Do transaction costs prevent smallholder's participation in Supermarket?

Empirical Evidences from India

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Selected Paper prepared for presentation at the 2020 Agricultural & Applied Economics Association Annual Meeting, Kansas City, MO

July 26-28, 2020

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I. Introduction:

Modern food retail chains (MFRC) have reported tremendous growth in India during the last two decades that is fastest among developing countries. Most MFRCs have started procuring directly from farmers with fixed support price and input support and most of them offer higher price than that of traditional markets. Empirical studies evaluating such channels have observed that farmers selling through MFRCs farmers increased their incomes significantly compared to the farmers in traditional marketing channels (Reardon, 2008; Fischer & Qaim, 2012). Nevertheless, benefits of such participation have befallen more to the medium and large farmers, despite majority belong to small and marginal class in the country (Singh, 2007; Gopalakrishna & Sreenivasa, 2009;Vishnu & Parmod, 2019). This raises the question why smallholders are unable to participate? What are the existing barriers in the participation in MFRCs for small holders? Existing studies on the subject stress on the lack of capacity at the part of small holders in terms of scarcity of resources, lack of investment and ability to produce quality products which prevent them to participate in such modern food retail chains which require better quality products (Bellemare,2015; Kedar & Kumar, 2014). However, most of the past studies neglected one important barrier known in the modern parlance as transaction costs (Coase ,1937: Williamson, 1975;Hobbs,1997; Pingali et al. 2005). There are limited studies in India having captured transaction costs appropriately as they are not easily accountable (Ning, 2003). This paper attempts to measure transaction costs empirically in terms of information cost, monitoring cost and negotiation cost for the marketing of two vegetable crops namely tomato and chili.

Previous studies on contract farming (CF) heavily focused on explaining the reduction in the price risk, input and output risk and uncertainty for smallholders after participation. Evidence from existing studies reveals that CF firm tends to behave opportunistically towards farmers (Allen, 1993; Escobal & Cavero, 2012). Farmers are exposed to risks through contracts mainly when the buyers are either monopsonist or

oligoposolist (Sivramkrishna and Jyotishi 2008). A risk of an incomplete contract and asymmetric information regarding quality, quantity, and price provides the CF firm scope for exploiting the marginal and small farmers (Hobbs, 1997). Surprisingly, existing literature has paid very little attention to transaction costs resulting from uncertainty, risk, market imperfections, and coordination failures. The existing studies on CF rarely look at the possibility of opportunistic behavior by the CF firm and the problem of asymmetric information and its impacts on the smallholders profit and welfare. The lacks of attempt are mainly due to the difficulty associated with quantifying the impact of opportunistic behavior and asymmetric information on farmers' income. There are very limited existing studies having captured opportunistic behavior and asymmetric information appropriately as they are not easily accountable (Ning, 2003). This paper attempts to quantify the impact of opportunistic behavior and asymmetric information on Tomato growers from India.

< TABLE 1. HERE>

How do we define transaction costs faced by farmers in participation in MFRCs? How to quantify these transaction costs incurred by farmers and how transaction costs prevent smallholders' participation in MFRCs?

Our paper attempts to develop a conceptual framework for quantifying transaction costs incurred by farmers with participation in MFRCs? Additionally, it attempts to measure which component of transaction costs contribute more to the total marketing cost? How the transaction cost can be reduced?

II. Analytical Framework, Method:

The study uses non-parametric propensity score matching estimator for guesstimating the transaction costs for modern retail chain vis-a-vis traditional marketing channels for fruits and vegetable commodities. Nearest neighbor matching (NNM) and kernel-based matching (KBM) are used in this paper as they are most common and important methods used in the literature (Mishra et all., 2016; Wooldridge, 2010). The NNM method picks each treated unit (MFRC farmers) and searches for the

control unit (Traditional marketing farmers) which has the closest propensity matching score. The main interesting feature of NNM is that all the treated units find a match (Mishra et al., 2016). In addition to this, Smith and Todd (2005) argued that matching with replacement involves a trade-off between bias and variance. Transaction costs are classified as information costs (ICs), Bargaining costs (BCs) and monitoring costs (MCs) incurred by farmers with MFRC with PCs, MCs, and independent farmers participation. TCs are incurred by the participation in MFRC for price uncertainty; price discovery costs, product quality uncertainty, rejection rate, and frequency of sale, lack of information on the reliability of the MFRC.The outcome variables (ICs, BCs, MCs, TCs and Net Profits) were estimated using Propensity Score Matching (PCM).

