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EFFECT OF COOPERATIVE MEMBERSHIP ON PERFORMANCE OF FARMERS: EVIDENCE OF CEREAL FARMERS FROM PLAIN REGION (TERAI) OF NEPAL

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ABSTRACT

Developing cooperatives is one of the important approaches to improve the farmer's performance. In this paper we used the data collected from western plain of Nepal and applied an endogenous switch regression model in order to study the relationship of farmers' membership in cooperative with benefit cost ratio of rice and wheat production. The findings show high benefit cost ratio for cooperative farmers in both rice and wheat. The findings also reveal higher amount of inputs use among the cooperative farmers as compared to the non-cooperative farmers. The disaggregation based on land area shows that farmers with small landholdings are more benefited from cooperative however cooperative membership evidence is more in farmers with higher land holdings. Our findings highlight that smallholders should be provided with assistance to be involved in cooperatives for higher benefit from cereal farming.

Keywords: Switch regression model - endogenous variables - agriculture cooperative - rice - wheat - benefit-cost ratio

INTRODUCTION

Agricultural cooperatives has been widely considered as an institutional tool to assist in overcoming the constraints that impede smallholders to take advantage of better agricultural production and

marketing opportunities and thus increase farm incomes (Hoken & Su 2018, Ma, Renwick, Yuan & Ratna 2018, Mojo, Fischer & Degefa 2017). Cooperatives are helpful to strengthen the negotiation capacity of farmers to gain more competitive price through reduction in transaction cost and information asymmetry and quality standard (Jia, Huang & Xu, 2012, Trebbin 2014). Nwankwo, Peters, and Bokelmann (2009) claim that information distributed to farmers during cooperative meetings helped them apply for government loans more easily and was pertinent to their social and agricultural requirements. Cooperatives develop opportunity for members, higher income and social protection and empowerment by fostering economies of scope and increasing bargaining power of their members. This helps them in uplifting from degradation and poverty (Somavia 2002). Agricultural cooperatives thus act as mechanisms for driving agricultural growth and rural development (Latynskiy & Berger 2016; Nganwa, Lyne & Ferrer 2010). Cooperative facilitate goat farmers to adopt improved production practices in Nepal (Neupane *et al.* 2022). Cooperative membership also helps farmers to increase production efficiency among smallholder goat farmers (Neupane *et al*. 2022). Promotion of cooperatives therefore, can be considered as a strong pillar of national as well as international economic and social development (Levin 2002). Cooperatives are able to teach and train their members efficiently so that the members are motivated for adoption of practice for significance agricultural growth and therefore, promotion of agricultural cooperatives has been attraction aspects for donors, governments and development workers of developing countries (Abebaw & Haile 2013, Deng, Huang, Xu & Rozelle 2010). While cereals are the major crops affecting livelihood of Nepal, farmers still neglect for appropriate use of inputs for better harvest from the product. Cooperatives can motivate farmers to use sufficient inputs and thus improve their performance regarding productivity of cereals. Although Nepal Government has considered cooperative as one of the three pillars of development, there is dearth of literature on the relevance of agriculture cooperatives in improving performance of farmers especially in case of cereals. Therefore, the purpose of this paper is to research how smallholder farmers' participation in cooperatives affects their performance.

A switching regression model for productivity and technology adoption

Microeconomic analysis of the impact of cooperative membership on agricultural productivity and incomes is hampered by the fact that the "before" and "after" activities of a farm that are rarely observed. Moreover

in case of biological production this is affected due to variation in climatic factors, where one year's production cannot be absolutely compared to other years. Impact on members and nonmembers has been however performed but the problem of endogeneity (Hausman 1978) of cooperative membership which might be due to various characteristics of farmers is not accessed through simple multiple regression analysis. For example, farmers who have more land, less education, more dependent on agriculture might be more likely to be involved in agriculture. In this case, cause of endogeneity is elf-selection towards cooperative membership, and failure to take this into account will overestimate the true impact of the membership.

