ \ if \ \ individual \ \ \ receives \ traitement \ T = 0 \end{cases}$$

These two variables correspond to the potential results of the program. They are never simultaneously observed for the same individual. For a treated individual, Y_{Ti} is observed while Y_{NTi} is unknown. In this case, the variable Y_{NTi} corresponds to the result which would have been carried out if the individual had not been treated (counterfactual). For an untreated individual, one instead observes Y_{NTi}, while Y_{Ti} is unknown.

[9] The dimensionality curse is related to the fact that there exists a great number of dependant variables or then the number of dependant variables is higher than the sample size

The result variable observed for each individual can thus result from the potential variables and the treatment variable by the following relation:

$Y_i = T_i Y_{Ti} + (1+T_i) Y_{NTi}$; where only the couple (Y_i, T_i) is observed for each individual. Thus, the causal effect of treatment is defined for each individual by: $\Delta_i = Y_{1i} - Y_{0i}$

This effect is the difference between what would be the individual situation if he was treated and what it would be if he was not. Since the estimation of treatment effect for each individual makes the analysis difficult[10], it is the estimation of two average treatment effects which seems logical:

-The average treatment effect of the global population $\Delta^{ATE} = E(Y_T - Y_{NT})$

-The average treatment effect for the population of treated individuals $\Delta^{ATT} = E(Y_T - Y_{NT} | T = 1)$

These two effects are equal if the result variables are independent of access variable to the program. In this case, we have: $\Delta^{ATE} = \Delta^{ATT} = E(Y|T=1) - E(Y|T=0)$

However, in reality, the decision of treatment determines also the result variable. Indeed, in this case, estimator formed below by the difference of the average of result variable is affected by selection bias.

$E(Y|T=1) - E(Y|T=0) = E(Y_T|T=1) - E(Y_{NT}|T=0) = E(Y_T|T=1) - E(Y_{NT}|T=1) +$

$E(Y_{NT}|T=1) - E(Y_{NT}|T=0) = \Delta^{ATT} + B^{ATT}$; where B^{ATT} is the selection bias. This bias is related to the fact that the average situation of individuals who received the treatment would not have been the same as that of those who did not receive treatment. Thus, since the counterfactual average of individuals treated $E(Y_{NT}|T=1)$ is not observed, one must choose a substitute in order to estimate the average treatment effect of being treated. That is possible only under two assumptions: the assumption of interdependence and the assumption of common support.

[10] This difficulty is related to the fact that the control groups are built with the objective that on average, they have identical characteristics to those of participants. It thus seems to tiresome and not relevant to estimate the treatment effect for each individual

V.1.2 Propensity Score Matching assumptions

Assumption 1: O*bservable selection and conditional independence.* The matching base on assumption that all the variables producing selection bias (control variables) are observed (Rosenbaum and Rubin, 1983; Rubin, 1996; Imbens, 2004; Dehejia and Wahba, 2002; Smith and Todd, 2005). Given Xi, the vector of observed variables. The assumption of selection on observables means that the latent result variables (Y_{NT}, Y_T) are orthogonal to the conditional participation of characteristics (X). Under this assumption, it is possible to cancel selection bias by comparing individuals with identical observed characteristics.

Assumption 2: *Existence of common support*. The application of matching techniques is only possible if there exists untreated individuals with characteristics identical to those of treated individuals $0 < P(T = 1|X) < 1$. The test of this assumption is based on the estimation of common support zone (Todd, 2007). The assumption of common support means that the probability associated to the participation, noted $P(T = 1|X) < 1$ is not zero: for any i, there exists a positive probability to participate.

V.2 Estimating method

The principle of estimating method is to use collected information about untreated individuals to build a counterfactual for each treated individual. Thus, the average treatment effect on treatment is:

$$\Delta^{ATT} = E(Y_T - Y_{NT}|T = 1) = E(Y - Y|T = 1)$$

$$= E[Y - E(Y|X, T = 0)|T = 1]$$

$$= [E(Y_T|T = 1, X = x) - E(Y_{NT}|X, T = 0, X = x)]$$

The estimator Δ^{ATT} is obtained as the average of all differences between the situation of treated individuals and the built counterfactual.

