



Research Article

Market-Oriented Farmer Collective Membership and Farm Income in Jammu & Kashmir: Evidence from Apple- and Vegetable-Growing Regions

Arshad Bhat*^{ID}

Amity Institute of Liberal Arts, Amity University Mumbai, Maharashtra, India

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*Corresponding author: Arshad Bhat, Amity Institute of Liberal Arts, Amity University Mumbai, Maharashtra, India, E-mail: bhatarshad09@gmail.com

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Abstract

The land use features of Jammu and Kashmir are small and fragmented land holdings, high reliance on horticulture, challenging topography and limited market access. These may entail high transaction costs and restriction on bargaining power for farmers, especially within the apple and vegetable value chain. Farmer collectives such as Farmer Producer Organizations and others based on farmers' organizations have been found to facilitate the aggregation of produce, provide better market access, reduce transaction costs and enhance farmers' involvement in farmers' value chains. The study aimed at finding out if there was any relationship between farmer collectives and increased farm income among visitors to apple and vegetable farmers in Jammu and Kashmir who belong to market-oriented farmer collectives. The analysis is based upon primary data from a cross-sectional survey of farmers, including 180 farmers and 180 non-farmers in market-oriented farmer collectives. Two kinds of treatment effects are estimated: the actual treatment effect and the counterfactual treatment effect, with the former considered in this paper as the exogenous treatment effect on average income of members, and the latter as the conditional treatment effect for those eligible for the collective but who wish to receive a payoff directly from the firm. The baseline approach used is Ordinary Least Squares estimation, while an Endogenous Switching Regression framework is used to account for potential self-selection effects both into collective membership and to estimate the actual treatment and potential counterfactual treatment effects on average income for members. The findings showed that collective members' income from their farming activity is better than the non-members who are similar. At the time of testing, membership was estimated to lead to a substantial per capita income difference on the ATET, due to observable selection as well as unobservable selection at the time of the test, of INR 71,500 a year. The estimated effects also vary across the production systems with an estimate of INR 89,200 for apple growers and INR 46,800 for vegetable growers. Collective membership under market-oriented approach may be a factor to better farm income in geographically limited agricultural areas as it enables farmers' participation in markets and boosts the farmers' access to the collective economic services. The study emphasized improving market linkages, aggregation, institutional services, and value-chain integration in the farmer groups in J&K.

Introduction

Agriculture has remained a key component in the socio-economic landscape of Jammu and Kashmir (J&K) and has helped to support livelihoods of a high percentage of rural inhabitants and has increased the income and job rate of the region significantly. Though the region has a relatively small geographical area it has varied agro-climatic conditions, both temperate in the Kashmir Valley to sub-tropical in the Jammu region. The resulting variety of existing agricultural and horticultural activities is in favor of a large variety of

high-value crops like apple, walnut, almond, and saffron and out of season veggies [1]. Horticulture by itself contributes a significant amount of agricultural production and exports, thus a strategic sector in rural areas development and income improvement in the region.

Yet, the agrarian form of Jammu and Kashmir is typified by small and divided landholdings, low level of mechanization and strong reliance on traditional methods of production. Based on the official estimates, most farmers in the area have marginal and small holdings, which not only restrict economies of scale

but also the opportunity to use modern inputs, credit, and organized markets [2]. These organizational limitations are also augmented by the mountainous topography of the region, delicate ecology as well as the scarcity of physical infrastructure that causes excessive transaction costs, post-harvest damages, and unstable prices. Consequently, the incomes received by the farmers in J&K are still susceptible even though high-quality crops are grown [3].

Access to markets is also one of the most pressing issues of farmers in Jammu and Kashmir. The marketing of agricultural products in the region is majorly subjected to intermediaries, commission agents and remote wholesale markets especially in horticultural produce like apples. Low connectivity, the lack of cold storage and grading services, and low bargaining power compel farmers to sell their products in distress situations and at times right after harvest [4]. The lack of powerful institutions of farmers also underpins the ability of farmers to negotiate prices and integrate into the modern value chains. As a result, a large part of the consumers' prices is being consumed by the intermediaries and producers receive only a small part of the end value.

