Assessing the economic impacts of farmer producer organizations: a case study in Gujarat, India

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Abstract Using data from a household survey in the Indian state of Gujarat, this paper examines the determinants and welfare impacts of farm households' participation in farmer producer organizations (FPOs). Small and marginal farmers participate in FPOs to improve their access to credit, storage, output and input markets and their bargaining power vis-à-vis traders. Households associated with FPOs have a higher level of income, consumption and investment and a lower incidence of indebtedness.

Keywords Farmer producer organizations, determinants, welfare, small and marginal farmers

JEL classification Q130, Q180

1 Introduction

In India, small and marginal farm households constitute almost 87% of the total farm households. They produce a small marketable surplus that keeps them tied to traditional marketing channels. Small-scale producers are at the receiving end in the market as they have little capital to invest; use traditional/conventional production techniques; depend largely on family labour; and lack channels and resources to participate in global value chains (Reardon & Barret 2000; Daviron & Gibbon 2002; De Janvry & Sadoulet 2005). It is, therefore, important to connect them with new models and forms of collaboration to improve their bargaining power in the prevailing value chain networks (Rondot & Collion 2001).

The integration of food markets, due to the rise of modern retail chains and supermarkets, has created opportunities as well as challenges for farmers (Dev 2012; Trebbin 2014). Emerging brand loyalties provide giant retailers the leverage to dictate cost-cutting measures and impose stringent standards on their suppliers. The sophistication of the food production technology adopted by producers poses a challenge to retailers and small and marginal farmers. New market forms such as contract farming target mainly large farmers, and smallholders cannot organize to benefit from emerging marketing systems (Kirsten & Sartorius 2002; Reardon et al. 2003; Van der Meer 2006; Singh 2012). Most farm households lack the infrastructure to benefit from economies of scale and continue to depend on the traditional marketing system and sell their produce at unremunerative prices (GoI 2013a). Even with state intervention in the marketing of cereals, private trade dominates in several states; in Gujarat, for instance, 77% of the cereal output is marketed through local private traders (GoI 2013b). To improve the bargaining power of agricultural producers through collaborative farm and marketing practices, farmer producer companies and farmer producer organizations (FPOs) were introduced in India during 2011-12 (Singh et al. 2018; Singh 2012).

There is a need to understand the aggregation process of such models and its plausible impacts on farmers' welfare; it is necessary also to identify the key determinants of the sustainability of FPOs. This paper attempts these goals through a case study in the Indian

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state of Gujarat. We selected Gujarat because a small percentage of agricultural commodities is procured through the mandi system in the state. Secondly, Gujarat is amongst the state where FPOs have been performing relatively better than elsewhere in the country (Singh et al. 2018).

2   Agricultural value chain networks and participation of small farmers

Farmers participate in agricultural supply or value chains through multiple channels. Traditional markets are dominated by a large number of small-scale producers and retailers with categorical demand and supply coordination. In traditional market networks, small farmers have more autonomy and better control over their production activities (Lee et al. 2012). These market networks, which have little or no brand recognition and are governed mainly by price and quantity, account for the largest volume of produce but yield little value for producers (Singh 2005). The mandi system aims at ensuring remunerative and stable agricultural prices for producers and consumers by enabling an environment conducive to the fair play of demand and supply forces, but only a very low share of the consumer price accrues to farmers because transaction costs are high and market agents form cartels (Reardon et al. 2003; Birthal et al. 2007; Pingali

et al. 2019). This system is counterproductive for those who can sell their produce through commission agents only, and even the proportion of produce sold through the mandi system is low. In India, the share of produce sold through private traders is quite large, and in Gujarat more than 75% of the output of cereals and pulses is sold through local private traders (figure 1).