Since such intrinsic characteristics affect the interest of being involved in cooperative and cannot be directly observed by researchers, they cannot be directly controlled for outcome variables. This problem of endogeneity can be explicitly solved by using simultaneous equation models (Hausman 1983). The study employs two stage switching regression model where first stage determines the factors affecting membership in a cooperative and second stage finds the relation between various factors affecting Benefit cost ratio (BC ratio) of members and non-members.

METHODS AND MATERIALS

Data and descriptive statistics

A multistage sampling method was applied for sample selection. At first the western terai region was purposively selected for the intensity of production of rice and wheat. Secondly, two villages (Manpakadi and Devdaha) where farmers intensively cultivate rice and wheat cultivation were selected. At third stage, two cooperatives were randomly selected from each village among which 80 members were selected from Manpakadi and 81 from Devdaha. Nonmembers were also selected from same villages where 77 respondents from Manpadadi and 82 from Devdaha were selected. Total of 320 farmers were selected among which all were cultivating rice whereas only 248 were involved in wheat cultivation. The data includes information about socioeconomic status of farmers, institutional characteristics and farm characteristics. Through in-person interviews, the data from a farm household survey were gathered. The enumerators involved were from agriculture background to ensure the quality data. The enquiry was made in Nepali language.

Table 1 shows the description and summary statistics of the all variables utilized in data analysis. The dummy variable indicating

cooperative membership or non-membership, is included as dependent variable on the selection stage with a value of 1 for membership and 0 otherwise. The outcome variable includes the benefit cost ratio from rice and wheat where the independent variables include socioeconomic variables, institutional factors, cultivation practices and inputs used in rice and wheat cultivation. Benefit cost ratio is the ratio of gross benefit and variable cost.

Table 1: Description and summary statistics of selected variables.

Variable	Description	Mean	S.D
Cooperative or non-cooperative farmer	0= Non member 1= Member	0.500	0.510
B/C ratio from Rice	Ratio of gross benefit	3.854	.839
B/C ratio from Wheat	and variable cost	2.301	1.050
Gender of household head	0= female 1= Male	.770	.420
Age of household head	1 = 31 to 40 2 =41 to 50 3= 51 to 60	1.79	.720
Number of members in family		6.07	1.457
Income of household from remittance	0 =No 1 =Yes	.300	.460
Loan received or not	0 =No 1= Yes	.630	.482
Do farmers visit ASC	0= No 1 =Yes	.610	.489
Received support from NGO	0 =No 1= Yes	.47	.500
Received training on agriculture	0= No 1= Yes	.59	.492
Rear livestock	0 =No 1 =Yes	.560	.497
Fertilizer used in rice	Kg per hectare	2.97	0.89
Fertilizer used in wheat	Kg per hectare	2.69	1.520
Total land cultivated	Hectare	0.632	0.290
Rice frequency of irrigation	0= limited 1= Adequate	.760	.430
Wheat Frequency of Irrigation	0= limited 1= Adequate	1.260	1.136
Mechanization in seeding (wheat)	0 =No 1 =Yes	.53	.500
Mechanization in harvesting (rice and wheat)	0 =No 1 =Yes	.55	.499

Table 2 shows the mean differences in the characteristics of cooperative members and non-members.

Table 2: Mean differenced in characteristics between cooperative members and non-members.

	Members		Non members		
	Mean	SD	Mean	SD	Diff
B/C ratio from Rice	4.61	.32	3.08	.35	1.53***
B/C ratio from Wheat	3.36	.75	1.52	.25	1.84***
Gender of household head	.68	.47	.87	.34	-0.19***
Age of household head	1.45	.60	2.13	.66	-0.68***
Number of members in family	5.20	1.19	6.94	1.15	-1.74***
Income from remittance	.25	.43	.36	.48	-0.11**
Loan received or not	.63	.48	.64	.48	-0.01
Do farmers visit ASC	.78	.42	.43	.50	0.35***
Received support from NGO	.51	.38	.42	.50	0.09
Received training on agriculture	.83	.38	.36	.48	0.47***
Rear livestock	.58	.49	.54	.500	0.04
Fertilizer used in rice	12.42	1.46	7.43	5.36	4.99***
Fertilizer used in wheat	16.46	5.85	6.98	2.61	9.482
Total land cultivated	0.70	0.306	0.56	0.25	0.14***
Rice frequency of irrigation	.98	.156	.53	.50	0.45***
Wheat Frequency of Irrigation	1.66	1.300	.86	.75	0.80***
Mechanization in sowing (for wheat)	.75	.433	.31	.205	0.44***
Mechanization in harvesting	.96	.205	.13	.340	0.86***