Collective action using farmer-based institutions has been more advocated in response to these problems to increase the involvement of smallholders in markets and to improve the performance of the farm level. Cooperatives, Farmer Producer Organizations (FPOs) and producer companies are intended to bring farmers together, to provide access to inputs, credit, and to create forward and backward integration within agricultural value chains. On the national level, it is argued that these institutions may lower transaction costs and enhance price realization as well as technology adoption by small and marginal farmers [5,6]. It is based on this potential that policy efforts in India have focused on the creation and/or empowerment of FPOs, such as specific schemes in hilly and backward areas [7].

Farmer collectives have even more importance in the situation of Jammu and Kashmir because of the geographical isolation of the area and the high cost of marketing the unit. Aggregation of farm products, common transportation and direct connection with wholesale purchasers or processors can make the markets highly efficient in these areas. Besides, farmer groups may be critical in the value addition process including the grading, packaging, cold storage, and primary processing which are crucial in improving competitiveness of horticultural products in J&K in the domestic markets [8]. Although this has come with these benefits, the performance of farmer collectives in the region has not been balanced as most organizations have been unable to attain financial viability and meaningful performance at the farm level.

Business orientation may be a crucial factor in understanding the capability of farmer collectives to make an economic contribution. Market oriented collectives are characterized by produce aggregation, collective marketing, market information, market price negotiation, value addition, and market linkages with the market. The importance of these functions lies especially in areas where the farmers do

not have access to remunerative markets due to fragmented production, geographical isolation and the strong costs of transportation and transaction costs. Previous work in other agriculture contexts shows collective marketing to be a means of increasing the bargaining power, as well as participation in and producer returns in markets [9].

Although farmer collectives have been introduced in the agriculture policy frame, the impact of farmer collectives on incomes is still largely under-researched in the state of Jammu and Kashmir. There is now some published work documenting marketing constraints in the horticulture value chain, and the ability of collective institutions to better aggregate farmers, increase access to markets, and improve market access and price realization is well established; but studies which explicitly take into account self-selection applying an econometric approach are relatively scarce.

In the light of this background the present study confined to market-oriented farmer co-operatives and assessed the impact of co-operative membership on farm income of apple and vegetable growers of J&K. The study compares collective members to non-member farmers who experience similar agro-climatic and crop conditions and applies an Endogenous Switching Regression framework that allows for the identification of selection into collective membership. The analysis also investigates the income impacts in producing either seasonal vegetable crops or perennial apple crops.

Since agriculture and horticulture are of strategic significance in Jammu and Kashmir, and increased policy attention is paid to the collective of farmers, it is evident that the region requires the studies which would determine their economic contribution. The knowledge of whether and how various business orientations of farmer collectives affect farm incomes and costs is important in the design of effective institutional and policy interventions. This paper tries to address this gap by looking at the role of the farmer collectives in Jammu and Kashmir with a particular interest to compare between production-oriented and market-oriented methods, and ultimately the implications to the costs of inputs, costs of marketing as well as the net farm income.

Review of literature

Agricultural collectives, especially Farmer Producer Organizations (FPOs), have received significant academic interest as a process of increasing market inclusion of smallholders, minimizing the cost of transactions, and maximizing the realization of income [6,7]. Collective action in India is getting increasingly accepted as a method of overcoming structural problems like broken holdings, low bargaining power, and poor access to formal markets [10]. Research has found out that FPOs could enhance the bargaining power of farmers in relation to buyers, enable them to access quality inputs at a reduced cost, and enhance access to rural credit in terms of shared collateral or credit support schemes [11,12].

