Multidimensional Poverty Among Calamansi Farmers in Oriental Mindoro, Philippines: Does Cooperative Membership Matter?

Carolyn D. Jimenez[1], Ceptryl S. Mina[2], and Salvador P. Catelo[3]

ABSTRACT

This study analyzed the role of cooperatives in alleviating poverty among calamansi farming households in Oriental Mindoro, Philippines. The Multidimensional Poverty Index (MPI), and Endogenous Switching Regression (ESR) were employed to analyze the poverty alleviating impacts of cooperative membership. The MPI of farmer-members and non-members were estimated at 1% and 11%, respectively suggesting that more non-member farmers experience multidimensional poverty than farmer-members. Results of the ESR model show that cooperative membership significantly reduces poverty by 4.44 points when assessed in terms of multidimensional deprivation index. In the counterfactual case, non-member farmers would have reduced the deprivation index by about 19.14 had they chosen to be a cooperative member.

Keywords: s*ustainable development goals, multidimensional poverty index, endogenous switching regression, average treatment effects*

Introduction

Poverty remains to be a perpetual challenge in the Philippines. While the proportion of poor population plummeted from 21.6% in 2015 to 16.6% in 2018, 17.6 million Filipinos (or about three million families) still fell below the annual per capita poverty threshold of PHP 25,740. Also, the latest estimates of the Philippines Statistics Authority (PSA) show that farmers and fishermen remain to be the poorest sectors with 34.3% and 34.0% poverty incidence, respectively (PSA 2020). Aside from earning below the poverty line, these sectors of the population were also deprived of access to basic services such as education and health and facilities including electricity, water, and sanitation (Dy-Liacco 2014).

One of the policy instruments found to be effective in alleviating poverty and improving the welfare of farmers is to organize them into cooperatives. This self-help group has been recognized as a powerful welfare improvement tool for it helps members escape the poverty trap (Jimenez *et al.* 2018, Tomaquin 2014, Develtere, Pollet, and Wanyama 2008). Similarly, cooperatives

are engaged in various activities that may result in benefits (e.g., improved productivity and household income) for its members making it an integral part of the poverty reduction process (Zeng *et al.* 2015).

Recognizing their contributions in poverty alleviation, cooperatives are often tapped by several institutions (e.g., local government institutions or LGUs and state universities and colleges or SUCs) as beneficiaries of various development programs in the Philippines (Jimenez *et al.* 2018). However, to date, the majority of the studies that analyzed whether a cooperative

Author's Information

[1]*Assistant Professor, Department of Agricultural and Applied Economics (DAAE), College of Economics and Management (CEM), University of the Philippines Los Baños (UPLB)*
cdjimenez@up.edu.ph

[2]*Assistant Professor (Corresponding Author), Institute of Cooperatives and Bio-Enterprise Development, CEM, UPLB*
csmina@up.edu.ph

[3]*Professor, DAAE, UPLB*
spcatelo@up.edu.ph

has pro-poor impact did not show the multidimensional aspects of poverty. These studies only employed unidimensional measures (e.g., income or expenditure) in assessing the impact of cooperative membership on poverty (Jimenez *et al*. 2018, Tomaquin 2014). Hence, the pro-poor impact of cooperative organizations has often been questioned (Bibby and Shaw 2005, Birchall 2003). Cognizant of its multidimensional nature, it is imperative to measure poverty by considering multiple indicators of wellbeing. Individuals or families may also be experiencing deprivations on basic needs such as housing and sanitation, health and nutrition, and education among others, in addition to income. Lastly, there are very limited studies that applied quantitative techniques in analyzing the role of cooperatives in poverty alleviation.

This study contributes to the literature by measuring the poverty situation among calamansi farming households in the province of Oriental Mindoro, Philippines. Likewise, the findings of this study can complement other poverty studies to guide policymakers in crafting programs and interventions towards attaining the first sustainable development goal (SDG-1), which is to "*end poverty in all its forms everywhere*" by 2030 (United Nations Development Program [UNDP]-Philippines 2020).

Methodology

Data Collection

This study was conducted in the municipalities of Victoria and Pola, Oriental Mindoro. The study sites were chosen for two reasons: 1) these municipalities produce most of the calamansi supply in the province and 2) they have calamansi farmers who are members and non-members of cooperatives.

