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Chapter 14

Assessing the Impact of Collective Marketing of Paddy Rice in Innovation Platforms by Smallholder Producers in Benin

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Additional information is available at the end of the chapter

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Abstract

Market access is a major constraint of smallholder rice producers in sub-Saharan Africa (SSA). There is increasing evidence that acting collectively offers one way for smallholders to participate more efficiently in the market. This chapter aimed to identify the determinants of participation in collective marketing of rice in innovation platforms in Benin and quantify its impact on household income and food security. Unlike previous studies, we used the local average treatment effect parameter to assess the impact of collective marketing of rice. Data were collected from a random sample of 257 smallholder rice producers. Results showed that participation in collective marketing increased the income of rice farmers on average by USD 148/ha. Main determinants of participation in collective marketing of rice were membership in a farmer group, training, and agreement on price. This chapter concludes that better training and well-functioning farmer groups sustain the impact of collective marketing of rice on food security.

Keywords: innovation platform, market access, paddy rice, impact assessment, Benin

1. Introduction

In perfectly competitive markets, where producers and marketers are assumed to trade goods at publicly known prices, the allocation of goods in the economy is efficient. However, the reality of the sub-Saharan African (SSA) agricultural context is characterized by information asymmetries among various actors [1, 2]. Smallholder farmers, who are mostly in rural areas, often do not have access to information regarding prices in urban areas. They mostly sell at farm-gate prices to local traders who do have access to price and information prevailing in

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other markets. Because of market imperfections, smallholder rice farmers in SSA face real difficulties in selling their products in the market. In some cases, it is the markets that do not exist, and in others, there are high transaction costs of participation [3]. In the case of food crops such as rice, the constraint of market access is more pronounced for smallholder producers in SSA than in other parts of the world. Smallholder rice producers receive low prices because they lack information on price and technologies, lack connection to established market actors, engage with distorted input and output markets, and lack access to both consumption and production credits.

Transaction cost economics stipulates that information asymmetry is the main reason why markets perform poorly and why transaction costs are high [4]. There is increasing evidence that acting collectively offers one way for smallholders to participate more efficiently in the market. Collective actions have different forms but mainly involve collective marketing. Collective action refers to action taken by a group either directly or indirectly in pursuit of members' shared interest [5] and occurs when people collaborate in joint action and decisions to accomplish an outcome that involves their common interest. Modern theory of collective action was developed to overcome free-rider problems and to design cooperative solutions for the management of common resources. The notion of collective action has been applied to group activities to enhance production and marketing of agricultural and food products [6, 7]. Thus, collective action is operationalized as an action by members of a group who come together to share market knowledge, sell together, and develop business opportunities [8].

In Benin, collective actions through innovation platforms (IPs) were developed as an organizational arrangement to link producers with traders and the private sector more efficiently by Africa Rice Center (AfricaRice) and the national agricultural research institute (INRAB). Collective marketing actions in the rice value chain in Benin involve activities such as training of producer groups and other actors in value chain and business development practices, group dynamics, financial management, conflict management, and group marketing. This resulted in the creation and consolidation of group activities, increased negotiation and bargaining skills, and enhanced leadership and entrepreneurial capacity of producer groups. This has led to collective marketing of rice among other activities [9]. Collective marketing is a marketing system that coordinates agricultural production while lowering transaction costs. Collective marketing has the advantages of reducing transaction costs, ensuring a fair income for producers, improving product quality, and improving access to credit [10]. However, collective marketing among farmers is difficult to organize, coordinate, and manage. Organizing farmers face challenges such as establishing rules to guide the operations of groups, securing commitments on the part of the group members to abide by collectively agreed rules, and monitoring as well as enforcing compliance with the rules [10]. The literature has proposed guidelines and conditions to enhance the success of collective marketing. For instance, it is argued that, for it to be effective, voluntary action and cooperation among farmers are important for creating sustainable livelihood options [11]. Whereas much literature and many case studies exist on collective action as a means for increasing smallholder farmers' market access, these studies are most often qualitative and context specific [8, 12]. This study aimed to identify the determinants of participation in collective rice marketing in Benin as well as its impact on income and food security.

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The contribution of this chapter to the literature is twofold. First, this study attempts to quantify the impact of the collective marketing on the livelihoods of smallholder farmers. It is important to assess whether collective marketing adopted by the members of IPs helped improve their livelihood. Indeed, existing empirical studies have demonstrated the effect of collective marketing only through success stories, without an assessment of the effect of the participation in collective marketing on livelihood [11–13]. Second, this study identified both factors affecting the participation of smallholder rice farmers in collective marketing and the quantity of rice sales through the group. Indeed, factors affecting participation in collective marketing are important for both policymakers and development partners to efficiently increase market access of smallholder farmers. In addition, these factors offer opportunities for effective implementation of collective action to benefit smallholder farmers.

