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Net Income Effects of Cooperative Peanut Marketing in Haiti

Lumane Pluiose and Cathy A. Hamlett

Agricultural cooperative organizations have spread throughout the world. This form of business is founded voluntarily by people with similar economic problems and interests. They meet as a group to take advantage of opportunities that are unavailable to the individual. The basic cooperative principles around which the cooperative is formed allow it to convert individual economic goals into a common objective that, when obtained, benefits all. (For a comprehensive text on cooperatives and their principles, see Cobia.) A more detailed discussion of cooperatives in traditional societies along with modifications of the standard cooperative principals to better fit within the traditional society is also available in Jolly.

Across the many countries of the world where successful agricultural cooperatives are in operation, the basic economic force that drives individuals to form cooperatives is a result of imperfections in the economic system of the country. In many cases, the cooperative allows farmers to affect the distribution and allocation of services within their community and to counterbalance concentrated market power.

Agricultural cooperatives are often used as a development tool to break the isolation of farmers and to open better communication channels between the often remote rural areas and the remainder of the country. They can broaden the range of agencies engaged in development efforts by providing a focal point through which assistance can be directed. For detailed descriptions of successful cooperatives in Nigeria, Taiwan, Korea, India, West Cameroon, and four Caribbean islands, see Abbott.

This paper presents the results of a rigorous attempt to document a marketing cooperative's effect on net income within a developing country. Haiti was chosen as a site for this study for several reasons. It is obviously a developing country and is one of the poorest in the world (for further

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documentation on the Haitian economy, see Lundahl; Tata; Weil et al.; or Fass). Cooperatives also have a long history in Haiti. Several agricultural cooperatives have survived and remained strong, especially over the past 10 years. Authors such as Elie, Fals-Borda and Inayatullah, and Ampuero-Ramos and Fletcher have written about such cooperatives. Haiti was also chosen because a comparison group of farmers who did not market cooperatively was identified as being adjacent geographically to a group that had formed a marketing cooperative 10 years previously.

The Study

The Haitian peanut marketing cooperative is called "Cooperative Arachidiere Perpetuel Secours de D'osmon" or CAPESEDO. It buys peanuts from its members at harvest when prices are low, stores them several months, and sells later in the year as prices rise due to market shortages. CAPESEDO is now 10 years old and has grown from 15 members in 1981 to 115 today. It strictly adheres to cooperative principles associated with the international cooperative movement (Jolly). A five- to seven-member board of directors represents the members in policy making, and a supervisory council oversees the peanut purchases since the cooperative has strict quality standards for purchases. In addition, there is a committee for education and a voluntary coordinator from CECI (Canadian Center for International Study of Cooperatives) who assists in management, education, and planning.

CAPESEDO was capitalized by its members through membership shares and grants from international agencies. Fixed assets include a small compound, several buildings, and four small storage silos. Operating capital needed above retained earnings is borrowed by the cooperative from various financial institutions. Such borrowing would be impossible for an individual Haitian farmer.

This study hypothesized that the marketing cooperative, CAPESEDO, was able to increase its farmer-members' net income from peanut production as compared with peanut farmers who did not belong to the cooperative. Net income, from a development perspective, is a more appropriate measure than net price received for the peanuts. Although net price is obviously an important component of net income, bringing in the production dimension allows for a fuller measure of the cooperative's impact on development. The cooperative is likely to have had a positive effect on production because of the cooperative's educational efforts aimed at improving management. The use of net price received would not capture other positive externalities due to the cooperative and would thus understate the cooperative's developmental impact.

CAPESEDO's effect on the net income per unit of peanut produced of its members was investigated by comparing peanut production incomes of cooperative members with peanut incomes of farmers who were not members of the cooperative. The group of nonmember farmers is located geographically adjacent to the cooperative farmers, with a cooperative member and nonmember farmer being 25 miles apart at the maximum. Both types of farmers are within the same local marketing area for peanuts.

Personal interviews were used to collect data from the two groups of farmers. A questionnaire was developed in English to gather information

on income and expenses related to peanut production and marketing. After translation into Creole (the most used language in Haiti), the questionnaire was field tested before the actual interviewing. The personal interviews were completed during a five-week period in the spring of 1991.

The overall group of farmers (both members and nonmembers) was stratified for sampling purposes. All members who had marketed peanuts through the cooperative for the past two years were interviewed. This group was therefore not sampled but interviewed in total. The other strata of nonmember farmers was too large to be interviewed in total and thus required sampling. The area has no postal address system to use for random selection so the aid of four local farmers was enlisted. The total area was divided into four nearly equal parts, and a farmer from that area was asked to select on a chance basis approximately 25 farmers in each area. This farmer then guided the interviewer to each house. Originally, the randomization plan had been to ask a local farmer to mark on a map the location of each nonmember farmer. Such conceptualization was impossible for the farmers.