Nevertheless, the performance of these institutions differs widely, and it depends on the quality of governance,

business orientation, availability of enabling infrastructure, and connections to formal value chains. Indicatively, Nath and Behera [13] discovered that most FPOs have been effective in enhancing input sourcing and information sharing, but few have been successful on how to incorporate farmers into the higher value markets, without other support on marketing, grading, and logistics. This highlights the notion that production-oriented groups, with the major aim of supplying inputs and providing extension services, can bring little economic values in case the market connections are low [14].

About the Indian hill and mountain scenario, some studies emphasize the significance of collective action in either reducing transaction costs and improvement of price realizations. Topography characterized by mountains relates to an increased cost of transportation and reduced availability of cold chains, which increase post-harvest losses and reduce farm prices [15,16]. Himachal Pradesh and Uttarakhand experience demonstrate that cooperatives have contributed to stabilizing the supply of inputs and services; nevertheless, market-oriented strategies, that is, the focus on aggregation, direct sales to processors, and collective marketing always provide the members with better price results [17,18].

In Jammu and Kashmir in particular, the research about agricultural marketing and institutional performance has been developing but is comparatively small. Available literature records extreme limitations of horticultural markets since they are dominated by intermediaries, poor grading and packaging facilities, and the absence of cold storage [19,20]. The main cash crop in the region apples is prone to distress sale immediately after harvest and price realization is strongly affected by the presence of commission agents and far away wholesale markets [21]. As a matter of fact, Bhat and Saleem [22] noted that farmers with closer ties to market networks and digital applications like e-NAM (National Agriculture Market) obtain better prices compared to the ones that are dependent on informal local markets.

An emerging literature has initiated a study that can examine the influence of institutional design in determining collective performance in J&K. According to Rashid and Wani [23], FPOs that have considered post-harvest aggregation and direct procurement agreements with retailers are exhibiting growth in terms of reducing marketing expenses and raising the amount of money obtained by members compared to those that have only prioritized the receipt of production support. On the same note, Ahmed and others [24] discover that collectives involved in value addition like grading, storage and branding contribute towards farms capturing a bigger portion of end market value, yet the strategies are not without external financial and technical assistance.

In spite of these developments, there still exists a gap in the empirical assessment of business orientation, particularly, the relative performance of production-based and market-based farmer collectives, in the economic, ecological and institutional environment of Jammu and Kashmir. This gap should be filled in the design of policies and support frameworks that may increase collective efficacy, ameliorate rural economic factors, and add to sustainable agricultural transformation in the area.

The present study does not aim at the empirical comparison between production oriented and market oriented collective action. The empirical sample includes members of the market-oriented farmer's collectives and nonmember farmers. For this reason, the production-oriented/market-oriented split is employed only conceptually, to facilitate the discussion of the existing literature concerning collective action. The empirical analysis is limited to determining the income effect on joining market-oriented collectives versus not joining them. It is important to distinguish this because this analysis will have an interpretation that goes directly to the groups in the sample.

Objectives of the study

The specific objectives of the study are:

1. To examine the characteristics and economic orientation of market-oriented farmer collectives operating in the selected apple- and vegetable-growing regions of Jammu and Kashmir.
2. To compare input costs, marketing costs, and net farm income between farmers who are members of market-oriented collectives and comparable non-member farmers.
3. To estimate the effect of market-oriented collective membership on farm income while accounting for potential self-selection using an Endogenous Switching Regression framework.
4. To examine whether the estimated income effects of collective membership differ between apple-growing and vegetable-growing farmers.

Methodology

Research design

The research design of this study is a cross-sectional quasi-experimental research design which seeks to determine the effect of market-oriented farmer collectives on the farm income in Jammu and Kashmir (J&K). Membership in farmer collectives is voluntary, and thus random assignment is not possible. The study therefore compares the collective member farmers and non-member farmers who grow the same crops and are operating in the same agro-climatic and market conditions.