The problem becomes estimating $E(Y_{NT}|X = x_i, T = 0) = f(x_i)$, for each treated individual with characteristics x_i. To reach the result, one must first make pairing on the base of "Propensity Score Matching". Then the next step will just be a question of defining the common support and calculating the variations.

V.2.1 Propensity Score estimation

Propensity Score Matching is used to select observable characteristics under the assumption of conditional inter-dependence. Hence this estimation is made from probit or logit model of participation to the program, by controlling all the variables X which affect in the mean time the "participation" and "result" variables. Indeed, estimators of PSM are less biased when X include variables which both affect the participation in the program and its result (Heckman and Al, 1998). Predicted values (*propensity score:* $P_i = P(T = 1/X)$) are then obtained. These values of propensity score represent the probability distribution for each farmer and for each transaction to participate in the program, i.e. selling through FOs. This predicted probability of participation is conditional to exogenous characteristics. The interest in estimating this predicted probability to take part in the program is to make the pairing of individuals having "propensity score", which are close; this explains the necessity to build a common support.

V.2.2 Common support determination

After the estimation of propensity score for all individuals in the sample, one determines the common support to make sure that for each individual who participate in the program, one can find at least an individual who did not participate and who has the same propensity score. To build the common support of propensity score, two approaches can be adopted. The initial method of pairing from Rubin (1977)[11]. Though it looks simple, many critics point out the problems of dimensionality, the nature of process and the unknown properties of its estimators. More details can be found in Crepon (2000)[12]. This method corresponds to the method of pairing of nearest neighbor. The studies of Heckman et al, (1997; 1998) enable to wipe out-the limits of Rubin (1977) method through the method of Kernel and locally weighted regressions. This method consists in generating for each observation of the group of treatment, an observation which is a weighted average of control group observations (either the unit, or a given interval). These weightings are inversely proportional to the distance between observation i (in terms of Pi) and control group observations. The results can be sensitive to the choice of interval and the weighting function. It is this method which will be used in this study.

[11] This method consists in associating with each treated observation, an untreated observation whose characteristics are identical

[12] Crepon B., 2000. Méthodes d'appariement dans l'évaluation des politiques de l'emploi. Communication aux Journées de Méthodologie Statistique, mimeo INSEE

V.2.3 Estimating of Standard Error

The standard error estimation is obtained by applying the methods of "bootstrap", which consists in replicating the entire estimation procedure on a random sample with handing-over in the initial sample and determining the standard error of the entire distribution of estimators obtained. This estimation of standard error considers the fact that the "propensity score" is been estimated. Hence, each bootstrap must take into consideration not only pairing on the random sample, but also the estimation of the score.

V.2.4 Estimating the FO impact using a « naïve » approach

After the estimation FOs impact by "Propensity Score Matching" method, it will be also necessary to estimate the impact of FOs using a simple approach called "naïve". This approach consists in making a simple comparison between collective sales and individual sales. The results obtained by this method will be then compared and discussed with those obtained by the method of "Propensity Score Matching".

V. 3 Sampling strategy

This study aims at evaluating the effect of cocoa collective marketing on cocoa farmer's price in Cameroun. It is based on data relating to 2487 transactions carried out by 904 farmers in the Center and South-West regions. These data result from a baseline survey carried out by IITA[13] in 2006. The first step will consist of highlighting the direct effect of collective sales on cocoa farmer's price by comparing collective and individual sales in center region. The sampling strategy that we adopted aims at circumventing the various sources of selection bias. Initially, the transactions on collective sales are different from the transactions on individual sales on a certain number of characteristics (which can have effects on cocoa farmer's price) which are linked to the transactions themselves on one hand and on the other linked to the farmers. Thus, the price differences between individual sales and collective sales can be completely or partially attributed either to the difference between these transactions, or to the effect of collective marketing. Then, the source of selection bias can come from certain non-observable characteristics at the regional, producers' or transactions' level. At the level of the region, a dynamics of FOs in marketing can come partly from the elites. At farmer level, there