The contract farming system was introduced in India during the 1990s to produce and market commodities. In this system, firms contract with farmers to purchase their produce. The quality, quantity, prices and times are predetermined and, often, companies provide farmers services like inputs and technical assistance (Singh 2002; Barret et al. 2012). The theory of transaction costs drives a firm's decision to contract with farmers; since the transaction costs of contracting with many small farmers is higher, firms often exclude them from contract farming (Reardon et al. 2003; Singh 2000; Sharma 2016). Producer-led alternatives such as cooperatives and producer companies integrate farmers with markets at lower transaction costs and let farmers decide their production and marketing strategies (Trebbin 2014; Singh et al. 2018). To integrate small farmers with agricultural markets, the Government of India introduced a pilot scheme of FPOs during 2011-12 through the Small Farmers' Agribusiness Consortium in the Ministry of Agriculture.
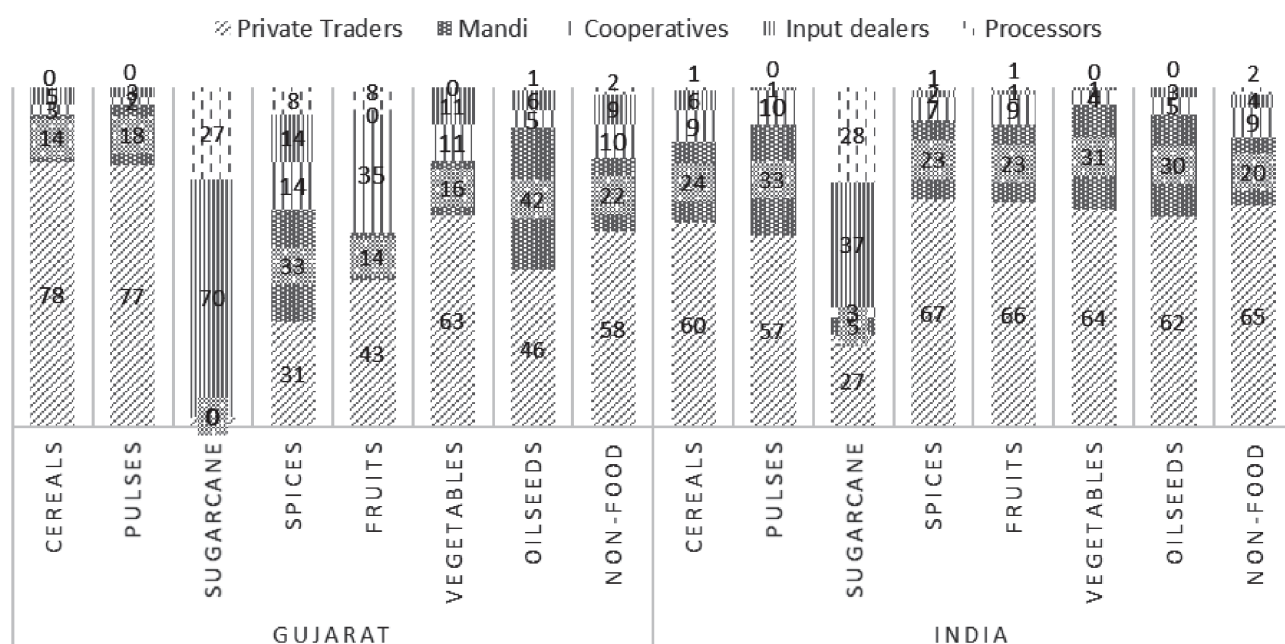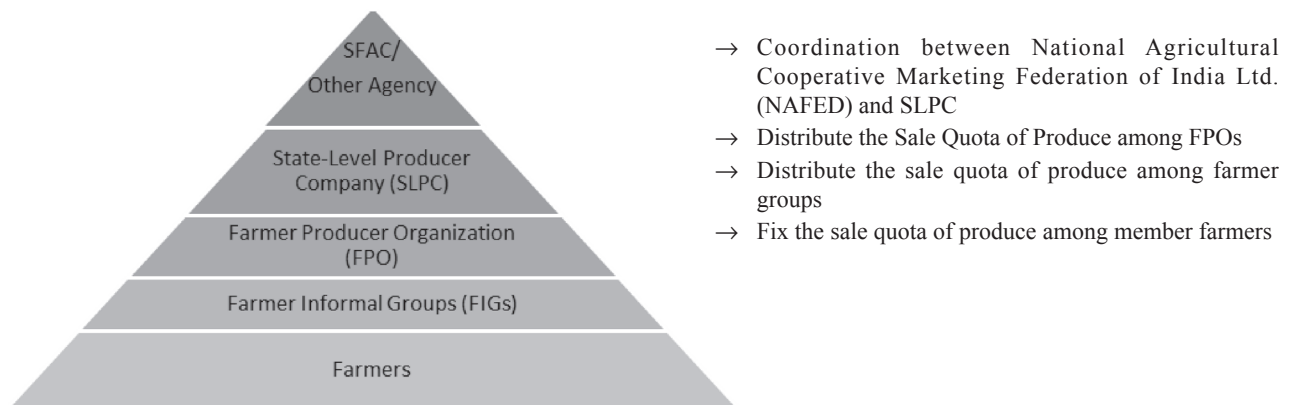