2. Methodology

2.1. Assessing the impact assessment of collective marketing

The objective of this study was to estimate what would have been the average situation of rice producers who participated in collective marketing if they would have not participated. Unfortunately, we cannot observe these two situations for the same farmer. One cannot observe what would have been the outcome for a participant if he did not participate. This missing value is known as the counterfactual and the impossibility of observing it constitutes the key challenge of impact assessment [14]. To resolve this problem, two approaches are proposed in the impact assessment literature, namely, the "naive" approach and the statistical and econometric approach.

The "naive" approach directly compares participants and nonparticipants and is potentially biased [15] because it does not account for self-selection in the participation in collective marketing. Consequently, the statistical and econometric approach based on the counterfactual is used to evaluate the impact of participation in collective marketing of rice on income and household food security of rice farmers. In the counterfactual framework approach, some parameters of interest are defined as follows:

- ATE: Average treatment effect measures the average impact of an innovation on the entire population. It also represents the expected impact on a person selected randomly from the population.
- ATE1: Average treatment effect on the treated determines the average impact of an innovation in the subpopulation of the treated. It also represents the expected impact on a person selected randomly from the subpopulation of the treated.
- ATE0: Average treatment effect on nontreated is the average potential impact of an innovation in the subpopulation of the nontreated. It also represents the potential impact on a person selected randomly from the subpopulation of the nontreated.

- LATE: Local average treatment effect is defined as the average impact of the treatment on persons who participate only after one or more of the participation determinants have been changed [16]. This subpopulation is named "compliers."

To overcome the fundamental problem of the impact assessment (i.e., the inability to observe the counterfactual) and to have reliable results, two classes of methods are proposed in the literature: experimental methods and nonexperimental methods.

Experimental methods entail gathering a group of persons who have agreed to participate in the treatment (collective marketing) and assigning them randomly to two groups: treatment group and non-beneficiaries group (control group). Participants in the experiment are therefore selected randomly and all differences with nonparticipants are only due to treatment. For this reason, experimental approaches are generally considered as being more reliable (unbiased estimates) and as giving the easiest-to-interpret results. However, in the case of social phenomena, the use of this method poses ethical challenges.

Therefore, economists use the nonexperimental approach, relying on economic and econometric theories to guide the analysis and minimize potential bias in impact assessment. Parameters can be estimated by either parametric or semi-parametric methods.

Suppose a binary variable is A_i that indicates participation of a farmer i in collective marketing of rice with $A_i = 1$ for participants and $A_i = 0$ for nonparticipants. And y_{1i} and y_{0i} are two variables representing the level of outcome indicators (income and food security) for individual i if they participated or not in collective marketing, respectively.

The semi-parametric method is based on the conditional independence assumption [17]. According to this assumption, the adoption variable A_i and the couple (y_{i1}, y_{i0}) are independent to each other, given observable characteristics X_i. This approach is used to reduce counterfactual-related bias. Under the semi-parametric method, ATE and ATE1 are given by [16]:

$$\mathrm{ATE} = \mathrm{E}\left(\frac{\mathrm{y}(\mathrm{A_i} - \mathrm{p(x)})}{\mathrm{p(x)}(1 - \mathrm{p(x)})}\right)$$

$$\mathrm{ATE1} = \frac{1}{\mathrm{p}(\mathrm{A_i} = 1)}\mathrm{E}\left(\frac{\mathrm{y}(\mathrm{A_i} - \mathrm{p(x)})}{1 - \mathrm{p(x)}}\right)$$

where $p(x)$ is the conditional probability of participation in the collective marketing (i.e., the propensity score); A_i indicates participation in collective marketing of rice with $A_i = 1$ for participants and $A_i = 0$ for nonparticipants; y is the outcome (income and food security); and E is the mathematical expectation.

The parametric method comprises simple regression, propensity score regression, and the use of instrumental variables. The instrumental variable is used in this study because it helps avoid bias due to both observable and non-observable characteristics [18, 19]. This method supposes the existence of at least one instrument (Z) which influences the participation in collective marketing but not the outcome variables (income and food security). In other words, the instrument influences income and food security only through participation to collective

marketing. In this study, "knowledge of the existence of collective marketing" is used as an instrumental variable. Indeed, knowledge of the existence of collective marketing affects the participation in collective marketing, but it is directly related neither to income nor to food security of the household. Therefore, it can be used as an instrument to estimate the LATE.