Econometric Model

The cross-sectional data collected through the survey were analyzed with an econometric statistical model. Data from farmers in both groups were pooled to estimate a model of the following form:

$$ANI_i = \beta_0 + \beta_1 LOCAL_i + \beta_2 KARO_i + \beta_3 PLAIN_i + \beta_4 PLN/MT_i + \beta_5 ERODED_i + \beta_6 HIRED_i + \beta_7 HIRE/FAM_i + \beta_8 KONBIT_i + \epsilon_i \quad (1)$$

where $i = 1, \dots, N$, and $N = 177$ is the total number of farmers interviewed.

Average net income per marmite of peanuts (ANI) is gross income (measured in local currency) less production and marketing costs divided by the total marmite of peanuts produced. (A marmite is the Haitian unit of measure for peanuts and is nearly the size of a large coffee can, i.e., approximately three pounds.) Specifically, net income was calculated as follows:

$$NI^j = \sum_{i=1}^n P_i Q_i - TeC^j$$

where gross income for farmer j equals the price received at each of n different market locations and times multiplied by the amount of peanuts marketed. TeC^j are the total production costs for farmer j and include the cost of labor, which is the primary production input, seed costs, and interest expense. Family labor is valued at its opportunity cost as measured by local wage rates. Marketing expenses include transportation costs and storage losses. A detailed explanation of the variables and the data gathering process can be found in Pluviose.

Before the model is described in more detail, an overview of the analysis may be helpful. Since the dependent variable is average net income per marmite of peanut produced, production decisions are endogenous to the model. The hypothesis is that the cooperative has spillover benefits that

affect production decisions. through various educational efforts, CAPESEDO attempts to improve the production practices of its member farmers. Thus the use of net income rather than net price captures the benefit of these educational efforts. The independent variables, by definition exogenous to the decisions affecting net income, are variables over which the individual farmer has little or no control in the short run. These variables are not affected by educational efforts. When the two groups of farmers were chosen for study, the assumption was that both groups faced the same exogenous constraints on net income and that the availability of cooperative marketing for one type of farmer was the only significant exogenous factor that differentiates the two groups. Structural tests described in a following section test this hypothesis. The independent variables can be grouped into two constraint categories: measures of land quality and quantity, and labor availability.

In summary, when viewing cooperatives from a developmental perspective, a broad view is more relevant. Rather than asking what effect the cooperative has had on net price received, a broader question of what impact the cooperative has had on production and marketing is more relevant. The use of net income per marmite allows the investigation of this broader question. But an econometric analysis is needed to test whether the groups are statistically the same in respect to exogenous constraints such as labor availability and land quality. Once this similarity is confirmed, the broader question of "has the cooperative positively impacted net income" can be asked.

Land Quality and Quantity

KARO is a continuous variable representing land area planted to peanuts. The Haitian karo is equal to 1.29 hectares. The coefficient on *KARO* was expected to be negative because of the expected negative correlation between output per *KARO* and farm size. Although such an expectation is not rational in economies that are beyond the subsistence level, in subsistence economics this has become a stylized fact that is empirically documented and much discussed. Several theoretical models have been put forth to account for this reality. Binswanger and Rosenzweig provide a recent summary of such models. Chayanov or Scott also provide additional background and explanation.

PLAIN and *PLN/MT* are binary variables categorizing the location of the land. *PLAIN* takes on a value of one if the land farmed is only on the plain. Likewise, if the farmer has land on both the plain and in the mountains, *PLN/MT* would have a value of one. Farmers with land only in the mountains were the base case. Farmers with some land on the plain were expected to enjoy a larger net income per marmite produced.

Land quality was further represented by binary variables. *ERODED* and *FERT/EROD* take on the value of one if land farmed is on eroded land or both fertile and eroded, respectively. Farmers with all fertile land were the base case. Farmers with some eroded land were expected to have a lower net income per marmite produced when compared with farmers with all fertile land.

Labor Availability

Several categorical variables were used to represent the labor availability for each farmer. Three types of labor are used by the Haitian farmers: family, hired, and "konbit." The konbit is a group labor activity. Similar to threshing bees from early U.S. farming, groups of farmers gather to plant or harvest someone's crop and in return that farmer participates in the others' konbit. The cost of konbit labor is feeding the participants one or two meals (*Legros*). In the subsistence literature, an entire branch of labor-supply models is predicated on a nutritional efficiency hypothesis (*Binswanger and Rosenzweig*). The konbit arrangement fits in nicely with these models. Because consuming appropriate nutrient levels is a constant battle for a subsistence farmer, the konbit, which ensures at least one good meal per day, is hypothesized to improve net income because labor is more efficient "on a full stomach."