III. Data Base:

Primary survey data used in this study was carried out in 2017 in Kolar district in Karnataka, the Southern part of India. The questionnaire was designed based on the focus group discussion with independent farmers, and MFRC procurement managers in the selected state. In order to select farmers selling to MFRCs and those selling to traditional spot markets, stratified random sampling was used. For that purpose list of farmers was obtained from MFRC and 100 farmers were randomly interviewed belonging to each supply chain. In this way, a number 100 farmers each were interviewed belonging to production contract (PCs), marketing contract (MCs) and control groups (traditional spot market farmers/independent farmers) for tomato. At aggregate a total number of 300 farmer observations are used in our paper.

<FIG. 1. HERE>

IV. Preliminary results:

< TABLE 2. HERE>

The descriptive statistics for tomato is presented in Table 2 for two different MFRC and independent farmers. Table 2 reports sample mean values for farm and household characteristics of PCs, MCs farmers (treatment group), and independent farmers (APMC farmers /control group) from the same region. We

found that, on an average, Both MFRC farmers were having more area as compared with independent farmers. However, the different between the MFRC and control group was significantly higher for MCs MFRC as compared with independent farmers. However, we found significantly difference with respect to the age of decision makers (in years) where farmers in PCs, and MCs have higher age than independent farmers. MFRC farmers are slightly older than independent farmers. We were expecting that MFRS chains prefers to purchase from young farmers. However, our study results have shown different results.

The decision maker experience was found higher (on an average five years higher) for MCs and independent farmers than PCs MFRS. However, the difference was not found to be statistically significant. Our results revealed that PCs farmer was better educated than other MCs and independent farmers, with statistically significant difference. We expect that openness to innovations increases with education. This finings is in line with other empirical findings which revealed that better educated farmers are more likely to participate in contract farming (Bellemare, 2012). Our finding shows that MFRC farmers borrowed more loan than independent farmers. Further, we calculated the percentage of decision makers not educated, decision makers with primary education, decision makers with tertiary and secondary education. As expected, we found that decision makers with primary and secondary educations reported higher for MFRC farmers than independent farmers. Better educated farmers might be more aware of MFRC requirement of the products. Better educated farmers can learn and adopt new choices of technologies that can open new market opportunities such as the MFRC.

Our study result shows positive relationship between the risk attitudes of tomato farmers and their willingness to participate in MFRS. Risk loving tomato farmers tended to participate more in MFRS than independent farmers. On an average we found that 41.18 per cent farmers reported higher risk preference followed by 58.82 per cent reported medium risk preference in PCs. On the other hand, our result shows that independent farmers had reported lower risk preference. It indicate that independent farmers are more risk averse than MFRSs farmers. Therefore, we argue that MFRC prefer to source mainly from risk loving farmers than risk adverse farmers.

Distance from farmers agricultural field to input and output markets has played significant role for farmers participation. Our finding shows that the farmers supplying MFRS have less distance to input markers, near good roads from farmers' field than independent farmers and the differences were statistically significant. Further we found mixed results with respect to the near output market distance and distance of collection centers where farmers in control group have medium value than MFRS farmers for tomato. These could be mainly due to non availability of transportation facility from MFRS. MFRS farmers have to take care of the transportation costs, hence, the increasing distance of collection centers might not play negative role for farmers participation in MFRC. Overall, these results suggest that in inputs markers play significant important role than near output markets for tomato farmers participation.

We found that, on an average, both (PCs and MCs) MFRC farmers were having more area under tomato as compared with independent farmers. Our study shows that MCs farmers have reported highest area (2.53 acres) under tomato followed by PCs farmers (1.75 acres) as compared with independent farmers (1.61 acres). We found statistically higher area under tomato crop for MCs as compared with PCs and Independent farmers. As expected, PCs farmers have reported lower area under tomato so that farmers gives more time for better grading and packaging for supply better quality tomato than MCs and independent farmers. Further, we found that PCs farmers have reported 30.90 per cent more yield (19.06 Ton per acre), followed by 22.57 per cent (17.01 tons per acre) for MCs than independent farmers (13.17 tons per acre). Our study shows that MFRC famers have reported significantly higher yield than independent farmers.