LATE through the instrumental variable method is estimated by [18]:

$$\text{LATE} = \frac{\text{Cov}(Y, Z)}{\text{Cov}(A, Z)} = \frac{\text{E}(Y \mid Z = 1) - \text{E}(Y \mid Z = 0)}{\text{E}(A \mid Z = 1) - \text{E}(A \mid Z = 0)}$$

Two forms of estimates are used in calculating LATE. They differ in whether or not the instrumental variable Z (knowledge of collective marketing) is completely random. Wald estimator is used if Z is completely random and localized average response function (LARF) is used if the instrumental variable is not random. In this study, "knowledge of the existence of collective marketing" (instrumental variable) depends on membership of an IP and it is not random. Therefore, LATE in this study is estimated using LARF.

There are two forms of LARF, namely ordinary least squares (OLS) LARF and exponential LARF. In this study, the OLS LARF fitted the data better. The OLS LARF may be estimated with or without interaction between participation variable and socioeconomic variables. A model with interaction of variables allows accounting for the heterogeneity in impact. OLS LARF both with and without interaction are tested. LATE estimation is based on the following regression:

$$Y = \alpha_0 + \alpha_1 A + \beta AX + \mu$$

where A is participation in the collective marketing of rice; X is the vector of other independent variables; α_0, α_1, and β are vectors of parameters to be estimated; and μ is the error term.

2.2. Calculation of food consumption score

To analyze the food and nutrition situation of rice farmers, the food consumption score (FCS) was used as a proxy. The FCS, developed by the World Food Programme (WFP) [20], is a composite score used as a proxy of food security. It is a weighted score based on dietary diversity, food frequency, and the nutritional importance of the food groups consumed. It is an indicator that reflects availability of, access to, and consumption of food at the household level. The FCS is a score calculated using the weighted frequency of intake of eight food groups (cereals and tubers, pulses, vegetables, fruit, meat and fish, milk, sugar, and oil) during 7 days before the survey. The weighted FCS has a range of 0–112. WFP advises a recall of 7 days to ensure both good time coverage and reliability of respondents' memory [20]. Based on these groups of foods, the FCS is estimated as follows:

$$\text{FCS} = \sum_{i=1}^{8} (a_i x_i)$$

where i is the food group, x is the frequency of consumption of different food groups consumed by a household during 7 days before the survey, and a is the weight. Based on the

Food items	Food group	Weight
Maize, rice, sorghum, millet, pasta, bread cassava, potatoes, sweet potatoes and other cereals and tubers	Main staples	2
Beans, peas, groundnuts and cashew nuts	Pulses	3
Vegetables and leaves	Vegetables	1
Fruits	Fruit	1
Beef, goat, poultry, pork, eggs and fish	Meat and fish	4
Milk, yogurt and other diaries	Milk	4
Sugar and sugar products	Sugar	0.5
Oils, fats and butter	Oil	0.5

Source: Word Food Programme [20].

Table 1. Food groups and weights for estimation of FCS.

nutritional importance of each food group, the weight assigned to each food group is presented in **Table 1** [20].

2.3. Data collection

The study was conducted in the southwest of Benin where two IPs were installed by AfricaRice and INRAB in 2009. In total, five villages were selected for this study comprising three treatment villages and two control villages. The latter two villages were selected to be as similar as possible to the treated villages based on characteristics such as infrastructure, production systems, and population. Indeed, the control villages were also eligible for the IP, but they were not included because of funding restrictions. From the list of rice producers in each village, 300 rice farmers were randomly selected from the scope of this study with an average of 60 farmers per village. Finally, 257 rice farmers were surveyed in 2015 and used for analysis because some farmers had left the villages or were not available for interview.

Two structured questionnaires were used for data collection. A village-level questionnaire was used in the focus-group discussion to collect information on the general characteristics of the village, agricultural production, access to services, and infrastructure. A household questionnaire was used to interview households on participation in collective marketing of rice, demographic and socioeconomic characteristics, and inputs used in and outputs of rice production.

Socioeconomic characteristics of sampled households are presented in **Table 2**. Differences between participants in collective marketing and nonparticipants were tested using student's *t*-test. This test showed that there were significant differences between participants and nonparticipants for many variables. This shows that there is a self-selection in participation in collective marketing of rice. Therefore, a simple mean difference of the outcomes (naïve method) would yield biased estimation of the impact of participation in collective marketing of rice.