To eliminate the possible self-selection bias, the analysis will be a mixture of Ordinary Least Squares (OLS) estimation and Endogenous Switching Regression (ESR) framework which will enable the consistent estimate of income differentials under both actual and counterfactual participation regimes.

Study area

The research is carried out in Jammu and Kashmir, where the livelihoods of farmers are majorly horticulture and the market accessibility constraints are also high. The following two different production systems are analyzed to represent the heterogeneity of crops:

The regions that grow Apple, which have perennial orchards, a lengthy gestation period, and are reliant on overseas markets.

Regions that grow vegetables, characterized by brief production cycles, high turnover of the market, and marketing that is largely localised.

Districts with a high level of these crops and whether they have working farmer collectives are chosen to be analytically relevant.

Data collection and sampling design

The farm households were selected to adopt the multistage sampling method. The purpose of the first phase was to select districts based on the significance of apple and vegetable farming, farmer collectives initiated in the market and their functioning. In the second stage, the blocks/villages were identified within the selected districts, and sample blocks were selected out of the total blocks. The third phase was to randomly choose the farm household from the sampled villages. A total of 360 farm households, including 180 farmers who did not organize into a market-oriented farmer group, and 180 farmers who are farmer's group members, were incorporated as the final sample. The selection of non-members was done to generate additional samples from comparable and/or the same villages engaged in similar crop production systems as the member households to ensure comparability between member and non-member households.

The primary data were gathered using a structured household survey in the agricultural 2025–26. The questionnaire gathers data related to the household demographic characteristics, farm size, cultivation of crops, consumptions of farm inputs, farm expenditure, farm outputs and farm sales, marketing, credit and extension services, access to markets, and farmer collective involvement. Data on collective membership consisted of information on the nature of collective activities and how involved the farmer was in market-related activities. Households were interviewed with the household members mainly responsible for farm management and marketing. Respondents were given information about the study purpose and participation was voluntary before giving them the questionnaire. The collection and verifying previously mentioned issues were addressed in the process of getting the data complete and internal consistency through statistical and econometric analysis.

Variable definitions and construction of data

Dependent Variable: Farm income (Y_i) is the primary outcome variable because it represents net income of apple or vegetable farming annually:

$$Y_i = \sum_{k=1}^n (P_{ik} Q_{ik}) - TC_i$$

Where P_{ik} and Q_{ik} denote price and quantity sold of crop k , and TC_i represents total paid-out costs of cultivation.

Key Explanatory Variable: Collective participation (C_i) is specified as a binary variable:

$$C_i = \begin{cases} 1, & \text{if farmer } i \text{ is a member of a market-oriented collective} \\ 0, & \text{otherwise} \end{cases}$$

Control Variables: The age and the educational level of the head of the house, the size of the farm, experience of the farmer, accessibility of irrigation, accessibility of the institutional credit, the contact with extensions, and the proximity to the nearest market are all considered in vector X_i . These factors encompass variations in human resources, resource endowment and market access.

Beconometric specification

As a preliminary analysis, the impact of collective participation on farm income is estimated using OLS:

$$Y_i = \alpha + \beta C_i + \gamma X_i + \varepsilon_i$$

And β is the average difference in income between member and non-member farmers, taking observable characteristics.

It is informative but does not take into account mental self-selection into collectives entirely. Thus, the primary analysis is based on an ESR framework.

Endogenous switching regression model

Participation equation

Farmer participation in market-oriented collectives is modeled as a latent decision:

$$C_i^* = Z_i \delta + u_i$$

$$C_i = \begin{cases} 1, & \text{if } C_i^* > 0 \\ 0, & \text{otherwise} \end{cases}$$

Where Z_i includes variables influencing participation, such as education, farm size, extension access, and proximity to collective offices, and u_i is an error term.