[13] International Institute of Tropical Agriculture

are entrepreneurial spirits and the relations which farmers can have with other FOs. Such biases are often considered by using the method of instrumental variables. But this method is limited when a treated observation significantly affects the result of another untreated observation by external effects. Lastly, the source of selection bias can come from externalities exerted by FOs on marketing capacity and/or the choice of non-members. The FOs can for example positively influence selling price through their bargaining power. This is profitable to the farmers even for those who do not sell through FOs. With the aim of minimizing these biases, we use matching techniques. These techniques, which were intensely developed in many economic impact evaluation theories, are still not quite applied in empirical studies. (Jalan & Ravallion, 2003a). Concerning our study, application of these techniques starts with previous studies as: impact evaluation of farmer field school (Gotland and Al, 2004), impact social fund development (Rao & Ibanez, 2003), impact evaluation the piped water (Jalan & Ravallion, 2003b), impact evaluation of road rehabilitation (Van de Walle & Cratty, 2002) and impact evaluation of co-operatives (Bernard and Al, 2008 and Bernard and Al, 2009). Our approach in one step consists firstly in matching collective transactions with the similar individual transactions in the Center region on the one hand and on the other hand with the similar individual transactions in South-west region. Then, the matching is carried out between the transactions on individual sale in the Center region and the similar individual transactions of South-west region. Each one of these matching enables us to consider the three forms of bias, since it considers at the same time the observable and non-observable characteristics of transactions, producers and region. Finally, to be sure of the validity of these techniques, it is necessary that the treatment sample and comparison sample both operate in the same market (Heckman and Al, 1998). For our case, we make sure that in the matching framework, transactions are sufficiently similar by considering various price determinants (marketing quantities, farmer size in term of total quantity sold, farmer age, farmer level of education, roads quality, etc). This study will use data collected through a questionnaire administrated by IITA for a "baseline survey" of STCP[14] program. This survey covered the period running from March 15 to April 15, 2006 and concerned cocoa farmers. The survey were carried out by 15 surveyors selected among 40 people having taken part in 4 days training. During this training, in addition of discovering of questionnaire out of the fied, there was also a part of testing the questionnaire in the field in a locality (Mengan) at

[14] Sustainable Tree Crop Program

approximately 40 km from Yaounde. With more than 85% of cocoa national production in Cameroun, the Center and South-West regions having to shelter STCP project constituted the survey base for sample selection. Thus, 83 villages were selected according to 7 criteria namely: i) rural areas of departments concerned with the project; ii) uniformity of the agro-climatic conditions in whole of intervention sites for the Project; iii) presence of structures of proximity and accompaniment of local populations; iv) agricultural prevalence of production systems; v) accessibility in any season. vi) stepping of certain zones with the activities with execution agency IITA (particularly in the Center region). vii) sufficient population density to reach a ration cost/benefit of Project satisfactory.

With regard to the farmers sampling, according to the estimated relative density of village compared to the others, a number of farmers to interview was affected. Thus, the selection of farmers surveyed was done by randomly at the village level from a list of farmers made up with the traditional authorities Data were collected on farmers as well as their transactions characteristics. From the both regions, data were collected on 904 producers having carried out 2487 cocoa transactions (Table 1). For better apprehending the impact of collective marketing, we exploited only the data from the area where there exist the individual and collective sales at the same time Centre region). We followed different surveyors' teams in the field as supervisor and coordinated data entry survey.

Table 1: Statistics of data collected by region and selling channel

Titles	**Farmers**			
	Individual sales	**Collective sales**	**Individual and Collective sales**	**Total**
Number	369	214	18	601
Price mean (FCFA/kg)	529	592	549	552
Price Standard Deviation	54.81	55.79	39.53	62.35

Source : IITA survey 2006

From the distribution of farmers by sales' category, we joint other statistics such as mean price and standard deviation of price (table 1)

Data collected have help to make a description of variables on farmers characteristics, transactions as well as variable result. Thus, one can distinguish the variable result (OUT) from the farmers and transactions characteristic variables (CAR) as well as logit regression variables (BIN).