Primary data were collected from 300 randomly selected farmers (160 farmer-members and 140 non-member farmers) through face-to-face interviews. Information on the socioeconomic (e.g., education, farming experience, land ownership status, farm size, household size, the volume of output sold, and household income and expenses), and institutional (e.g., availability of transportation, credit, and extension services) characteristics of the farming households were collected.

Analytical Tools

Several analytical tools were employed in this study. Descriptive statistics were used to explain the socioeconomic characteristics of the respondents. Monetary and nonmonetary approaches were used to examine the multifaceted nature of poverty. Endogenous switching regression (ESR) was implemented to evaluate the factors that determine cooperative membership and to see the impact of cooperative membership on the multidimensional deprivation index.

Monetary Income Poverty

In analyzing income poverty, the PSA's 2018 annual per capita poverty threshold of PHP 25,740 was used. The poverty threshold refers to the minimum income needed to satisfy the basic food and non-food requirements of a household (PSA 2020). Furthermore, this study used household expenditure as a proxy for household income in measuring monetary poverty. This is based on the premise that annual income received by a farming household in developing countries such as the Philippines tends to vary due to seasonal agricultural production. Furthermore, the majority of household income in these countries came from either work in the informal sector or self-employment. These put the accuracy and reliability of income into question (Prakongsai n.d.).

Nonmonetary (Multidimensional) Poverty

Unlike the monetary (income) poverty approach that uses a single indicator, MPI covers multiple indicators in analyzing the poverty situation among households or individuals (Alkire and Foster 2011, Agbola, Acupa, and Mahmood 2017). Moreover, MPI does not only measure the incidence, but also the intensity of deprivation in all three dimensions of poverty such as education, health, and living standards (Alkire and Santos 2014). Deprivation scores in these dimensions also represent the level of achievement of the households. Table 1 summarizes the dimensions, indicators, cut-offs, and weights used in the analysis of MPI.

Using MPI, the poor were identified using a two-stage cut-off process. The stages chronologically use the deprivation cut-off and poverty cut-off. First, a deprivation cut-off was set for every indicator and then every single farming household was categorized as either deprived or non-deprived with respect to every indicator or measure in every dimension. Weights were then assigned to every dimension such that the sum of the weights in all dimensions adds up to the number of dimensions. The weighted sum of deprivations for every individual was computed and then a second (poverty) cut-off that cuts across all the dimensions and sets the sum of weighted dimensions in which a household must be deprived to be categorized as multidimensionally poor was assigned. Results were then censored by assigning zero value for nonpoor, and continuous value for poor households.

Table 1. Dimensions, indicators, deprivation cut-offs, and weights of the multidimensional poverty index

Dimensions of Poverty & Indicators	Cut-Off
Education	
Years of schooling	Deprived if no household member has completed five years of schooling
Child school attendance	Deprived if any school-aged child is not attending school up to class 8
Health	
Child mortality	Deprived if any child has died in the family
Nutrition	Deprived if any adult or child for whom there is nutritional information is malnourished
Living Standard	
Electricity	Deprived if the household has no electricity
Improved sanitation	Deprived if they do not have an improved toilet or if their toilet is shared
Improved drinking water	Deprived if the household does not have access to clean drinking water or clean water is more than 30 minutes' walk from home, round-trip.
Flooring	The household has a dirt, sand, or dung floor.
Cooking fuel	The household cooks with dung, wood, or charcoal.
Asset ownership	The household does not own more than one of the following: radio, TV, telephone, bike, motorbike, or refrigerator and does not own a car or truck.