Figure 1. Percentage of agricultural produce sold through various agencies in Gujarat and India
Source: GoI 2013

Figure 2. Vertical integration of agricultural marketing through FPOs
Source: Singh et al. (2018)

The purpose of forming FPOs is to collectivize farmers, especially small farmers, at various levels across states to foster technology penetration, improve productivity, enable improved access to inputs and services and increase farmer incomes, thereby strengthening their agriculture-based livelihoods (GoI 2013a). The main objective of FPOs is to enhance the forward and backward linkages of small farmers by providing them technology, inputs and access to markets. Farmer producer organizations organize farmers through farmers interest groups (FIGs) and aggregate input demand and produce and help to reduce transaction costs and bring economies of scale (figure 2). The FIGs consist of 15-20 farmers and build their association with an appropriate federating point (FPO) to manage and plan their activities. The decentralized structure of FPOs allows for capacity building, ensures access to quality inputs and services for intensive agriculture and encourages cluster competitiveness with access to remunerative markets.

3 Conceptual framework

The critical ecosystem services that attract farmers to participate in FPOs are credit, retail services of inputs and other factors of production (Singh & Singh 2013; Trebbin 2014; Kumar et al. 2015). Unless these services are provided by an organization, farmers are less likely to divert their surplus produce from local traders or producer organizations (NABARD 2019). An ecosystem that is favourable and can motivate farmers to participate in FPOs offers market risk mitigation services through retail marketing and spot markets (National Agriculture Market, Agricultural Produce Market Committee); futures trading (National Commodity & Derivatives Exchange Limited); linkages with corporates and exporters; and direct marketing (Singh 2002; Birthal et al. 2007). It also offers infrastructure arrangements such as storage, processing, packing and branding (Singh 2002; Onumah et al. 2007); technology support such as extension services and advisories and provision of quality inputs (Barham 2009; Dev 2012); and credit support such as during harvesting and sowing seasons (Reardon et al. 2009; Poulton et al. 2010; Dev 2012).

At the household level, a farmer's interpersonal conditioning factors such as education, land size, cropping pattern, consumption and awareness about modern agricultural practices influence their decisions to participate (Sharma 2016; Singh et al. 2018). Efficient marketing leads to positive economic outcomes for households. It is hypothesized that participation in FPOs reduces transaction costs and realizes remunerative prices through economies of scale. Economic welfare may be enhanced by FPO-led marketing through several channels:

- better bargaining and avoiding distress sale (Onumah et al. 2007; Barham & Chitemi 2009);

- employment generation in farm and non-farm activities (Kumar et al. 2015; Singh et al. 2018);

- better extension services that may lower input costs and enhance productivity (Rondot & Collin 2001); and