Empirical specifications

Choice of cooperative membership

We assume that the farmers choose to be involved in cooperative if they feel that utility of being involved is higher than when not involved. The farmers are assumed to be risk neutral and are concerned to increase their benefit. The study can be modeled in two stages.

First stage:

$$M_i^* = Z_i\alpha + \eta_i \quad (1)$$

Where M_i=1 if M_i^* >0, and 0 otherwise.

M_i=1 for cooperative members and 0 otherwise.

Vector $\mathbf{Z}_i$ represent variables that are the variables affecting for membership decision

Second stage:

In this stage, the effect of membership on benefit cost ratio is considered. Since simple approach for OLS regression to access the effect of cooperative on BC ratio due to various vectors might be biased as it assumes that membership is exogenous which in fact has potential to be endogenous as it might be based on individual self-selection due to their characteristics. These unobservable characters of farmers affect their decision as well as profit from production. For example, there are chances that only the farmers who have skill in agriculture are involved in cooperative. This might not be addressed through simple OLS regression.

The study therefore follows (Di Falco, Veronesi & Yesuf 2011) to account for this kind of heterogeneity by using simultaneous equation model of membership and income by full information maximum likelihood (FIML). The analyses select those variables which would directly affect the membership (selection variable) but not the outcome variable (income). The outcome variable will be affected only through selection variable which in turn is affected by instrumental variables.

Selection bias estimation model and impact assessment

For members : $$Y_{1i} = X_{1i}\beta_1 + \varepsilon_{1i} if M_i = 1 \quad (2)$$

For non-members: $$Y_{2i} = X_{2i}\beta_1 + \varepsilon_{2i} if M_i = 0 \quad (3)$$

Where, Y_i = Benefit cost ratio of rice and wheat

X_i are the factors of production, socioeconomic and demographic characteristics of the farmers, which includes the vector of covariates in Z, whereas β denotes parameter to be determined.

As specified in (Di Falco *et al.* 2011), the key assumptions of the equation model is that the error terms in equation 1,2 and 3 have trivariate normal distribution with mean 0 and covariance as shown in matrix below.

$$Cov\left(\eta, \varepsilon_{1i}\varepsilon_{2i}\right) = \begin{matrix} \sigma_\eta^2 & \sigma_{\eta 1} & \sigma_{\eta 2} \\ \sigma_{1\eta} & \sigma_1^2 & \\ \sigma_{2\eta} & & \sigma_2^2 \end{matrix} \quad (4)$$

Where, σ_η^2 denotes variance of error term in equation 1 which can be assumed to be 1 as coefficients are estimable only up to a scale factor (Maddala, 1983). σ_1^2 and σ_2^2 are variances of error term of equations 2 and 3 respectively. $\sigma_{1\eta}$ and $\sigma_{2\eta}$ are covariates of η_i, ε_{1i}, and ε_{2i}. The covariance

between ε_{1i}, and ε_{2i} is undefined because Y_{1i} and Y_{2i} cannot be simultaneously observed. A significant implication of error structure is that $E(\varepsilon_{1i})$ and $E(\varepsilon_{2i})$ conditional on sample selection (for members and non-members respectively) are non-zero, as the error term of equation 1 is correlated to error term at equation 2 and 3.

$$E\left[\varepsilon_{1i} \setminus M_i = 1\right] = \sigma_{1\eta} \frac{\text{Ø}Z_i\alpha}{\Phi Z_i\alpha} = \sigma_{1\eta}\lambda_{1i} \tag{5}$$

$$E\left[\varepsilon_{2i} \setminus M_i = 0\right] = \sigma_{2\eta} \frac{\text{Ø}Z_i\alpha}{1-\Phi Z_i\alpha} = \sigma_{2\eta}\lambda_{2i} \tag{6}$$

Where, Ø is standard normal probability distribution function, Φ (.) is standard normal cumulative distribution function

$$\lambda_{1i} = \frac{\text{Ø}Z_i}{\Phi Z_i\alpha} \quad \text{and} \quad \lambda_{2i} = \frac{\text{Ø}Z_i\alpha}{1\text{-}\Phi Z_i\alpha}$$

.λ_{1i} and λ_{2i} are called inverse Mills Ratios (MIR) computed form equation 1-3 which correct the selection biases in endogenous switches regression.