Adapted from Alkire and Santos (2014) and Agbola, Acupan, and Mahmood (2017)

Following Alkire and Santos (2014), the weighted deprivation score (D_i) computation is simplified following this implicit equation:

$$D_i = w_{ij}E_{ij} + w_{ij}H_{ij} + w_{ij}S_{ij} \tag{1}$$

where w_{ij} = the weight relevant for each component

E_{ij} = score for each indicator in education

H_{ij} = score for each indicator in health

S_{ij} = score for each indicator in living standard

Endogenous Switching Regression Model

In the ESR model, the farming household's behavior is analyzed using two outcome equations and a treatment equation that denotes which regime a household is facing. Following Lokshin and Sajaia (2004) and Lokshin and Sajaia (2011), cooperative membership decision can be represented by the following:

$$M_i^* = \alpha Z_i + \mu_i \tag{2}$$

with

$$M_i = \begin{cases} 1 & if \ M_i^* > 1 \\ 0 & if \ M_i^* \le 0 \end{cases} \tag{3}$$

Conditional on treatment, the outcomes of a decision are denoted by the following:

$$\text{Regime 1: } y_{i1} = \beta_1 X_{i1} + \epsilon_{i1} \qquad if \ M_i = 1 \tag{4}$$

$$\text{Regime 2: } y_{i0} = \beta_0 X_{i0} + \epsilon_{i0} \qquad if \ M_i = 0 \tag{5}$$

where M_i is a binary variable with a value of 1 if an individual chose to become a cooperative member, and 0 otherwise, Z_i denotes a vector of observable characteristics that affect the decision towards cooperative membership (i.e., educational attainment, farming experience, and household income). In the outcome equations, y_{ij} represents the outcome variables; X_{i1} and X_{i0} are vectors of explanatory (exogenous) variables; and β_1, β_0, and α are vectors of parameters to be estimated. The disturbance terms of the outcome equations (ϵ_{i1} and ϵ_{i0}) and treatment equations μ_i are assumed to follow a trivariate normal distribution with zero mean vector and covariance matrix specified as:

$$\Omega = \begin{bmatrix} \sigma_u^2 & \sigma_{1u} & \sigma_{0u} \\ \sigma_{1u} & \sigma_1^2 & . \\ \sigma_{0u} & . & \sigma_0^2 \end{bmatrix} \tag{6}$$

In this variance-covariance matrix, σ_u^2 is the variance of the error term in the selection equation and σ_1^2 and σ_0^2 are variances of the error terms in the continuous equations. The covariances are given as non-diagonal values. The variance of the error term in the selection equation can be assumed to be 1 (α is estimable only up to a scalar factor). In the covariance matrix, the dot (.) indicates that the two outcomes (deprivation scores) cannot be observed simultaneously for a particular household (Lokshin and Sajaia, 2011).

Since the disturbance terms in the treatment equation (cooperative membership) are correlated with those in the outcome equations (deprivation scores), the expected values of the disturbance terms in the outcome equations conditional on the sample selection are nonzero (Di Falco *et al.* 2011). If the estimated covariances turn to be significant, cooperative membership and deprivation scores are correlated showing evidence of endogenous switching.

After estimating the model's parameters, the conditional expectations are computed as follows:

Farmer-members who chose to belong to a cooperative (observed):

$$E(Y_{i1}|M_i = 1, X_{i1}) = X_{i1}\beta_1 + \sigma_1\rho_1 f(\alpha Z_i)/F(\alpha Z_i) \tag{7}$$

Non-member farmers had they decided to belong to a cooperative (counterfactual):

$$E(Y_{i1}|M_i = 0, X_{i1}) = X_{i1}\beta_1 + \sigma_1\rho_1 f(\alpha Z_i)/(1 - F(\alpha Z_i)) \tag{8}$$

Farmer-members had they decided not to belong to a cooperative (counterfactual):

$$E(Y_{i0}|M_i = 1, X_{i0}) = X_{i0}\beta_1 + \sigma_0\rho_0 f(\alpha Z_i)/F(\alpha Z_i) \tag{9}$$

Non-member farmers who chose not to belong to a cooperative (observed):

$$E(Y_{i0}|M_i = 0, X_{i0}) = X_{i0}\beta_1 + \sigma_0\rho_0 f(\alpha Z_i)/(1 - F(\alpha Z_i)) \qquad (10)$$

The difference between equation 7 and equation 9 is the treatment effect on the treated (TT) while the difference between equation 10 and equation 8 is the treatment effect on the untreated (TU) (Di Falco *et al.* 2011, Heckman, Tobias, and Vytlacil 2001).