- reduction in transaction costs associated with transport, handling and supervision (Lee et al. 2012; Singh & Singh 2013).
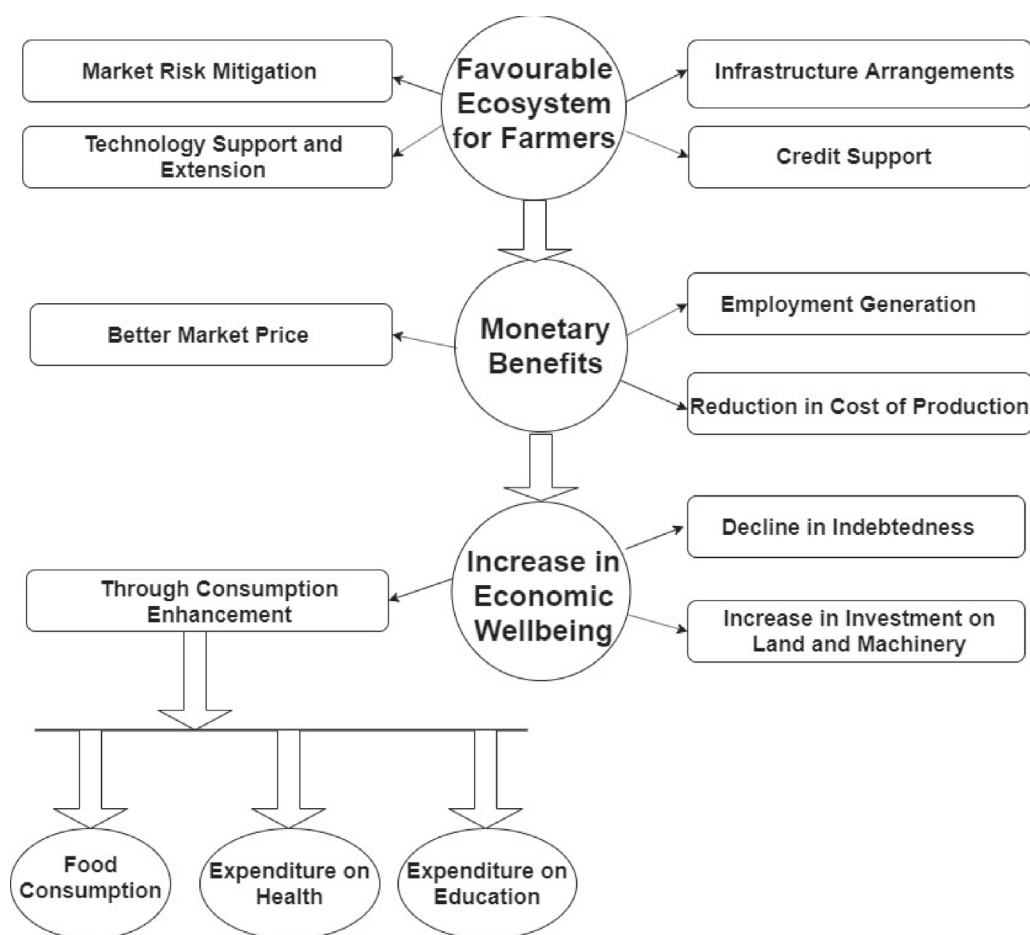
Figure 3. Impact of favourable ecosystem for farmers under FPOs and possible outcomes on economic
Source: Authors' own creation

All these factors may lead to positive outcomes for households such as an increase in consumption expenditure on education, health and nutrition; a decline in indebtedness; and an increase in investment on productive assets (figure 3).

4 Data and methods

This paper is based on primary data collected from member and non-member farmers of FPOs in the Indian state of Gujarat in 2018. It also compiles information from various stakeholders in FPOs, including state-level producer companies, government officials and resource institutions responsible for establishing or facilitating FPOs. We collected information from 200 members of FPOs and 100 non-members. The surveyed FPOs involved 800 to 2000 farmers, wherein a majority are small and marginal farmers (table 1).

Table 1. Distribution of members and non-member of FPOs by farm size (in hectares, ha)

Size of owned land	Gujarat	
	Member farmers (%)	Non-member farmers (%)
Marginal & small (up to 2 ha)	54.5	48.0
Semi-medium (2-4 ha)	44.0	47.0
Medium (4-10 ha)	1.5	5.0
Large (10+ ha)	0.0	0.0
All	100.0	100.0

Source: Field survey

To ensure a meaningful comparison of the outcomes of participation in FPOs, we selected FPO members and non-members considering similarities in cropping pattern, irrigation sources and distance from urban markets.