If found the estimated covariance $\hat{\sigma}_{1n}$ and $\hat{\sigma}_{2n}$ are statistically significant, it indicates that membership decision and describing variables are associated, indicating the presence of endogenous switching and thus reject the null hypothesis that there is absence of sample selectivity bias. This model is known as switching regression model with endogenous switching (Maddala and Nelson 1975). By using full information maximum likelihood estimation, the endogenous switching regression model can be estimated (Lee & Trost 1978). Given the prior assumptions regarding the distribution error term, the logarithmic likelihood function is:

$$\ln L_i = \sum_{i=1}^{n} M_i \left[\ln \text{Ø}\left(\frac{\varepsilon_{1i}}{\sigma_1}\right) - \ln\sigma_1 + \ln\Phi\left(\theta_{1i}\right)\right] + \left(1-M_i\right)\left[\ln \text{Ø}\left(\frac{\varepsilon_{2i}}{\sigma_2}\right) - \ln\sigma_2 + \ln 1 - \Phi\left(\theta_{2i}\right)\right] \tag{7}$$

Where,

$$\theta_{ji} = \left(Z_i\alpha + \frac{\rho_j\varepsilon_{ji}}{\sigma_j}\right) \Big/ \sqrt{1-\rho_j^2}\,, \qquad J=1,2$$

ρ_j denoting correlation coefficient between the error terms ε_{ji} of equation 2 and 3 respectively.

Treatment effect estimation

The average treatment effect (ATE): The ATE measures the difference in mean (average) outcomes between units assigned to the treatment and units assigned to the control. In this paper we formally define ATE through defining two potential outcomes i.e benefit cost ratio for members of cooperatives denoted by Y_{1i} and benefit cost ratio for non-member of cooperatives denoted by Y_{2i}. Here membership in cooperative is treatment. We also denote membership as M=1 and non-membership as M=0. ATE denotes the average treatment effect in the population (Newton *et al.*, 2009)

ATE= Potential outcome mean of members - Potential outcome mean of non-members

$$ATE = E\left(Y_{1i} \setminus M_1 = 1\right) - E\left(Y_{2i} \setminus M_1 = 0\right)$$

Potential outcome mean (POM) = Average potential outcome of targeted subpopulation of population

$$POM = E\left(Y_{1i} \setminus M_i = 1\right) \qquad \text{(for members)}$$

$$POM = E\left(Y_{2i} \setminus M_i = 0\right) \qquad \text{(for non-members)}$$

ATET (Average treatment effect on treated) = Average treatment effect on the treated subpopulation. It is the expected effect of treatment for a randomly drawn individual from those individuals in the population that have undergone treatment.

$$ATET = E\left(Y_{1i} \setminus M_i = 1\right) - E\left(Y_{2i} \setminus M_i = 1\right)$$

Endogenous variables

Thus the two explanatory variables: support from NGO and recipient of training may have endogeneity effect and are determined jointly with membership decision.

RESULT AND DISCUSSION

Table 3 and 4 presented estimates for the variables that affect a decision of farmer's to join an agricultural cooperative and its effect on the benefit-cost ratio for rice and wheat, respectively. As discussed that full information maximum likelihood (FIML) approach estimates both selection and outcome equations simultaneously as presented in different columns of tables 3 and 4. The outcome equations which represent the effect of