Results and Discussion

Characteristics of Calamansi Farmers

Table 2 shows the socioeconomic characteristics of 300 calamansi farmers in Oriental Mindoro, Philippines. It shows that the mean differences in years of farming experience (3.41 years) and volume of output sold (1.81 metric tons) are both significant at a 5% level. The average annual household consumption expenditure of farmer-members and non-members was PHP 55,400 and PHP 46,860, respectively. The mean difference of PHP 8,540 is significant at the 1% level.

Table 2. Sociodemographic characteristics of non-member farmers and farmer-members, Oriental Mindoro, Philippines, 2017

Item	Farmer Group			Comparison	
	Members n=160 (a)	Non-Members n=140 (b)	All N=300	Difference (a-b)	T-value
Educational attainment	8.18	7.71	7.95	0.47	1.21
Farming experience	26.7	23.24	24.97	3.47**	2.00
Household size	4.08	4.18	4.13	-0.10	-0.56
Farm size	1.05	1.22	1.13	-0.17	1.22
Volume of output sold (metric tons)	3.95	2.15	3.05	1.81**	2.19
Income from other sources (thousand PHP/year)	37.06	51.42	44.24	-14.36*	-1.85
Consumption expenditure (thousand PHP/year)	55.4	46.86	51.13	8.54***	4.47

***, **, * significant at the 1%, 5% and 10% levels, respectively
Source: Field survey (2018)

Monetary (Income) Poverty

Table 3 shows that during the study period, 64 out of the 300 calamansi farmers (21.33%) were classified as income poor with per capita income below PHP 25,740 per year. This result is above the 10.6% poverty incidence recorded in the province in 2018 (NNC 2020). This finding also confirms the report of PSA (2020) showing that more farmers are earning below the poverty line compared to other sectors of the country. Meanwhile, poverty incidence among non-member farmers (37.86%) were observed to be higher compared to farmer members (6.87%). This could be due to existing cooperatives in the area who also provide financial services (e.g., credit and savings) which allow farmer-members more engagement in economic activities.

Table 3. Poverty incidence (per capita) among calamansi farming households in Oriental Mindoro, Philippines, 2017

| Subsamples | Farmer Groups | | | | All | |
| | Members | | Non-members | | | |
	No.	%	No.	%	No.	%
Poor	11	6.87	53	37.86	64	21.33
Nonpoor	149	93.13	87	62.14	236	78.67
Total	160	100	140	100	300	100

Note: annual per capita poverty threshold = PHP 25,740/year
Source: Field survey (2018)

Nonmonetary (Multidimensional) Poverty

Table 4 presents the deprivations faced by farming households in terms of three poverty dimensions: education, health, and living standards. Concerning education, the result shows that 4% of the respondents were deprived in terms of years spent in school all of which came from farmer non-member households. Moreover, 16% of all respondents, the majority of which are from non-member households, were considered deprived in terms of child school attendance. These results are in agreement with the UNDP-Philippines (2018) report highlighting that despite the numerous programs to increase enrollment in primary education and to reduce the number of out-of-school children, there are families that were still facing problems in sending children to school. Based on the figures, it can also be inferred that farmer-member households were able to provide the children's need for education better than non-member farmers. Some of the reasons mentioned by farmer-respondents were the lack of financial capacity and lack of a child's interest in schooling.

In terms of health measures, some families still do not have access to adequate health services. Five percent of the respondents recorded incidences of child mortality and child malnourishment. These figures only suggest that there were families that still lack access to affordable and safe medicines and vaccines especially for their children (UNDP-Philippines 2018). It can also be observed that compared to farmer-members, non-member farmers had higher incidences of child mortality and child malnourishment. These findings suggest that farmer-members were less deprived of health services than non-member farmers.