4.1 Empirical framework

The simplest way to assess the impact of participation in FPOs on outcome variables is to estimate an ordinary least squares (OLS) equation of the following form.

$$y_i = \alpha + \Sigma\beta_k D_{ki} + X'\delta + e_i \qquad \ldots(1)$$

where y is the outcome variable, and D is a dummy for membership in FPO. X is a vector of other explanatory variables that influence the outcome variable. The estimates of OLS, however, are likely to be biased because several unobservable factors such as skills may motivate farmers to self-select for participation in FPOs. To correct the bias due to self-selection, we follow Heckman's two-step estimation procedure (Heckman 1979). In the first step, we estimate the probability of participation in FPOs using a probit model.

$$P_i = \beta_2'X_{2i} + u_{2i} \qquad \ldots(2)$$

where, P is the probability of participation and X_i is a vector of explanatory variables. From Eq. (2), we obtain the inverse Mills ratio (λ), which we use in the outcome equation for correction of selection bias.

$$y_i = \alpha + \Sigma\beta_k D_{ki} + X'\delta + \theta_i\ \lambda + e_i \qquad \ldots(3)$$

5 Determinants of farmers' participation in FPOs and its economic impact

5.1 Descriptive statistics

Farmers can be motivated to participate in FPOs if they are provided markets for sale of produce, storage facilities, processing, extension services, inputs and credit. We find that 56% of member farmers reported to have benefitted from the provision of an assured market for their produce (table 2).

Table 2. Distribution of farmers availing inputs and services

Support	Yes (%)		
	Members	Non-members	Total
Market risk mitigation	56.0	24.0	45.3
Storage	39.0	13.0	30.3
Processing	36.5	0.0	24.3
Extension services	67.0	41.0	58.3
Input availability	48.5	23.0	40.0
Credit support	44.5	16.0	35.0

Source: Field survey

Storage is one of the most important factors in avoiding distress sale; 39% member farmers had availed storage facility through FPOs. Most FPOs are finding it hard to provide their member farmers processing facilities because they lack funds and also because of market competition from the multi-national and large agro-processing units. The processing is restricted to sorting and grading. More than 36% of member farmers reported having used the processing facilities. In the pre-harvesting period, extension and input provision are the other important activities of FPOs. Some FPOs provide their members post-harvest credit for improving their storage capacity and purchasing inputs for the next sowing season. About 45% of member farmers had accessed post-harvest credit.

Their decision to participate in FPOs is influenced by several other factors, such as households' resource endowment, access to information and credit and demographic factors. Our findings show that FPO members are much younger and better educated and they have better access to information and credit (Table 3). They are also more associated with cooperatives. Their land size, however, is smaller (2.5 acres) than that of non-member farmers (3.4 acres).

Table 3. Key characteristics of members of FPOs

	Member farmers	Non-member farmers	All
Age (years)	38.3	52.6	43.1
Education (years)	8.0	4.8	7.0
Information and communication technology (ICT) use (%)	42.0	19.0	34.3
Size of land (acres)	2.5	3.4	2.8
Institutional credit access (%)	47.5	31.0	42.0
Member cooperative society (%)	62.0	20.0	48.0

Source: Field survey

Farmer members of FPOs allocate more area to non-food crops (45.1%) than their non-member counterparts (32.8%) (table 4). This indicates that FPOs introduce more non-traditional crops and provide farmers opportunities to align their cropping pattern with the market demand. Provision of storage and processing along with post-harvest credit help farmers avoid

Table 4. Direct benefits of FPOs after harvest

Benefits	Member farmers	Non-member farmers
Area under non-food grains (% area)	45.1	32.8
Number of days between harvesting and sale of produce (mean days)	11.6	4.4
Proportion of produce sold in the open market (% area)	46.4	92.4
Organic farming (% area)	28.7	12.5

Source: Field survey

Table 5. Income and employment from participation in FPOs

	Member farmers	Non-member farmers	t-test
Net income (Rs./acre/annum)	31,763	24,371	4.98***
Total income (Rs./ household)	98,358	89,020	2.28**
Extra employment (man-days/household)	25	0	5.57***

Note: *** and ** indicate significance at 1% and 5% respectively.
Source: Field survey

distress sale: member farmers could postpone their sale by 11.6 days after harvest compared to 4.4 days by non-member farmers. Due to marketing through FPOs, the share of produce sold by their members in the open market is just 50% of that by non-members. The FPOs could also help their members switch to organic cultivation.

Table 5 shows the monetary benefit of participating in FPOs: members' net farm income was Rs. 31,763 per acre, about 30% more than that of non-members, a statistically significant difference. The FPO members could find an additional 25 man-days' employment from activities such as packing, sorting, loading and sealing. On the whole, member farmers realized about 12% more of household income.