Table 2 : Description of the variables used in the analysis

Variables	Description of the variable	Unit	Categories
Pp	Price received by the farmer	FCFA/kg	OUT
TypeTransac	Type of sales: via a PO versus individual exclusively	1= if Collective	BIN
Gender	Gender of farmer	1=if Male	CAR
Age	Farmer Age		CAR
Educ	Farmer Level of Education	1=if has been in school	CAR
Farmsize	Farm Size of Farmer	in hectare	CAR
(Farmsize)2	Farm Size of Farmer square	in hectare	CAR
Hseholdsize	Household Size		CAR
(Hseholdsize)2	Household Size square		CAR
RentScol	Selling during the period of start of the school year	1= if Yes	CAR
Cred	Credit received from the buyer for those who sell individually	1= if Yes	CAR
TotInc	Farmer total income		CAR
IndDivers	Index of the producer's income diversification (the smaller the index, the more the producer is diversified)	between 0 and 1	CAR
DistProd	Distance from the house to the point of sale	Km	CAR
QTransac	Quantity per transaction	Kg	CAR
NbTransac	Number of transactions per producer during the campaign		CAR
NbBuyers	Number of approved buyers in the village		CAR
HarvestSeason	Season of abundance	1= if Yes	CAR
QTot	Producer's production	Kg	CAR
QTot	Producer's production square	Kg	CAR
InfoP	Information about the CIF price (international market price)[15]	1= if Yes	CAR
DistBuyer	Number of km between the point of sale and the port of Douala	Km	CAR
DistBuyer2_	Number of non-tarmac km between the point of sale and the port of Douala	Km	CAR
PCaf	Delayed CIF price (previous fortnight	FCFA/kg	CAR

[15] CIF = cost, insurance and freight

VI. Empirical results

This study aims at measuring in a robust way the effect of farmers' organization through collective sales on cocoa farmer selling price. The challenge faced here consists in reducing considerably the measurement bias by using the technique of "propensity score matching". Our study enables us to quantify by minimizing bias, the impact of collective sales of farmer organizations on cocoa farmer's price in Cameroon. Table 3 presents descriptive statistics of variables used in the analysis.

Table 3 : Descriptive Statistics of variables used in the analysis

Variables	Obs	Mean	Std, Dev,	Min	Max
TypeTransac	583	0.37	0.48	0	1
Gender	583	0.91	0.28	0	1
Age	583	50.28	14.67	19	100
Educ	583	0.93	0.26	0	1
Farmsize	583	1.92	1.78	0.5	22
(Farmsize)2	583	6.83	29.95	0.25	484
Hseholdsize	583	4.55	1.91	1	7
(Hseholdsize)2	583	24.35	16.88	1	49
Cred	583	0.30	0.46	0	1
RentScol	583	0.58	0.49	0	1
TotInc	583	44.72	32.37	7.5	300
IndDivers	583	0.60	0.28	0	2.08
DistProd	582	0.47	1.84	0	32
QTransac	583	241.96	238.02	16.5	2000
NbTransac	583	2.41	1.10	1	7
NbBuyers	583	4.50	3.42	1	10
HarvestSeason	583	0.80	0.40	0	1
QTot	583	562.34	603.14	40	6320
(QTot)2	583	679382.50	2377311.00	1600	4E+07
InfoP	583	0.38	0.49	0	1
DistBuyer2_	583	20.48	30.28	1	90

VI.1 Estimation of the probability propensity score

The results of probit estimation of collective marketing participation are presented in Table 4. These results show that household size, average quantity per transaction, number of transaction, total quantity sold and information received by farmer on the international price significantly influence cocoa farmer's participation in collective marketing.

Table 4: Probit Estimation of determinants of collective marketing participation

Variables	Coefficients	P-value
Gender	0.277554	0.232
Age	-0.002424	0.578
Educ	0.367920	0.168
Farmsize	-0.261040	0.046
(Farmsize)2	0.036220	0.011**
Hseholdsize	-0.173291	0.289
(Hseholdsize)2	0.013220	0.473
Cred	0.079147	0.572
RentScol	-0.211672	0.171
TotInc	0.002499	0.236
IndDivers	0.029453	0.901
DistProd	0.015953	0.577
QTransac	0.000718	0.007***
NbTransac	0.149003	0.032**
NbBuyers	0.178909	0.000***
HarvestSeason	0.179896	0.341
QTot	0.001204	0.007***
(QTot)2	-0.000001	0.001***
InfoP	0.234329	0.064*
DistBuyer2_	0.002344	0.306
Constante	-2.132124	0.000***
Observations		582
Pseudo-R^2		0.23

***Significant at 1% level, **significant at 5% level, and *significant at 10% level

The distribution of "propensity scores" between treatment and control groups is shown in Figure 1. This figure clearly shows that the two distributions are different.