Outcome equations

Two separate income regimes are specified:

Regime 1 (Collective members):

$$Y_{1i} = X_{1i} \beta_1 + \varepsilon_{1i} \text{ if } C_i = 1$$

Regime 2 (Non-members):

$$Y_{0i} = X_{0i} \beta_0 + \varepsilon_{0i} \text{ if } C_i = 0$$

Where Y_{1i} and Y_{0i} represent farm income under participation and non-participation, respectively.

Error structure and identification

Assuming the disturbances observed in equations (2) and (3) are trivariate normal with zero means and an unrestricted

covariance structure, we can write R^2 the endogenous switching regression model. If the disturbances in Equations (2) and (3) have zero means and an unrestricted covariance structure associated with a trivariate normal joint distribution, R^2 the endogenous switching regression model may be written. By correlating the participation and outcome disturbances, the model can capture unobservable factors that at the same time affect farmers' collective participation decision and their farm income.

To determine the participation equation, an exclusion restriction is needed that impacts the likelihood of collective membership but not directly on the farm income equations after conditioning on the observed characteristics contained in the outcome equations. The main exclusion restriction is distance to the collective office as the costs of attending collective meetings, access to collective services, information and coordinating collective marketing activities are directly influenced by physical distance. The further away farmers are located from a farmer's collective office, the higher their odds of incurring more travel time and transportation expenses accessing collective services, and the lower the chance of farmers' membership. At the same time, this distance directly does not affect farm income, holding farm level characteristics which affect income, constant, except in the case where farm size, level of education, extension access, credit access, irrigation, farming experience, farm proximity to market and other observable farm characteristics vary. The farmers' likelihood of joining the collective is thus considered to be its primary role.

The function of the rule of exclusion is evaluated by means of its statistical linkage with the collective participation. The estimated participation equation reveals that distance to the collective office ($\beta = -0.061$, $p < 0.05$) has a negative and statistically significant participation coefficient, suggesting that the distance of a collective office is negatively related to probability of participation. This gives us empirical support for the relevance condition of the exclusion restriction. The exclusion restriction is not imposed directly into the farm-income outcome functions, reflecting the role of collective participation as a form of exclusion as opposed to an income channel direct effect.

Person interpretation of the estimates will remain subject to the maintained assumption that the distance to the collective office effect does not have any independent effect on farm income when the farm observed determinants of farm income are held constant because exclusion restrictions cannot only be assessed statistically by considering the significance of the estimates. This assumption is therefore regarded as an identifying condition as opposed to a condition which could be definitively proven from the cross-sectional data.

Treatment effects estimation

The ESR framework allows estimation of counterfactual outcomes and treatment effects.

The Average Treatment Effect on the Treated (ATT) is defined as:

$$ATT = E(Y_{1i} | C_i = 1) - E(Y_{0i} | C_i = 1)$$

Where, ATT measures the average effect of treatment on those who received it. $E(Y_{1i} | C_i = 1)$ is the observed outcome of treated units after treatment. $E(Y_{0i} | C_i = 1)$ is the counterfactual outcome what the same treated units would have experienced?

Crop-specific impact analysis

The ESR model is estimated on apple and vegetable farmers to consider heterogeneity between production systems. This enables analysis of whether there are differences in the collective participation effects of income in perennial crop systems and seasonal crop systems.

Model diagnostics and robustness

Heteroskedasticity is addressed based on robust standard errors. The relevance of correlation coefficients of error terms is tested which is important to verify the existence of endogenous selection. The likelihood ratio tests are used to determine the significance of model parameters jointly.

Ethical considerations

Informed consent is obtained from all respondents, and data confidentiality is strictly maintained.

Methodological justification

The OLS-ESR method is quite appropriate when considering the impact assessment of farmer association in non-experimental conditions. ESR model is a clear explanation of self-selection bias and is able to estimate the counterfactual income outcomes and therefore it is very suitable in high quality empirical research published in top agricultural and development economic journals.