The experience in rice farming was 7 years; participants had slightly more experience in rice production (8 years cf. nonparticipants' 6 years). However, the average rice cultivated area was

	Participants (n = 102)	Non-participants (n = 155)	All rice farmers	Difference between participants and nonparticipants
Age of the household head (years)	45.33 (14.92)	42.85 (11.82)	43.84 (13.17)	2.48*
Household size	4.75 (2.37)	4.47 (1.67)	4.58 (1.98)	0.27
Formal education (%)	37.25 (48.59)	46.45 (50.03)	42.80 (49.58)	9.20*
Years of experience in rice production (years)	7.69 (5.99)	6.50 (5.76)	6.97 (5.86)	1.19*
Distance to the nearest market (km)	9.31 (4.41)	10.45 (3.26)	9.99 (3.79)	1.13**
Access to credit (%)	16.67 (37.45)	9.68 (29.66)	12.45 (33.08)	6.98**
Market access via an asphalt road (%)	45.10 (50)	21.29 (41.07)	30.74 (46.23)	0.24***
Having received training in rice production (%)	83.33 (37.45)	36.77 (48.38)	55.25 (49.82)	0.47***
Use of irrigated lowland (%)	93.13 (25.41)	54.19 (49.99)	69.65 (49.82)	0.39***
Experience in use of contract (%)	50 (50.26)	5.81 (23.46)	23.35 (42.38)	0.44***
Membership of group or association (%)	91.18 (28.50)	67.10 (47.14)	76.66 (42.39)	0.24***
Total available area for rice (ha)	2.70 (6.31)	0.74 (1.91)	1.50 (4.34)	1.99***
Rice cultivated area (ha)	0.33 (0.41)	0.33 (60.66)	0.33 (0.54)	0.002
Yield (t/ha)	3.50 (1.67)	2.71 (1.53)	3.03 (1.63)	0.79***
Food consumption score (FCS)	74.55 (28.77)	74.01 (26.08)	74.22 (27.13)	0.54
Net agricultural income (USD/ha)	614.08 (580.09)	367.80 (415.41)	463.02 (527.46)	246.28***

*Significant at 10%.
**Significant at 5%.
***Significant at 1%.
( ) = Standard deviation.

Table 2. Socioeconomic characteristics of rice producers.

low (0.33 ha) for both participants and nonparticipants. The rice yield of participants was 3.5 t/ha, while that of nonparticipants was only 2.71 t/ha. Net annual income per hectare of participants in collective marketing of rice (USD 614 per ha) was higher than that of nonparticipants. The difference can be explained by both the yield and the price. Indeed, one of the advantages of collective marketing is the possibility of selling rice at a higher price compared to individual selling. However, this difference should not be interpreted as an impact of collective marketing.

3. Results and discussion

3.1. Determinants of participation in collective marketing

Probit model was used to identify the determinants of farmers' participation in collective marketing of rice. Results showed that the model was significant at 1% (**Table 3**). In addition, the value of McFadden's Pseudo R^2 was high (0.75) showing a good fit of the model. In

Variables	Coefficients	Standard error	Marginal effect
Age of household head (years)	−0.02	0.02	−0.01
Membership in farmer group (0 = no, 1 = yes)	0.86*	0.45	0.24**
Number of years of residence in the village	0.01	0.02	0.01
Training on rice farming (0 = no, 1 = yes)	0.76**	0.38	0.24**
Agreement made on the price (0 = no, 1 = yes)	3.60***	0.46	0.93***
Poor condition of roads to the nearest market (0 = no, 1 = yes)	2.35***	0.45	0.76***
Household size	0.05	0.09	0.02
Available area for rice production (ha)	0.15***	0.06	0.05**
Yield (t/ha)	0.28**	0.11	0.09**
Formal education (0 = no, 1 = yes)	−0.22	0.36	−0.07
Number of years of experience in rice production	0.06	0.06	0.02
Access to credit (0 = no, 1 = yes)	−0.18	0.49	−0.06
Gender (0 = female, 1 = male)	0.13	0.37	0.04
Constant	−4.57***	0.98	
Number of observations	257		
Log likelihood	−43.77		
Wald Chi^2 (DF = 9)	257.73***		
McFadden Pseudo-R^2	0.75		

*Significant at 10%.
**Significant at 5%.
***Significant at 1%.