Figure1: Propensity scores distribution among treatment and control groups

To ensure the robustness of our estimations, several techniques can be used. We focus on two commonly used methods: nonparametric kernel regression matching proposed by Heckman (1998) and five nearest neighbors matching. In the first technique, each producer treaty is matched with the entire sample of comparison. However, for each observation in the treatment group, an observation which is the weighted average of observations in the control group is generated. Those weights are made inversely proportional to the distance between each observation concerned and the control group observations, on the base of “propensity score" distribution. In the second technique, each treated observation is paired with the average of its five nearest neighbors of comparison sample, always based on "propensity score" distribution. To ensure maximum comparability of treatment and comparison group, the sample is restricted to the region of common support defined by the values in the range of "propensity score" in which treatment and control observations of can will be found.

Table 5: Balancing test of samples

Variables	Unmatched sample			Kernel-based matching			5 nearest neighbors matching		
	Means		P-value	Means		P-value	Means		
	Treated	Control		Treated	Control		Treated	Control	P-value
Gender	0.96	0.89	0.00***	0.96	0.94	0.28	0.96	0.94	0.34
Age	47.50	51.91	0.00***	47.47	48.48	0.48	47.47	48.62	0.42
Educ	0.95	0.92	0.09*	0.95	0.97	0.48	0.95	0.97	0.31
Farmsize	2.18	1.77	0.01**	2.05	2.21	0.26	2.05	2.16	0.43
Hseholdsize	4.71	4.46	**0.13**	4.70	4.50	0.27	4.70	4.61	0.61
Cred	0.29	0.31	**0.62**	0.29	0.18	**0.01****	0.29	0.18	**0.01****
RentScol	0.62	0.56	**0.20**	0.61	0.55	0.16	0.61	0.56	0.29
TotInc	49.89	41.79	0.00***	49.47	50.18	0.82	49.47	51.27	0.57
IndDivers	0.62	0.59	**0.20**	0.62	0.62	0.98	0.62	0.61	0.84
DistProd	0.67	0.35	0.05**	0.67	0.79	0.68	0.67	0.70	0.91
QTransac	273.17	224.49	0.02**	273.52	249.58	0.31	273.52	244.68	0.21
NbTransac	2.82	2.18	0.00***	2.79	2.69	0.35	2.79	2.73	0.59
NbBuyers	6.56	3.30	0.00***	6.60	6.72	0.73	6.60	6.76	0.63
HarvestSeason	0.84	0.78	**0.11**	0.83	0.78	0.19	0.83	0.77	0.10
QTot	644.16	515.76	0.01**	644.76	721.41	0.16	644.76	712.00	0.21
InfoP	0.46	0.33	0.00**	0.46	0.42	0.37	0.46	0.41	0.31
DistBuyer2_	18.48	21.58	0.24	18.31	26.49	**0.00*****	18.31	26.66	**0.00*****

***Significant at 1% level, **significant at 5% level, and *significant at 10% level

The right way to test the validity of matching is to compare characteristics average of farmers in the treated sample with the corresponding characteristics of control group generated. Therefore, the absence of significant differences between treatment and control groups confirms the validity of matching. Thus, we undertook a series of statistical tests of farmer's characteristics and trading difference in three samples: the sample of unmatched farmers, the sample of farmers matched with kernel technique and the s sample of farmers matched with five nearest neighbors technique. Table 5 shows the significant difference in the vast majority of characteristics in farmers sample unmatched (collective sales with those who sell individually). In addition, in the matched farmers samples (Kernel and five nearest neighbors), two characteristics (Credit received from the buyer and miles of dirt road between the producer and the port of Douala) are significantly different between those who sell collectively and those who sell individually. In summary, matched samples ensure the validity of comparability required.