cooperative membership on benefit cost ratio of rice for members as well as nonmembers are presented in the third and fourth columns of table 3 respectively. Similarly, the outcome equations which represent the effect of membership of cooperative on benefit cost ratio of wheat were presented in the third and fourth columns respectively in table 4. Additionally, the estimates of the first stage regression residuals for the potential endogenous variable (cooperative membership) were shown in the second column of tables 3 and 4. In the cases of rice and wheat, these residuals are found not statistically different from zero, indicating the estimation of coefficients is reliable (Wooldridge 2009). The likelihood ratio test for joint independence of the three equations indicates that the equations are dependent. The nonzero value of covariance terms ($\sigma_{\mu M}$ and $\sigma_{\mu N}$) are non-zero, indicating that the model justifies the use of endogenous switch regression (ESR) model and self-selection in the cooperative membership (Rivera, 2002). The significance of $\sigma_{\mu M}$ and implies that involvement in cooperatives increases benefit cost ratio for the non-members if they are involved in cooperative (Lokshin & Sajaia 2004). The negative sign of $\rho_{\mu N}$ and positive sign of $\rho_{\mu N}$ shows that both cooperative members and nonmembers have higher BC ratio when they are involved in cooperatives.

Determinants of cooperative membership

In the selection specification, the variables having same name have different values because of different sample size (as only 248 out of 320 households grow wheat), the statistical effect are however similar. The tables show that gender, age and number of members in the family and area of cultivation have statistically significant effect on membership choice. Our study shows that households headed by female are more likely to be involved in a cooperative which is in contrast to the findings from Ethiopia (Abebaw & Hailey 2013). Further, the household size is negatively related to membership in our research and this finding is also in contrast to that of Bernard and Spielman (2009). Fisher and Quaim (2012) found that Household size has no significant effect on membership. More is the area of cultivation higher is the chance of being involved in cooperative and this result is agreement with that by (Bernard *et al.* 2010, Ito, Bao and Su 2012, Ma and Abdulai 2016). Similarly the members are among those who use higher dose of fertilizers and sufficient irrigation. This result is in line with a finding in Ethiopia where farmers in cooperative were using higher amount of pesticides and fertilizer (Abebaw & Haile 2013). A study shows that people with poor management do not join cooperatives (Van der,

2005). Livestock rearing households had higher tendency to be involved in cooperative and this finding is similar to that by (Barrett *et al.*, 2012). Intensity of mechanization for seed sowing (in wheat) and harvesting (in rice and wheat) was high among members.

Table 3: Determinants of cooperative membership and its impact on BC ratio from rice

	Selection	**Members**	**Nonmembers**
Constant	-.452 (29.806)	2.757***(.156)	2.70*** (.199)
Gender of household head	-3.590* *(10.437)	.248***(.036)	-.102* (.061)
Age of household head	-3.164* (10.206)	.029 (.031)	-.138***(.035)
Number of members in family	-6.683*(15.349)	.052*** (.017)	-.006(.020)
Income from remittance	-10.123 (23.811)	.028(.042)	.022(.046)
Loan received	5.780(12.879)	-.220***(.047)	-.162***(.049)
Visit to agriculture service center	5.405**(11.573)	.049*(.043)	.148 ***(.044)
Rear livestock	4.441***(10.315)	.312***(.046)	.066(.047)
Fertilizer use	2.449*(238.520)	2.41*** (.383)	3.287***(.363)
Irrigation frequency	.146(4.059)	.286***(.107)	.080**(.044)
Mechanization in harvesting	2.862*** (.394)	.407*** (.066)	.343***(.097)
Total cultivated land	.538***(1.518)		
Res (support from NGO)	0.011(0.11)		
Res (Training received)	0.076 (0.299)		
$Ln\sigma_{\mu M}$		-1.616 ***(0.58)	
$\rho_{\mu M}$		-.56** (.916)	
$Ln\sigma_{\mu N}$			-1.338*** (.058)
$\rho_{\mu N}$			.629 (.48)
LR test of independent equations	24.03***		
Log likelihood	-2.748		
Observations		320	320

Note: Dependent variable is

Reference gender is female, reference irrigation is inadequate irrigation and reference age of household age is age group of 30 to 40