During the survey, FPO members were asked about their utilization of the extra income. They reported to have spent it on education and health. As a result, their per capita consumption was higher (table 6).

With the extra income and credit support from FPOs, they could repay their debts. The average loan outstanding for FPO members was two-thirds of that for non-members. Some FPOs members also invested in productive assets.

4.2 Econometric estimates

A brief description of the variables used in the estimation of Heckman's two-step model is provided in table 7.

Table 8 presents the results of selection and outcome equations. As expected, the significant determinants of farmers' participation in FPOs appear to be the provision of markets, inputs, credit and services. Several household characteristics also determine participation. The probability of participation in FPOs is greater for younger and better educated farmers. On the other hand, the probability of participating in FPOs is higher for farmers cultivating smaller landholdings.

Table 6. Outcome indicators of participation in FPOs

	Member farmers	Non-member farmers	t-test
Consumption expenditure (Rs./capita/annum)	19,745	16,175	3.87***
Loan outstanding (Rs./household)	33,328	50,531	-2.34**
Investment on productive assets (Rs./household)	9,626	7,199	2.06**

Note: ***and ** indicate significance at 1% and 5% respectively.
Source: Field survey

Table 7. Details of variables considered for Heckman's selection model: two-step estimation

Variables	Explanation	Description
Dependent variable in model	Farmers who are currently members of FPOs are considered participating members as against others	Participate-1, others-0
Participation in FPO		
List of independent variables		
FPO infrastructure		
Market risk mitigation	Performance of FPO in marketing	Facilitate marketing-1, do not facilitate-0
Storage	Provision of storage	Yes-1, No-0
Processing	Provision of processing	Yes-1, No-0
Extension services	Provision of extension services	Yes-1, No-0
Input availability	Provision of improved inputs	Yes-1, No-0
Credit support	Provision of institutional credit	Yes-1, No-0
Farmer's characteristics		
Age	Age of farmer in years	Continuous variable
Education	Educational level of farmer	Continuous variable
Member of society	Is the farmer a member of a cooperative society?	Yes-1, No-0
Size of land holding	Size of land owned by farmer	Continuous variable
ICT use	Does a farmer use ICT for progressive farming?	Yes-1, No-0
Institutional credit	Does a farmer have access to institutional credit?	Yes-1, No-0
Other variable(s)		
Market dummy	Distance from nearby city	Near-1, Distant-0

Table 8. Impact of FPOs on income, consumption, investment and loans outstanding

Variables	Participation	Income	Consumption	Investment	Debt
Participation in FPO	-	9,983.920***	3,152.143***	2,791.208***	-19,321.690***
		(0.000)	(0.001)	(0.000)	(0.000)
Age	-0.026***	18.693 ^{NS}	17.815 ^{NS}	5.105 ^{NS}	20.581 ^{NS}
	(0.000)	(0.261)	(0.527)	(0.787)	(0.791)
Education	0.058**	28.425 ^{NS}	-29.883 ^{NS}	65.035 ^{NS}	131.431 ^{NS}
	(0.019)	(0.561)	(0.719)	(0.244)	(0.567)
ICT	0.780***	-719.225 ^{NS}	-712.697 ^{NS}	408.334 ^{NS}	-868.434 ^{NS}
	(0.002)	(0.187)	(0.440)	(0.510)	(0.734)
Land	-0.194***	223.503*	-1.957 ^{NS}	91.714 ^{NS}	418.684 ^{NS}
	(0.000)	(0.078)	(0.993)	(0.523)	(0.480)
Institutional credit	0.099 ^{NS}	-5,45.096 ^{NS}	1,254.119*	-178.714 ^{NS}	200.641 ^{NS}
	(0.679)	(0.216)	(0.094)	(0.721)	(0.923)
Member of cooperative	1.183***	-814.243 ^{NS}	-623.787 ^{NS}	67.916 ^{NS}	-2946.678 ^{NS}
	(0.000)	(0.205)	(0.566)	(0.926)	(0.327)
Market risk	0.774***	-1049.574 ^{NS}	-345.949 ^{NS}	-793.252 ^{NS}	1490.000 ^{NS}
	(0.002)	(0.147)	(0.698)	(0.186)	(0.546)
Storage	0.579**	146.060 ^{NS}	-435.061 ^{NS}	-712.500 ^{NS}	-3514.409 ^{NS}
	(0.033)	(0.786)	(0.633)	(0.245)	(0.164)
Extension	0.667***	-153.282 ^{NS}	252.812 ^{NS}	-698.954 ^{NS}	-2255.064 ^{NS}
	(0.005)	(0.774)	(0.780)	(0.251)	(0.368)

Contd...