Results and discussion

The results of Table 1 show the descriptive characteristics of collective members and non-members. There are several observable differences between the two groups which are systematic. In terms of education, average attainments of members are more; this applies to farm size as well. More members of the group report having access to institutional credits, and to extension services. In addition, members also enjoy higher annual income. These descriptive differences suggest that collective members are not necessarily the same as non-members, before differences observed and unobserved characteristics are accounted for, thus justifying the use of an econometric model expressly designed around the possibility of the collective membership being a self-selected membership. The description should however not be interpreted as a causal estimation of the effect of the value of collective participation.

Determinants of collective participation

Table 2 reports estimate from the participation (selection) equation of the ESR model. The probability of collective

participation is much higher in relation to education, size of farms, and institutional access. The coefficient of distance is negative and shows that the distance between farmers is important in mobilizing the farmers. These results can be supported by research focusing on transaction costs and access to information as the factors that stimulate collective action [25,26].

Endogenous switching regression results

Table 3 presents income equations under two regimes: collective participation and non-participation. The endogenous selection is confirmed by the importance of correlation coefficients (ρ) which proves the method of ESR. The members' negative selection implies that farmers who face less likely incomes are more likely to be part of collectives which means that naive OLS estimates would underestimate collective effects. The income returns to education, credit and extension services are increased by collective membership and the results imply that there are complementarities between institutional participation and human capital.

Table 1: Descriptive Statistics of Sample Farmers.

Variable	Members (n = 180)	Non-members (n = 180)	t-value
Age (years)	44.6 (9.8)	46.9 (10.4)	-2.01**
Education (years)	9.4 (3.2)	6.8 (3.6)	7.12***
Farm size (ha)	1.21 (0.63)	0.89 (0.54)	5.34***
Farming experience (years)	19.8 (8.6)	21.1 (9.2)	-1.45
Access to credit (%)	64.4	38.9	—
Extension contacts (%)	71.7	42.2	—
Annual farm income (INR)	356,200	261,400	6.89***

*Notes: Standard deviations in parentheses. ** $p < .05$, *** $p < .01$.

Table 2: Selection Equation: Determinants of Collective Participation (Probit).

Variable	Coefficient	Std. Error
Education (years)	0.083***	0.021
Farm size (ha)	0.417***	0.108
Extension contacts (dummy)	0.512***	0.136
Access to credit (dummy)	0.298**	0.124
Distance to collective office (km)	-0.061**	0.027
Constant	-1.346***	0.392

*Notes: ** $p < .05$, *** $p < .01$.

Table 3: ESR Income Equations.

Variable	Members (Regime 1)	Non-members (Regime 2)
Education	0.072*** (0.019)	0.041** (0.018)
Farm size	0.384*** (0.091)	0.269*** (0.083)
Irrigation access	0.218** (0.104)	0.146 (0.097)
Credit access	0.257*** (0.086)	0.132* (0.078)
Extension contacts	0.293*** (0.092)	0.171* (0.089)
σ (income eq.)	0.41	0.47
ρ (selection correlation)	-0.36**	0.29**

*Notes: Dependent variable is log of farm income. ** $p < .05$, *** $p < .01$.

Robustness assessment of the exclusion restriction

The effect of the distance from the collective office was considered in an additional examination of the identification approach to the identification strategy, which is not included in the participation equation. The coefficient of this variable is strongly related to collective participation with the statistically significant negative coefficient in the selection equation. There is no direct structural impact of distance on farm income in the outcome equations in the identification strategy. The maintained exclusion assumption is that, given the farm and household characteristics, distance influences the income mainly through its influence on the probability of collective participation.

Hostilities assume, thus, their conditional interpretation regarding the Endogenous Switching Regression estimates, which are presented in the tables. Therefore, there is a conditional interpretation of the Endogenous Switching Regression estimates, presented in the tables, about the army and hostilities. Because the data are cross sectional, a restriction cannot be explicitly determined by statistical tests at this stage. The high participation coefficient is of course an indication of instrument relevance, and the economic motivation and the fact that the major farm, household, institutional and market-access controls are all included explicitly suggest that distance is just reflecting observed differences in income generating capacity.