Our study finding revealed that MFRC procurement price was significantly higher than control group for tomato. We found that PCs procurement price was 35.88 per cent (12.54 Rs per kgs) higher than independent farmers, followed by 13.52 per cent (9.32 per cent) for MCs farmers. Further, we find significant higher revenues, profits, and yield, for MFRS farmers as compared with the independent

farmers for Tomato. Furthermore, we found that MFRC farmers have reported higher tomato cost of cultivation per acre than independent farmers.

Our estimates reveal that the tomato farmers in Karnataka engaged with PCs MFRC tend to have higher profits (Rs 75,836 per acre) followed by MCs (Rs 20,212 per acre) than independent farmers (Rs 13,988 per acre[1]). Similar, farmers engaged in MFRC for tomato PCs have the highest yield gains and significantly higher profit than MCs and independent farmers Table (2). Similar finding have been reported by other studies (Mishra et al. 2016).

V. Empirical results and discussion :

< TABLE 3. HERE>

Table 3 shows the empirical results of probit estimates for PCs MFRC and independent farmers. We run two probit model, in the first model, we emphasis on farm size whereas in the second model emphasizes more on infrastructure related variables. Performance and robustness check parameters of the model reveal that Model II performs better and is preferred. The model II is highly significant and correctly predicts 66.9 % of the observed outcomes.

Our empirical findings revealed that price received from supermarket (In Rs per kgs) , near other collection center distance from agri. field (in kms), loan amount per hh (in Lakhs), distance of hhs agri. field from home (in kms), hhs decision makers age (in years) were statistically significant and positive determining farmers participant in PCs MFRC for tomato. The coefficient of price offered by supermarket was positive and significant factor, indicating that with increase in price from supermarket farmers are more likely to participate in PCs. On the other hand, we found a negative relationship associated with input market distance from agri. field (in kms), Hhs, with illiterate school education. Among all the

[11] We have not included the transaction cost for calculating the profit. In next chapter we will be calculating the profit with transaction costs.

factors, the result of primary school education (dummy variable) was unexpected. Other studies findings have revealed that with more education farmers are more likely in the supermarkets (Rao & Qaim ,2011).

Further, our results revealed that households with high-risk appetite, household size (in numbers), net sown area (in acre) were positive but not statistically significant factors responsible for farmers participation in PCs. The coefficient for fixed price in the advance (dummy variable), farmers awareness about supermarket (in numbers), Hhs, with illiterate education had negative coefficient. Farmers were not willing to accept the fixed price option in advance mainly due to lower price offered from supermarkets. However, the existing literature shows that for reducing the price uncertainty in the open markers farmers prefer to fix the prices in advance.

< TABLE 4. HERE>

It is observed from table 4 that the coefficients confirmed the results from of our descriptive statistics (table. 2). Price received from the supermarket and decision maker age positively influences farmers' participation in MCs MFRC. Our findings are similar to other studies finding in Kenya (Rao, Brümmer, and Qaim 2012), China (Miyata et al., 2009), and Ghana (Boahene et al., 1999). We were expecting that MFRC might prefer younger farmers. As against, our finding shown that higher age decision maker are more likely to participation in MCs MFRC for tomato. The distance of other collection centers was found statistically significant, indicating that increasing other MFRC collection centers likely to increase farmers' participation in MCs MFRC. This indicates that farmers might have associated with more than once MFRC for selling their product.

However, our study shows that Hhs, with illiterate and primary school education, input market distance (in kms) and household size (in numbers) were statistically significant and negatively influence farmers participation in MCs MFRC. Given the important of distance, it is understandable that farmers with close to the input market are more likely to participate in MFRC for tomato. Contrary to the expectation, the coefficient of the variable household size is found to be negative and significant, suggesting increase in

household size farmers are less likely to participate in MFRC. This is not common finding in the supermarket adoption literature (Schipmann and Qaim 2010).

Households with high-risk appetite, net sown area (in acre), land holding (numbers of plot), and preference for fixed prices in advance farmers awareness about supermarket (in numbers) appears to have a positive effect on the farmers participate in PCs MFRC.