Regarding living conditions, all households were more deprived of assets (84%), and least deprived of adequate housing conditions (2%). About 2% of all the respondents still had dirt floors. More farmer-members (91%) were deprived of assets (e.g., cars) compared to non-member farmers (84%). Furthermore, non-member farmers had notably higher deprivation in terms of adequate cooking fuel (71%) as compared to farmer-members (59%). The findings regarding the households' access to clean drinking water seem to coincide with the immediate impact of the community water system provided by the existing cooperative in the area. In particular, only 3% of farmer-members lack access to clean drinking water compared to 13% of non-member farmers. This only suggests that the benefits of farmer households from cooperative membership go beyond the organizations' support to the production and marketing of calamansi. The results also indicate that not all farmers had access to electricity and basic sanitation facilities. Families with no access to electricity commonly use kerosene or alcohol lamps for lighting while those deprived of safe and affordable drinking water often collect water from dug wells and natural springs. Meanwhile, families that did not have access to basic sanitation facilities (e.g., with water-sealed toilet bowl) normally use open pits to dispose of human waste. These results also imply that the study area is still in need of adequate infrastructures or facilities for improved and affordable energy (e.g., electricity), water, and sanitation facilities. Overall, when it comes to living conditions of households, farmer-members appear to have experienced lower levels of deprivation in all indicators than non-member farmers.

Table 4. Multidimensional deprivations experienced by calamansi farming households in Oriental Mindoro, Philippines, 2017

Dimensions and Indicators	All (%) N=300	Farmer Groups		Indicator Weights
		Members (%) n=160	Non-members (%) n=140	
Education				
No one has completed five years of education	4	0	8	0.167
At least one school-aged child not enrolled in school	16	4	29	0.167
Health				
One or more children have died	5	1	9	0.167
At least one member is malnourished	7	3	11	0.167
Living conditions				
No electricity	7	6	9	0.056
No access to adequate sanitation	3	1	5	0.056
No access to clean drinking water	8	3	13	0.056
House has a dirt floor	2	2	3	0.056
Household uses "dirty" cooking fuel (dung, firewood, or charcoal)	59	49	71	0.056
The household has no car and owns at most one of: bicycle, motorcycle, radio, refrigerator, telephone, or television	84	79	91	0.056

Source: Derived from survey data (2018)

The MPI shows that only 12% of farming households were identified as poor when evaluated using the multiple indicators of poverty (see Table 5). Comparing the two farmer groups, it can be inferred that there are more poor people among non-member farmers (21%) than farmer-members (2%). Meanwhile, in terms of intensity of poverty, non-member farmers stood at 53%, implying that these farmers were deprived in more than half of the weighted indicators. Meanwhile, farmer-members were only 39% deprived of the weighted indicators. Based on the overall MPI estimate, the multidimensional poverty incidence among all calamansi farming households is 3%, with farmer-member being less multidimensionally poor (2%) compared to farmer non-member households (5%). The results underscore that calamansi farmer-members were less multidimensionally poor compared to non-member farmers.

Table 5. Multidimensional poverty index of calamansi farming households in Oriental Mindoro, Philippines, 2017

Indicator	All (%) N=300	Farmer Groups	
		Members (%) n=160	Non-members (%) n=140
Multidimensional poverty headcount (H)	12	2	21
Intensity (breadth) of deprivation (A)	46	39	53
Multidimensional poverty index (MPI = A × H)	6	1	11

Source: Field survey (2018)

Econometric Analysis

The ESR model addresses the problems associated with selection bias by accounting for both the observed and unobserved household characteristics while simultaneously estimating the selection and outcome equations. Table 6 summarizes the results of the ESR model.

Table 6. Regression results on the determinants of cooperative membership and its impact on multidimensional deprivation, Oriental Mindoro, Philippines, 2017

| Variable | Cooperative Membership N=300 | | Multidimensional Deprivation | | | |
| | | | Members N=300 | | Non-Members N=300 | |
	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
Constant	-21.098***	5.540	0.846***	0.214	0.953***	0.271
Consumption expenditure	1.817***	0.527	-0.050**	0.021	-0.070***	0.027
Educational attainment	0.042	0.044	-0.003**	0.002	-0.003	0.004
Farming Experience	0.004	0.011	0.000	0.000	0.003***	0.001
Household size	-0.191*	0.104	0.010**	0.005	0.027***	0.007
Farm size	-0.971	0.109	0.005	0.004	-0.009	0.009
Income from other sources	-0.011***	0.003	0.000	0.000	0.000	0.000
Volume of output sold	0.045*	0.026	-0.001**	0.000	0.000	0.003
Access to transport services	0.384	0.412	-0.048***	0.017	-0.004	0.029
Extension contact	0.779**	0.314	-0.063***	0.012	-0.033***	0.003
Access to credit	0.560*	0.34	-0.125***	0.023	-0.137***	0.028
Land ownership	-0.225	0.278	-0.012	0.009	-0.065**	0.027
Neighbor membership	2.784***	0.324				
ϱ_1			0.016	0.134		
ϱ_0					-0.581***	0.217
Wald chi2(11)	140.16***					
Log pseudolikelihood	280.906					
LR test of independent equations	3.56**					