Treatment effects estimation

Table 4 reports estimated treatment effects. The Average Treatment Effect on the Treated (ATT) reveals that aggregate participation raises the farm income by around INR 71,500 annually which corresponds to 25 per cent increase of the counterfactual. This affirms the fact that the income disparities are not simply a result of already existing traits but actual gains of common action. These profits are probably due to higher price realization, lower transaction costs, and access to inputs and markets, as it is also observed in other developing regions [27–30].

Table 4 shows the actual and counterfactual results of the income outcomes through the ESR framework. Within collective members, mean farm income of observed collective members is estimated at INR 356,200 and mean farm income of counterfactual (in absence of collective membership) is estimated to be at INR 284,700. The resulting ATT is INR 71,500 which suggests an annual additional income of about INR 71,500 to the member farmers if they participate in the system as compared to the regime of non-participation. The observed income for non-members of the sample is INR 261,400 and the corresponding estimate of their counterfactual income under collective participation is INR 313,700, i.e. an ATU of INR 52,300. The estimates are counterfactual, meaning that the differences in the estimated income levels of the two groups can't be attributed to differences in variables that are considered to have been observed; however, they are still subject to the assumptions made for the ESR identification process.

Table 4: Estimated Treatment Effects from ESR.

Outcome	Income (INR)
Actual income of members (Y_1)	C=1)
Counterfactual income (Y_0)	C=1)
ATT	71,500*
ATU	52,300**

Notes: Actual income represents the observed mean income under the farmer's observed participation status. Counterfactual income represents the estimated mean income under the alternative participation regime. ATT = Average Treatment Effect on the Treated; ATU = Average Treatment Effect on the Untreated. * $p < .05$; ** $p < .01$.

The net income impacts are like the general economic reasons to support market oriented collective action, such as better market coordination, aggregation, and service to market institutions. The present empirical specification, however, does not distinguish the causal effect of individual mechanisms, i.e. price premium, reduction in marketing costs, reduction in input costs or reduction in post-harvest losses. These mechanisms are thus considered as possible pathway and would not be taken as direct causal relation in the current investigation. Further disaggregation of the income effect into price, quantity, marketing cost, input-cost and post-harvest effects would need further value chain and transaction-level data.

Crop-specific results

The heterogeneity is reflected in the estimate of market-oriented collective's income effect in the crop specific ESR. Estimated ATT for the apple growers is INR 89,200, and vegetable growers the ATT is estimated as INR 46,800. These estimates suggest there are no differences in the collective membership-farm income relationship across the two production systems.

Similarly, the significantly higher likelihood of impact on apple growers correlates with the nature of apple production, which tends to be longer, and relies more heavily on aggregation, storage, grading, transportation and having access to geographically remote markets. The estimated impact for vegetable growers is slightly smaller in absolute terms, and it could be that the short production term and strong dependence on more local markets is contributing to these differences. These interpretations are based on the institutional and market setting of the two crop systems, but not each single mechanism as such, like price premiums, lower marketing costs or lower post-harvest losses is estimated separately. Therefore, the estimates of the crop specific income effects from collective participation need to be understood as a range of collective income effects per specific agricultural activity and not as a specific estimate of the marketing mechanism.

Study limitations

The implications of the results should be interpreted with caution because there are several limitations to be noted. First, the analysis is conducted on cross-sectional data and hence changes in farm income before and after collective participation cannot be observed. Second, using the Endogenous Switching

Regression framework, the specification of the participation and outcome equations as well as the exclusion restriction affect the validity of the estimates even if the framework identifying assumptions are met; and third, in the ESR framework the selection on both observed and unobserved factors is accounted for under the assumptions, though explaining the selection involves specification that is crucial for validity of the estimates. Third, in the present study it is not analyzed empirically whether the members of production-oriented collectives differ from the market oriented collective members. Fourth, the analysis does not break down the impact of component mechanisms (i.e. price premiums, marketing costs reduction, input costs reduction or reduction of post-harvest losses). Lastly, no spatial variability of climatic risks is explicitly modeled in the study. A more comprehensive assessment of farmer collective impact on farmer benefit and their resilience could be achieved in future studies using panel data, detailed value chain information by gender and farm size, and meteorological indicators.