These categorical variables (*HIRED*, *HIRE/FAM*, and *KONBIT*) represent different sources of available labor. Type of labor available is considered exogenous to the model and therefore not a production decision. Family labor was used as the base case, and hired labor, both hired and family labor, and konbit were explicitly included in the estimation. Hiring labor was expected to decrease net income when compared with using all family labor, but konbit was expected to have a positive effect on income because of the efficiencies involved.

And the final variable, *LOCAL*, is a binary variable that takes on a value of one if the farmer belongs to a cooperative and zero otherwise. This variable is hypothesized to be positive given the study's overall hypothesis that the presence of a marketing cooperative has significantly increased, for its members, the net income per marmite of peanut produced.

Several other variables were included in the initial modeling efforts but were not significant upon estimation. These variables included years of farming experience, alternative sources of income, education level, land tenure arrangements, and credit availability.

Testing for Group and Structural Differences

As explained previously, the two types of farmers were hypothesized to be similar except for cooperative membership. Before the pooled model in equation (1) was estimated to determine if the cooperative had a significant effect on net income, two concerns were addressed with further analysis. The first was to test for heteroscedasticity of the variances between the two types of farmers and the second was to test for structural differences in the relationships of independent variables to net income for the two types.

The variance of each group was estimated by fitting equation (1) to each farmer type (local is dropped out). The variances, expressed as a ratio, are distributed as an F. The null hypothesis that the variances were equal could not be accepted, which indicates the presence of heteroscedasticity. To correct for this, weighted least squares (WLS) was used. WLS is a special case of generalized least squares and involves transforming both the dependent and independent variables by dividing the data from each group by

the standard error associated with that group. See Judge et al. for further explanation of the test and weighted least squares.

A method developed by Chow was used to test whether the two types of farmers faced a different structural environment for production. The coefficients on equation (1), fit separately for each farmer type, are compared to determine if they differ significantly. If the coefficients are statistically the same, the data can be pooled and a full model fit. A test statistic developed by Chow, which is distributed as an F , can be used to test the hypothesis that the estimated coefficients for each group are statistically the same. Full specification of the Chow test is as follows:

Full Model (f)

$$\begin{bmatrix} Y_c \\ Y_{nc} \end{bmatrix} = \begin{bmatrix} X_c & 0 & Z_c & 0 \\ 0 & X_{nc} & 0 & Z_{nc} \end{bmatrix} \begin{bmatrix} \beta_c \\ \beta_{nc} \\ \delta_c \\ \delta_{nc} \end{bmatrix} + \begin{bmatrix} \epsilon_c \\ \epsilon_{nc} \end{bmatrix}$$

Restricted Model (r)

$$\begin{bmatrix} Y_c \\ Y_{nc} \end{bmatrix} = \begin{bmatrix} X_c & Z_c & 0 \\ X_{nc} & 0 & Z_{nc} \end{bmatrix} \begin{bmatrix} \lambda \\ \delta_c \\ \delta_{nc} \end{bmatrix} + \begin{bmatrix} \epsilon_c \\ \epsilon_{nc} \end{bmatrix}$$

where $\lambda = \beta_c = \beta_{nc}$ and the subscripts c and nc stand for data from farmers who belong to the cooperative and those who do not, respectively. The full model allows all coefficients between the two groups to differ, and the restricted model allows only an intercept term (δ_c and δ_{nc}) between the groups to differ. The restricted model is identical to equation (1) where *LOCAL* is a binary variable differentiating between cooperative membership and nonmembership. The F statistic to test the hypothesis $\beta_c = \beta_{nc}$ versus the alternate hypothesis $\beta_c \neq \beta_{nc}$ is as follows:

$$F = \frac{[ESS_r - ESS_f] / q}{ESS_f / [N_c + N_{nc}] - 2k} \approx F(q; N_c + N_{nc} - 2k)$$

For this model, q is equal to eight, $k = q + 2$, $N_c = 91$, and $N_{nc} = 86$. The results of the test ($F = 1.10$) fail to reject the null hypothesis that indicates that the data show no significant structural differences between groups. Thus, the pooled model is valid and further investigation is supported.