Table 3. Determinants of participation in collective marketing.

general, six variables affected farmers' participation in collective marketing: membership in a farmer group, training, agreement on the rice price, condition of roads to the nearest market, availability of suitable land for rice and yield.

Effect of membership of farmer group on participation in collective marketing was positive and significant at the 10% level. In addition, the marginal effect of membership in a farmer group was 0.24 meaning that membership in a farmer group increased the probability of participation in collective marketing by 24%. These results can be explained by the fact that groups are social networks where producers have access to information and can easily be informed about the existence and advantage of collective marketing opportunities. These results are similar to those obtained by other studies [21, 22] who found that farmer groups are good platforms for social capital strengthening and by which smallholders can obtain information on the market. This information can help farmers reduce transaction costs and sell their products at a high price. Indeed, higher price is an important factor for farmers' decision to participate in collective marketing. The agreement on the price of paddy rice had a positive and significant influence on participation in collective marketing. This result showed that

agreement on the price for collective marketing is an important criterion for producers. This can be explained by the fact that poor market access and low prices are the main reasons behind the collective marketing initiative. Therefore, collective marketing will only be interesting for rice farmers if higher price can be obtained. Therefore, farmers want to be confident of achieving a higher price before engaging in any collective marketing of paddy rice.

The type and condition of roads to the nearest market also had positive effects on the participation in collective marketing. Results showed that farmers living in villages with bad roads to markets are willing to participate in collective marketing. Bad road condition increases both travel time and transportation cost. To reduce these transaction costs, farmers preferred collective marketing.

The rice yield had a significant effect on the participation of producers in collective marketing. This result is explained by the fact that high yield increases the market orientation of the farmers as they need to sell the surplus of their production. Farmers perceived collective marketing as an opportunity for them to increase their production to take part in this new marketing channel. This result confirmed the findings of many other empirical studies [23–25].

3.2. Determinants of the quantity of rice supply through collective marketing

When rice farmers decide to market rice through collective marketing, they have also to decide on the quantity they will supply. The quantity is an important determinant of the success of collective marketing: the greater the quantity of rice, the greater the bargaining power of the farmer group to get a high price. Therefore, it is important to analyze factors that affect the quantity of rice sold through the collective marketing by a given farmer. Tobit model was used to identify the determinants of quantity of rice supply through collective marketing. Results showed that important determinants of quantity of rice supply were quantity of paddy produced, existence of market, price of paddy, and experience in rice production (**Table 4**).

The quantity of rice produced had a positive and significant effect on the quantity supplied through collective marketing. This shows that the more farmers produced, the more they sold through collective marketing. Indeed, with the increase in quantity produced, farmers have a large surplus, and collective marketing is a good opportunity for them. This result confirms findings by others [23, 24].

The price of paddy in collective marketing had a significant effect on the quantity supplied. This means that when the agreed price via collective marketing is high, farmers will sell more rice through this channel. This shows that the price was not only an important factor for a farmer to participate in collective marketing but also a determinant of the quantity to be sold through the channel. Thus, the price agreed through collective marketing will determine the sustainability of this channel. This result confirms the findings by Omiti et al. [25] who found that output price is an incentive for sellers to supply more products to the market.

3.3. Impact of participation in collective marketing on income

Net rice income was used as a proxy for income to assess the impact of collective marketing of rice. Wald test for heterogeneity was significant showing that the impact of collective marketing

Variable	Coefficient	Standard error
Age of household head (years)	−9.30	6.21
Formal education (0 = no, 1 = yes)	82.28	192.44
Agriculture as main activity (0 = no, 1 = yes)	129.02	277.56
Experience in rice production (years)	64.96**	31.92
Existence of market (0 = no, 1 = yes)	2026.93***	285.58
Price of paddy (USD/kg)	14.46**	6.56
Quantity of paddy produced (kg)	0.13*	0.07
Gender (0 = female, 1 = male)	99.94	191.30
Commercial production (0 = no, 1 = yes)	1095.07***	319.63
Produce for consumption (0 = no, 1 = yes)	−400.52	432.29
Constant	−3843.18***	1055.46
Sigma	902.38**	65.07
Number of observations	257	
Log likelihood	−856.70	
Wald Chi^2 (df = 8)	239.24***	
McFadden Pseudo-R^2	0.13	

*Significant at 10%.
**Significant at 5%.
***Significant at 1%.

Table 4. Determinants of the quantity of paddy sold through collective marketing.

was heterogeneous (**Table 5**). Consequently, the OLS-LARF function with interaction was used to estimate the impact of collective marketing. Four parameters were calculated: ATE, ATE1, ATE0, and LATE.