***, **, * significant at the 1%, 5%, and 10% levels, respectively

Source: Field survey (2018)

Significance of the ESR Model

Using the Wald test, the chi-square value of 140.16 is found to be significant at the 1% level. The Wald test also confirms the significance of the regression model and indicates the joint significance of the error correlation coefficients in the treatment and outcome equations. This finding also suggests that household characteristics included in the model significantly improves the fit of the treatment (choice of cooperative membership) and outcome (multidimensional deprivation score) models. Furthermore, Table 6 shows that ϱ_0, the coefficient of cross equation error correlation is significant at the 1% level which indicates the presence of selectivity bias. These results justify the use of ESR in evaluating the impact of cooperative membership on multidimensional deprivations scores of calamansi farming households.

Determinants of Cooperative Membership

As shown also in Table 6 several factors are affecting the decision of farmers towards cooperative membership. In particular, household consumption expenditure, the volume of output sold, extension contact, access to credit, and neighbor membership positively and significantly affect cooperative membership decisions. On the other hand, household size and income from other sources have negative and significant effects on farmer's decisions towards cooperative membership. This implies that smaller households with lower income coming from other sources will more likely choose to belong to a cooperative.

Determinants of Multidimensional Deprivation

Table 6 also presents the impact of cooperative membership on multidimensional deprivation scores of both farmer-members and non-member farmers. Based on the table, household size positively and significantly influences the deprivation scores implying that

regardless of the farmer group, deprivation score increases with bigger family size. Likewise, Table 6 shows that household consumption expenditure, access to credit, and extension contact significantly reduced the deprivation scores of both farmer-members and non-member farmers. Interview with the respondents revealed that farmers with regular contact with extension service providers had better access to material inputs such as planting materials, fertilizers, pesticides for calamansi production. This result is in agreement with the study of Gomina (2015) highlighting that extension contact provides farmers with greater access to information and the use of modern technologies such as tools and equipment, use of improved varieties, pesticide, and insecticide thereby reducing educational and asset deprivation.

Meanwhile, the estimated coefficients for farmer-members and non-member farmers show that there exist some heterogeneity and differences between farmer groups with respect to their deprivation score determinants. Among farmer-members, educational attainment, the volume of output sold, and access to transport services have a negative and significant influence on deprivation scores. This implies that farmers with higher educational attainment, a higher volume of output sold, and access to transportation services will have lower deprivation scores. Unlike farmer-members, higher deprivation scores were observed for non-member farmers who are non-owner operators and with longer years of farming experience.

Impact of Cooperative Membership on Multidimensional Poverty

Results of the ESR model show that cooperative membership brought a negative and significant impact on the deprivation scores of calamansi farmers (see Table 7). The expected deprivation index for calamansi farmers who chose to belong to a cooperative is estimated at 9.07 while it is about 20.49 for those who did not. In the counterfactual scenario, farmer-members who chose to belong to a cooperative would have a deprivation index of 13.51 had they decided not to. Hence, cooperative membership had reduced the deprivation scores by 4.44 points for farmer-members. In the counterfactual case, non-member farmers would have reduced the deprivation index by about 19.14 had they chosen to be a cooperative member.

Table 7. Impact of cooperative membership on multidimensional deprivation score, 300 calamansi farmers, Oriental Mindoro, Philippines, 2017

Variable	Household Type and Treatment Effects	Decision Stage		Average Treatment Effect (ATE)
		Cooperative Membership	Non-membership	
Multidimensional Deprivation Score	Members (TT)	0.091	0.135	-0.044(0.003)***
	Non-members (TU)	0.013	0.205	0.191(0.007)***

*** significant at the 1% level
ATT average treatment effect on the treated
ATU average treatment effect on the untreated
Source: Field survey (2018)

The reduction in the deprivation score is expected since cooperatives often provide a variety of services that go beyond the production and marketing of calamansi. Using part of their community development fund (CDF), cooperatives were also involved in the provision and distribution of food and non-food needs of farmer-members and their community.