Model Estimation and Results

A weighted least squares version of equation (1) was then estimated to correct for heteroscedasticity. Table 1 presents the estimated coefficients. An R^2 of 0.49 indicates a good fit for cross-sectional data, and the F statistic for the model was significant at the 0.0001 level. Standardized estimates are also presented in table 1 for an indication of relative impact of each coefficient.

For testing the study's hypothesis, *LOCAL* was the most interesting variable. It represented whether or not the farmer belonged to the marketing

Table 1.—Results of Econometric Estimation

Variable	Coefficient	Std. Error	Prob > t	Standardized Estimate
INTERCEPT	-11.73	4.675	0.0130	
LOCAL	6.87	1.858	0.0003	0.24
KARO	-6.43	1.538	0.0001	-0.25
PLAIN	5.23	3.946	0.1817	0.11
PLN/MT	11.02	5.096	0.0319	0.19
ERODED	-3.72	2.011	0.0662	0.12
FERT/EROD	-2.46	4.334	0.5715	-0.03
HIRED	-12.50	6.863	0.0704	-0.12
HIRE/FAM	-22.95	3.552	0.0001	-0.50
KONBIT	5.25	2.640	0.0482	0.16

cooperative and, thus, the effect on net income of having access to a marketing cooperative. It was highly significant with a positive sign. Of the standardized estimates, it had greatest positive impact on average net income. This is strong evidence that the cooperative was able to positively affect average net income for its farmers.

As expected, *KARO* was negative, which indicates the presence of negative correlation between output and farm size. As mentioned previously, the development literature contains many models and possible explanations for this negative relationship in subsistence economics.

The variables relating to land quality behaved as expected. The presence of some land on the plain enhanced net income when compared with having only mountain land. *PLAIN*, however, was not significant.

Labor availability is also a significant component of the model. As was expected, *konbit* had a positive impact on income when compared with only family labor, but hiring labor had a negative impact. From the standardized estimate perspective, using a combination of hired and family labor had the largest negative impact on net income.

Throughout the analysis, no emphasis has been placed on the absolute values of the variables or a quantitative interpretation of the coefficients. This has been done by design because first, the focus of the study is on the relative impact of the cooperative and second, previous experience with collecting primary data in developing countries taught us that attempting to measure absolute differences would be nearly impossible.

Summary and Conclusions

Differences in net income per marmite of peanuts for two types of Haitian peanut farmers were investigated in this study. The two types are located nearby in northeastern Haiti. One type of farmer belongs to a marketing cooperative that is 10 years old (*CAPESEDO*) and primarily markets peanuts. *CAPESEDO* buys peanuts from its members, stores them about eight months, and then sells them when prices are higher. The other type of farmer markets his peanuts individually.

Information on the farmers' production and marketing practices was collected by administering a questionnaire through personal interviews. A Chow test was used to confirm that the structural coefficients for the two types of farmers were not significantly different. The variances between the groups, however, were found to be heteroscedastic, and this was corrected by using weighted least squares.

A linear model was estimated that related average net income per marmite of peanuts produced to several variables including a categorical variable for cooperative membership. The membership designation was the greatest positive contributor to average net income per marmite. Thus, being a cooperative member enhanced net income per marmite when compared with marketing individually.

The model also showed that farm size was negatively correlated to net income per marmite, which is typical of subsistence farmers. Because of this, subsistence farmers are often called "self-exploited," which has generated a whole literature of theoretical models to explain seemingly irrational behaviors (Reynold; Scott; and Stevens and Jabara). For the purposes of this study, the results of the analysis indicate that Haitian farmers behaved as expected.

Labor availability was a significant exogenous determinant of net income per marmite. Hiring some labor negatively affected net income when compared with only family labor. Using konbit labor improved net income.

Farmers who had some land on the plain experienced a larger net income when compared with farmers with all mountain land. Farmers who had eroded land were at a net income disadvantage when compared with farmers with some fertile land.

Throughout this study, every attempt was made to establish two comparison groups that differed only in cooperative membership. This began with a selection of the groups based on a priori knowledge of the area. Following the personal interviews, a statistical test was used to test the a priori information and supported it. One must be realistic, however, and recognize the constraint under which social scientists must operate (generally we cannot create situations through experimental design but must take the world as given to us). The comparison groups are not completely analogous to control groups in experimental design. With that caveat, the cooperative appears to have positively affected net income per marmite of peanuts produced. This study thus provides another supportive block to the body of evidence that cooperatives can positively affect farmers in developing countries.

Government agencies and nongovernmental organizations that are working to positively affect incomes and, as a result, the lives of farmers in developing countries should consider the cooperative as one mechanism to accomplish this. The research presented in this paper indicates that for at least one group of farmers in a subsistence economy, cooperative marketing enhanced income.

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