Inputs	0.474*	-547.991 NS	892.521 NS	-307.101 NS	-2722.533 NS
	(0.055)	(0.286)	(0.305)	(0.599)	(0.259)
FPO credit	0.690**	-425.668 NS	-329.873 NS	-732.688 NS	-2,609.348 NS
	(0.017)	(0.454)	(0.732)	(0.258)	(0.328)
Distance	-0.003 NS	-285.424 NS	186.112 NS	-594.361 NS	-907.813 NS
	(0.989)	(0.558)	(0.822)	(0.284)	(0.691)
Mills	-	-871.352 NS	-929.414 NS	-444.003 NS	-4103.232 NS
		(0.248)	(0.467)	(0.605)	(0.246)
Constant	-0.357 NS	89542.59***	16568.940***	7873.908***	56860.040***
	(0.468)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	227	227	227	227	227
Model information	LR chi^2(12) = 146.340 Prob > chi^2 = 0.000 Pseudo R^2 = 0.469	Adjusted R^2 = 0.779	Adjusted R^2 = 0.093	Adjusted R^2 = 0.115	Adjusted R^2 = 0.280

Note: Figures in parentheses are probability values.
Note: ***, ** and * indicate significance at 1%, 5% and 10%, respectively. NS means non-significant.
Source: Estimated from field survey data 2018

This is expected as smaller land sizes force them to look for a support system that can alleviate their agricultural production constraints.

The results of the outcome equations are also presented in Table 8. We have four outcome variables: household income, consumption expenditure, investment in productive assets and loans outstanding. The inverse Mills ratio is non-significant, highlighting that the estimates of impacts on income, consumption, investment and debt are free from any selectivity bias. The effect of participation in FPOs is positive and significant; a farmer member of an FPO is likely to earn Rs. 9,983 per annum more than a non-member. Similarly, participation has a significantly positive impact on consumption expenditure and investment. The households associated with FPOs report spending Rs. 3,152 more on consumption and Rs. 2,791 more on productive assets. On the other hand, they are likely to be less indebted.

5 Conclusion

This paper examined the factors influencing farmers' participation in FPO and the economic impacts of such participation. Our findings show that farmers participate in FPOs to avoid market risk; and to get extension and technical knowhow, improved inputs, credit and storage and processing facilities. Generally, small and marginal farmers who are relatively younger, educated and more informed have a greater probability of participating in FPOs. Such participation leads to improvement in income, consumption expenditure, investment on productive assets and a reduction in indebtedness. These findings help us to conclude that the success of FPOs would crucially depend on the provision of an assured market, post-harvest credit and extension support. The success story of FPOs may not be replicable uniformly across the country; it is necessary to identify the region- and crop-specific factors of the success of FPOs.

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Appendix Table 1. Details of surveyed FPOs and farmers in Gujarat

Level of Investigation	Name	Location	Crops
FPOs	1. Shri Munikripa Vegetable Producer Company Ltd.		Tomato, bitter gourd, brinjal, gram, cumin seed, wheat pigeon peas, green gram, black gram, gram and cotton
	2. Bhal Pradesh Vividh Khet Utpadak Ane Vechan Sahakari Mandali Ltd.	Ahmedabad	
	3. Netrang Pulse Crop Producer Company Ltd.	Ahmedabad	
	4. Lilotri Pulse Producer Company Ltd.	Bharuch	
	5. Shree Khambat Taluka Anusuchit Jati Sehkari Kheti Utpadak Sangh Ltd.	Sagbara, Narmada	
	6. Dhari Krushak Vikas Producers Company Ltd.		
No. of farmers	200	Ahmedabad, Bharuch and Sagbara	
No. of non-member farmers	100		