Education

Cooperatives supported programs that aim to provide children with improved access to education. Identified cooperatives assisted in the rehabilitation of public schools in their community and provided scholarships to qualified children of their members. Together with private organizations, some cooperatives also distributed backpacks and school supplies to children of cooperative members.

In partnership with the national government, LGUs, and non-government organizations (NGOs), cooperatives had also initiated various programs that aim to deliver better quality health services to the members and community residents. Some cooperatives conducted feeding programs and provided financial health assistance (e.g., insurance) to their members. Furthermore, cooperatives also facilitated the distribution of medical supplies, first-aid kits, and other health care products to barangay health centers to safeguard the health and safety of people in their community.

Living Conditions

Cooperatives, in partnership with the LGUs, and NGOs, facilitated the provision of the community water system (CWS) and farm-to-market roads (FMRs) in their community. Before the implementation of the CWS project, some residents have to spend at least one hour per day to fetch clean drinking water from the nearest water source. The community water system made it possible for households to have a water source that is just five meters away from their houses. Meanwhile, improved road conditions reduced the travel time of going to and from the town proper from two hours to one hour. Furthermore, these projects provided livelihood opportunities such as the establishment of canteens and wet markets or *talipapa* for some households.

Cooperatives were also actively involved in providing aids to members especially in times of crisis or disasters. During typhoons, some cooperatives distributed relief goods (e.g., rice, canned goods, and hygiene kits) and other essential needs to the member households. Some even provided loans and other financial assistance for the reconstruction of houses damaged by typhoons.

Apart from the above-mentioned services, cooperatives also assisted to ensure that government funds are used appropriately. For instance, the *Pantawid Pamilya Pilipino* Program (4Ps) beneficiaries, who are also cooperative members, received financial management training from the cooperatives. The training provided knowledge on how to appropriately spend the conditional cash assistance received from the government. Cooperatives also ensure that each member-beneficiary will avail of the goods and services that satisfy the food and non-food requirements of their members' households.

The cooperatives set up stores that sell affordable food (e.g., rice, canned goods, noodles, distilled water to members, and formula milk), medical essentials (e.g., medicines and alcohol), and school supplies with favorable payment terms and conditions to its members and their community. Moreover, cooperatives distributed patronage refund (part of the cooperatives' net surplus) to their members who availed of products from the coop store.

Summary and Conclusion

This study employed both monetary and nonmonetary approaches in analyzing the poverty situation among calamansi farmers in the province of Oriental Mindoro, Philippines. This study also assessed the determinants of cooperative membership and the impact of cooperative membership on calamansi farming households' multidimensional deprivation scores. A cross-sectional farm household-level data was collected from 300 randomly selected farming households that were used for the analysis.

Results showed that more non-member farmers were income poor, earning below the per capita poverty threshold PHP 25,740 per year. Similarly, compared to farmer-members, non-member farmers were more deprived in all three dimensions of poverty namely: education, health, and living standards. These findings further imply that more non-member farmer households are multidimensionally poor.

　　　　Furthermore, using the ESR model, the study found that household consumption expenditure, the volume of output sold, extension contact, access to credit, and neighbor membership significantly influence farmers' decision towards cooperative membership. Additionally, the study provided information on the heterogeneous impact of cooperative membership on the degree of deprivation experienced by calamansi farmers. The estimated coefficients of deprivation score determinants (e.g., educational attainment and farming experience) for farmer-members and non-member farmers confirm that differences exist between the farmer groups. Furthermore, cooperative membership had a heterogeneous impact on the level of deprivation faced by farmer-members. In particular, cooperative membership significantly lowers the multidimensional deprivation scores of calamansi farmer-members by 4.44 points. The reduction in the deprivation score is expected since cooperatives provide various services that cater to both income and non-income needs (e.g., health, education, living conditions) of member households. Hence, cooperatives help farmers escape from the multidimensional poverty trap. These findings also underscored the need to create an enabling environment that will promote cooperative membership and support the development of the cooperative.

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