Conclusion

The present study compared farmer groups centric on farming activity of apple and vegetable crops with their farmer incomes and market orientation as keywords considering farmer group organization as farmer collective to study the improvement of their incomes. This primarily cross-sectional household data approach, combined with an Endogenous Switching Regression model, controlled for the possibility of selection to collective participation and projected income returns from the actual and hypothetical collective participation scenarios. The findings show that being a member of a farmer collective involved in market orientation is linked to increased farm income compared to what they were estimated to have experienced if they hadn't joined one.

The approximate Annual Total Tributary is Rs. 71,500. The actual mean income of the collective members is estimated at INR 356,200 while the estimated counterfactual income (collection without collective participation) is estimated at INR 284,700. Their counterfactual income were on average estimated to be INR 313,700 in the presence of the GCD, and INR 261,400 in the absence of the GCD, a difference (ATU) of INR 52,300. These results suggest that there are economically relevant income disparities related to collective participation dependent on the identifying assumptions of the ESR model.

There is also some variation among crop systems that is indicated through the analysis. For apple farmers, ATT is estimated as Rs 89200/- and for vegetable farmers ATT is estimated as Rs 46800/-. The higher estimate is among apple growers, which is consistent with the higher level of importance of the activities of aggregation, storage, grading, transport, and distant chains in the apple value chain for growers. The present study does not, however, estimate the effect of each mechanism (marketing-cost saving, input-cost saving, price premium or loss reduction in post-harvest stages) separately. These mechanisms need therefore to be considered as potential pathways and paths rather than as causal pathways.

Heterogeneity and distributional considerations

Benefits of collective membership may vary between farm households, which cannot be detected from means of estimated averages. The size of the farm might affect farmers' aggregate marketing ability and their potential to reap collective gains, and gender might affect their information, mobility, institutional access, and their involvement in farming markets. There are no estimates of the separate means, gender, or farm-size treatment effect estimated in the present analysis. Thus, it is not possible to obtain any idea from the present results of the distributional incidence of the estimated income effects. Empirical studies into the future must make an explicit estimation of the heterogeneous treatment effect for farmers of different farm sizes and farmer gender categories and look at if collective participation is equally effective across different categories of farmer.

Future perspectives and policy implications

The results have applicability for the agricultural development programmes of Jammu and Kashmir and geographically narrow horticulture areas. To make collective organizations more active in agricultural markets, collective capacity in areas such as collective aggregation, market coordination, accessing information, transportation, grading, storage and linkages with farmers' markets should be considered. Policy can then be oriented to enhancing the organizational and business skills of the farmers associations, improving their access to extension, agricultural credit etc. un-reducing the spatial and informational constraints to participation in farmer associations. The estimated impacts may vary across apple and vegetable growers and interventions need to be tailored to the crop specific nature of the seasonal vegetable and perennial horticultural value chain.

Another path forward is an attempt to incorporate agro-climatic risk in collective performance analysis. The region of Jammu and Kashmir is facing spatially varying rainfall variability, dry spell, temperature change along with other climatic risks in the horticultural and vegetable production systems. Future studies may employ household-level panel data together with gridded meteorological observations and standardized precipitation or drought indices at several temporal resolutions. This study would enable us to explore the effects of farmer collectives not just in improving farmer income but also in mitigating farmer risk, income stability and resilience in the context of climate variability. Measuring treatment effects with agro-climatic indicators could also prove useful to highlight any possible differential in the impact of collective action based on the level of climatic stress.

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