**** P<0.01*

***P<0.05*

**P<0.1*

Effect on benefit cost ratio of rice

Table 3 estimates the impact of cooperative membership on benefit cost ratio from rice. Differential effect of household head gender among

members and non-members was observed. Members with male headed household have higher BC ratio in rice while members with male headed household head have higher BC ratio, indicating that female headed household head are not successful to reap the benefits of cooperative. This may be because females have to be bound with household chores along with agriculture activities and therefore could not be dynamic with the benefits of cooperative. Age of household head has no significant effect for members indicating all ages are benefited with membership whereas for non-members BC ratio is higher for the lower age group. Membership exerts positive effect on BC ratio for family with higher members. This might be because more family members mean they have time to take part in activities of cooperative and thus benefited. Remittance has no significant effect while loan has negative effect on both members and nonmembers which might be because of use of loan for other purpose than agriculture. Visit to agriculture service center has positive effect on both members and non-members. Livestock rearing has significant positive effect on BC ratio of rice for members while non-significant positive effect for non-members. The positive effect may be because of use of FYM in rice field. Use of fertilizer and irrigation adequacy has positive effect on BC ratio for both members and non- members inferring that fertilizer and irritation are vital input of rice production. Similarly mechanization in harvesting exerts a positive and highly significant result.

Effect on benefit cost ratio of wheat

We now analyze how cooperative participation affects BC ratio of wheat as presented in table 4. The table reveals that male headed household head have higher BC ratio in members whereas the effect of household head gender has non-significant effect on non-members. This implies the same situation as in rice that females are not able to take the benefit of membership. Age of household head has no significant effect for both members and non-members whereas number of more members has positive effect on members. Remittance has significant negative effect on BC ratio of non-members which might be because the remittance recipient households are less concerned with wheat farming. According to the key informants rice being the prioritized cereal, less concern was given by many farmers on wheat production. Loan has negative effect on members while not significant on non-members whereas rearing livestock has not significant effect on both members and non-members. This situation also shows the negligence of farmers towards wheat as they put the FYM only

for rice. Visiting to agriculture service center has positive effect on BC ratio form wheat for both members and non-members, indicating that counseling by technicians has positive effect in wheat production. Use of fertilizer and irrigation adequacy has positive effect on BC ratio for both members and non- members inferring that fertilizer and irritation are vital input of wheat production. Mechanization in seed sowing as well as harvesting has positive effect on benefit cost ratio from wheat.

Table 4: Determinants of cooperative membership and its impact on BC ratio from wheat

	Selection	**Members**	**Nonmembers**
Constant	6.751(8.877)	.993*** (.187)	1.569***(.152)
Gender of household head	-2.923*(2.191)	.250***(.091)	-.075(.054)
Age of household head	-2.00**(.880)	.018(.058)	.029(.025)
Number of members in family	-1.794*(1.120)	.057*(.033)	-.028(.018)
Income from remittance	.143(2.76)	.041(.088)	-.091**(.037)
Loan received	1.153(1.359)	-.307* (.127)	.068(.044)
Visit to agriculture service center	1.794***(.563)	.038**(.081)	.115***(.039)
Rear livestock	6.571**(3.197)	.042(.061)	.023(.034)
Fertilizer use	3.250*(1.788)	2.678***(.200)	.421**(.194)
Irrigation frequency	-.708(1.29)	.258***(.075)	.019**(.025)
Mechanization in sowing	1.526 ***(.336)	.202***(.112)	.03 *(.037)
Mechanization in harvesting	3.143***(.352)	.825*** (.147)	.196 **(.043)
Total cultivated land	.057 ***(.114)		
Res (support from NGO)	0.052(0.67)		
Res (Training received)	0.042 (0.5)		
$Ln\sigma_{\mu M}$	-1.244*** (.069)		
$\rho_{\mu M}$		-.238 (.308)	
$Ln\sigma_{\mu N}$			-1.688***(.059)
$\rho_{\mu N}$			.222(.621)
LR test of independent equations	3.28**		
Log likelihood	-2.0315573 (12.765)		
Observations	248	248	248