VI.2 Average effect of collective marketing

The indicator of cocoa collective marketing impact is the net price received by farmers. The impact of collective marketing on net price paid to farmer's shows whether in collective sales (compared to individual sales) enables farmers to have a higher price. This certainly goes through the reduction of transaction costs and the increase of bargaining power. Table 6 presents the results of average treatment effects estimation for collective marketing in terms of price received by cocoa farmers. To ensure the robustness of this estimation, we first calculated the difference in the output variable (net farmer cocoa price) between treatment group and the control group. Then, for the standard error, we made 100 replications bootstrap in Stata Program.

Tableau 6: Average effect of collective marketing after two stapes replication

	Kernel-based matching		**5 nearest neighbors matching**		
Outcome variable	**ATT**	**Std. error**	**ATT**	**Std. error**	**Number of observations**
Net Price received by the farmers	44.238	6.329***	43.971	6.291***	582

Note: Stratified bootstrap with 100 replications are used to estimate the standard errors
***Significant at 1% level, **significant at 5% level, and *significant at 10% level

The results of average effects estimation for both methods (for Kernel matching and matching five-nearest neighbors) show that farmers who sell collectively receive 44 FCFA per kilogram more than those who sell individually, which represents a premium of 8%. This effect is statistically significant at 1% and robust across the two forms of matching.

Given these estimations, we find that the two matching methods (for Kernel matching and five-nearest neighbors matching) lead to similar results as much in the matching test as in the average effects estimation.

Moreover, whatever the matching technique used, a comparison of Propensity Score Matching method with the Naïve method is necessary to better assess the contribution of this method to impact evaluation of collective sales' (Table 7).

Tableau 7: Comparison of the average effects using Naïve and PSM methods

Titles	Values
Average Price in individual sales (FCFA per kg)	529
Average Price in collective sales (FCFA per kg)	592
Average effects using Naïve method (FCFA per kg)	63
Average effects using PSM method (FCFA per kg)	44
Average effects difference of two methods used (FCFA per kg)	19

The results in Table 7 show that the difference between the average effect by Naïve method and Propensity Score Matching method is 19 CFA francs per kg. Application of Naïve method is biased because of non consideration of individual characteristics of farmers and transactions. This difference is the result of bias reduction by applying Propensity Score Matching method.

VII. Conclusion and recommendations

The importance of collective marketing carried out by farmers' organizations (FOs) is to have farmer's positive benefit generated from externalities for those who participate. The objective was to assess the impact of cocoa collective marketing on the net price received by farmers. Analysis of data collected by STCP-IITA in 2006 enable us to draw the main conclusion: the impact of collective marketing on price received by cocoa farmers in the Centre Region of Cameroon is a reality. This effect is positive and statistically significant. It is estimated at 44 FCFA per kilogram by PSM method and representing an increase of 8% of average sale price (comparing collective with individual sale). This increase is the same order of magnitude as that found in other countries for other farmers (Bernard et al. 2008). Furthermore, the use of naïve method enables to be aware of the bias that this method contain. Thus, we note that there is a difference of 19 FCFA per kilogram between the two methods. This difference which can be attributed to the existence of bias in the naïve method, do not affect the importance of collective marketing impact.

Given this conclusion, the main recommendation is to promote the development of collective marketing by FO. The reason that some farmers do not sell through FO (although this would allow them to get a better price) may be partly related to credit access (Kamdem et al., 2009; 2010). Indeed, one can assume that farmers who need urgent cash advance cannot sell to FO because they need credit (private buyers only offer them) or because they cannot wait market days to sell their cocoa to FO. The development of credit system available to farmers (or the creation of credit systems by FO) obviously would increase significantly the share of supply captured by FO.

In addition, future studies may be conducted to analyze the conditions for the emergence of FO to understand why they appeared in some areas and not in others. It would also be appreciable in future studies to identify factors that lead farmers to join or not the FO. This may also help to identify the factors that guide farmers who are members of FO to choose selling through FO or not. Such studies would help to guide policies to facilitate the development of FO and strengthen their impact on prices received by Farmers.

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