Results showed that the impact of participation in collective marketing of rice is estimated at USD 148/ha for a farmer randomly selected in the population. Considering only the population of actual participants, the collective marketing had bigger impact—estimated at USD 249/ha. The potential impact in the population of nonparticipants was USD 81/ha; thus, nonparticipants would benefit if they decided to participate in collective marketing of rice. This shows that both actual participants and nonparticipants had an advantage to engage in collective marketing. This result confirms findings by other studies [23, 24]. However, the impact on actual participants in this study is bigger, showing that there is a good target of the collective marketing of rice in the study area.

The LATE with interaction was significant at 1% (**Table 5**). This means that collective marketing had a positive impact on the income of compliers. Indeed, the potential impact of collective marketing was USD 179/ha for the population of those who would participate if they were aware. The high value of this impact showed that widespread awareness of collective marketing is likely to have most impact. This indicates that a widespread awareness campaign should

	Parameter	Estimation	Z test
ATE (OLS) Double robust			
	ATE	147.951***	5.19
	ATE1	248.6242***	7.92
	ATE0	81.701**	2.56
	Selection bias	100.673***	5.87
	Wald test (heterogeneous impact)		F (4, 461) = 15.45***
LARF (OLS) parametric			
	LATE	179.391***	9.03
	Wald test (heterogeneous impact)		F (1, 120) = 6.9e + 09***

***Significant at 1%.
**Significant at 5%.

Table 5. Impact of participation in collective marketing on income.

be organized to increase the impact of collective marketing on the livelihood of smallholder rice producers.

3.4. Impact on food security

The impact of collective marketing on food consumption score (FCS) was estimated using the OLS-LARF function with interaction. The Wald test showed that the impact of collective marketing was heterogeneous (**Table 6**). This means that the impact of collective marketing on food consumption score varied from one rice farmer to another.

The average treatment effect (ATE) was significant at 1% and estimated at 7.32. This shows that participation in collective marketing allowed farmers to increase their FCS by 7.32 points.

	Parameter	Estimation	Z test
ATE (OLS) Double robust			
	ATE	7.32***	1.73
	ATE1	11.41***	3.21
	ATE0	4.66	0.55
	Selection bias	4.08***	2.96
	Wald test (heterogeneous impact)		F (5, 442) = 3.10***
LARF (OLS) parametric			
	LATE	12.33***	3.34
	Wald test (heterogeneous impact)		F (2, 115) = 6.4e + 07***

***Significant at 1%.

Table 6. Impact of collective marketing on food consumption score (FCS).

Considering only the population of participants in the collective marketing, the impact on the FCS was 11.41. However, the potential impact on the subpopulation of nonparticipants (ATE0) was not significant.

Similar to ATE and ATE1, the LATE was significant at 1%. This means that participation in collective marketing had a positive impact on the FCS of compliers. Indeed, the impact of collective marketing was high in the subpopulation of those who would participate if they were aware. This confirms that large diffusion of collective marketing initiative will have a positive effect on food security. This result confirms the findings of other studies [26].

4. Conclusions

This study analyzed the determinants of participation of rice farmers in collective marketing and determined the impact of this new marketing channel on their livelihoods. Food security and income were used as proxies for livelihood. Results showed that the impact of participation in collective marketing of rice was positive and significant on both income and food security. Participation in collective marketing of rice allowed farmers to increase their income by USD 148/ha on average. In addition, using collective marketing helps farmers to increase their food consumption score. However, to take more advantage of these benefits, farmers need to participate in and supply large quantities of rice through collective marketing. Results showed that the main determinants of participation in collective marketing of paddy rice were membership in a farmer group, training, agreement on rice price, condition of roads to the nearest market, availability of suitable land for rice, and yield. In addition, the determinants of quantity of rice supply through collective marketing were rice production, price of paddy, and experience in rice production. These results showed that price is not only an important factor for a farmer to participate in collective marketing but also a determinant of the quantity to be supplied through collective marketing. Market access also influences both participation and quantity of paddy rice sold through collective marketing. Therefore, collective marketing will be sustainable if it allows farmers better access to markets and high prices. Better market access can be achieved through better training and well-functioning farmer groups. The training must include, in addition to rice production management, technical skills on value chain and business development practices, partnership, group dynamics, financial management, marketing and conflict management. Wide-scale awareness campaigns should be organized to increase the impact of collective marketing.

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