*** P<0.01
**P<0.05
*P<0.1

Estimating treatment effect

The average treatment effect on treated takes account of the selection bias brought on by both observable and unobservable factors while estimating the result. The estimate of average treatment effect on treated is presented in table 5 which shows that the effect of membership of cooperative on benefit cost ratio from rice and wheat. The result reveals that there is higher BC ratio for both rice and wheat for members and the treatment effect on treated is significant. Positive effect of cooperative membership on production, farm income and farm profit has been reported by various researchers (Bernard *et al.* 2010, Chagwiza, Muradian & Ruben 2016, Mojo *et al.* 2017, Neupane, Adhikari & Rauniyar 2015, Neves, Silva, Freitas & Braga 2018, Verhofstadt & Maertens 2014, Wossen, Abdoulaye, Alene & Feleke 2017).

Further impact of membership according to size of farm is presented in table 6 which shows that percentage change in benefit cost ratio is high for farmers with small holdings of land. The results show that small holder farmers are more benefited from being cooperative members. The findings are parallel with those of (Ito *et al.* 2012, Ma & Abdulai 2016).

Table 5: Effect of membership of cooperative on BC ratio from rice and wheat

	PO means		**ATET**	**Percent change**
	Non Member	**Member**		
BC ratio of rice	2.889*** (.167)	4.647 ***(.105)	1.921*** (.342)	28.4
BC ratio of wheat	1.612*** (.106)	2.727***(.265)	1.648*** (.266)	52.1

Table 6: Impact of cooperative membership on BC ratio from rice and wheat by farm size

	Farm size (ha)	**PO means**		**ATET**	**Percent change**
		Non Member	**Member**		
BC ratio of rice	0.2 -0.5	2.682*** (.329)	4.787***(.174)	2.455***(.723)	78.486
	>0.5-0.85	2.853 ***(.381)	4.366 ***(.149)	1.902***(.696)	53.067
	Above 0.85	3.221***(.125)	4.735***(.252)	2.667***(.683)	47.004
BC ratio of wheat	0.2 -0.5	1.497***(.157)	2.518*** (.557)	1.914***(.453)	68.203
	>0.5-0.85	1.75***(.173)	2.793*** (.238)	1.283***(.358)	59.6
	Above 0.85	1.933***(.106)	3.287***(.348)	1.075***(.281)	58.00

CONCLUSION AND POLICY IMPLICATIONS

This paper is based on a cross sectional data where in-person interview was performed among the randomly selected households to study the effect of cooperative membership on benefit cost ratio of rice and wheat for smallholder farmers in western plain of Nepal. The study area entails two villages of western plain of Nepal where rice and wheat are intensively grown by farmers for their livelihood. In order to prevent selection bias in the outcome, the analysis uses endogenous switching regression model taking into account factors both observed and unobserved. The results shows that the members were self-selected and the members have higher benefit cost ratio than non-members. Finding also indicate that if non-members are involved in cooperative, they could perform better.

The findings show that land cultivation area is positively related to membership whereas number of members in household was negatively related to membership. Also the members used higher dose of fertilizers as compared to the non-members, though dose is not sufficient as per the national recommendation among both members and non-members. According to the finding, higher dose of fertilizer application is positively related to increment in BC ratio of rice and wheat and similar was the irrigation. Therefore, the findings recommend that farmers should be facilitated to use sufficient fertilizer for higher benefit. Effect of fertilizer was high when it procured from cooperative indicating the quality of fertilizers purchased from informal source might be low. so cooperatives should be developed in such a way to provide sufficient amount of all kinds of inputs so that farmers won't have to rely on the informal and non-reliable sources. Mechanization of farm activities is high among members which reveals that farmers can be motivated for mechanization through cooperatives to lessen their cost of production and increase profit. Though female headed households have higher tendency to be involved in cooperatives, the households with male headed were more benefited, therefore females should be provided with ample opportunity to be able to be benefited from cooperatives. Also, since loan has negative effect on output, monitoring of usage of agricultural loan is important. Findings also show that farmers with more cultivated land have greater tendency to be involved in cooperatives whereas percentage change of benefit cost ratio was higher among small landholdings as compared to larger land holdings indicating that smallholder farmers can be benefited through cooperative membership. Government policies therefore should be focused to include the small holders in the cooperative.

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