VI. Empirical results from Transaction cost

< TABLE 5. HERE>

The estimated propensity scores are used to derive average treatment effects of supermarket/MFRC participation on the outcome variables of interest (Profit, productivity and revenue etc). We use the NNM methods and impose the common support condition to ensure proper matching. Table 4 presents the average treatment effects estimated by NNM, as well as indicators of matching quality from the matching models. We compared PCs, MCs with independent farmers (IF). Results from table 4 indicate that, NNM matching estimator, PCs MFRC shows positive and significant impact on farmers profit, productivity, and total revenue per acre for tomato but reported significant higher cost of cultivation and transaction costs per acre. The NNM causal effect of PCs MFRC adoption on profits (Rs. 42023 per acre) suggests that the profits (after including TCs) of MFRC farmers' are higher than the profits of non-contract (independent) farmers by about Rs 42,023 per acre (73.34 % higher than IF) significant at 1 % level. Transactions cost (TC) was significantly higher for MFRC farmers as compared to independent farmers. TCs accounted for 13.51 % share in total cost for PCs whereas for the independent farmers TCs was less than 5.33 %.

Further, the causal effect of PCs adoption on procurement price (4.51 Rs per kg) suggests that procurement prices of PCs are higher than independent farmers by about 4.51 Rs per kg (significant at 1 %) for tomato. In other words, we found that the procurement price from PCs was higher by 36.08 % than

IF farmers price from traditional or APMC markets. On the other hand, PCs farmers reported Rs 36,698 higher and significant total cost of production than independent farmers. Remarkably, the production cost was 30.32 % higher for PCs MFRC farmers than IF. The profit was reported higher by 73.34 % for PCs MFRC farmers than independent farmers' profit. PCs MFRC farmers enjoy higher yields 5.48 ton per acre (28.48 % higher) compared to independent farmers. We analyze different components of TCs ie. information costs, monitoring costs and bargaining costs. Our results revealed that IC, BC and MC were higher for PCs MFRC farmers by 54.81 %, 79.16 % 70.55 %, respectively. Monitoring cost is higher due to uncertainty associated with grading standards. Our finding is line with the finding of other (Escobal and Cavero 2012; Hobbs 1997; Key, Sadoulet, and Janvry ,2000).

The average treatment effects revealed significant impacts on MCs farmer's participation on outcome variables. Participation in MCs leads to increase farmers profit by Rs 5,344 per acre (in other word, 28.49 % higher profit), higher revenue by Rs 5,349 (5.02 %), higher and productivity by 4.00 tons per acre (23.53 %) and higher procurement price by Rs 1.10 per Kgs than independent farmers for Tomato. But almost all the variables were not significant.

Similarly, TCs was higher and significant for MC farmers by Rs 3,062 per acre (43.33 %) higher than independent farmers. TCs accounted 8.05 % share in total cost for MCs farmers as compared with 4.56 % share for independent farmers for Tomato. Furthermore, our finding revealed that among all the TCs, MCs accounted highest share (with 47.87 %) followed by bargaining cost (with 37.98 %) and IC (14.15 % share) for MCs farmers.

Our result shows that PCs MFRC significantly benefited the farmers by Rs 57,299 net profit per acre (statically significant), followed by Rs 18,758 net profit per acre (statically in-significant) for MC tomato farmers (including TC in total costs for profit calculation). However, the independent farmers of PCs, and MC reported the net profit Rs 15,255 per acre and Rs 13,414 per acre, respectively. Therefore, we

conclude that MFRC have helped the farmers for increasing the welfare ranged between 28.49 to 98.66 % higher as compared with independent farmers' net profit. Further, results in table 4 also indicate that PCs MFRC farmers reported significantly higher procurement pries Rs 12.50 per Kgs (36.08 % higher than IF) , followed by Rs 9.49 per kgs (11.62 % higher than IF) for MCs. Furthermore, we found that PCs MFRC farmers reported significantly higher productivity 19.26 tons per kg (28.45 % higher than IF),followed by 17.00 tons per acre (23.53 % higher than IF) for MCs.

As compared with TC across MFRC for tomato, our study revealed that TC reported significantly higher with Rs 16,352 per acre (72.49 % higher than IF), followed by Rs 7,067 per acre (Statically significant) for MC (43.33 % higher than IF). In other words, proper institutional arrangement can help the farmers for raising the profit for PCs, MCs by 13.51 %, and 8.05 %, respectively.

VII. Conclusions

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We strongly suggest that NGC needed to promote for connecting small farmers with MFRC. NGO can help for reducing the uncertainty and supervision costs incurred by the farmers. Further, NGO can help for building trust between farmers and MFRC and can help for reducing the TCs. Further, we suggests for establishing proper institutional arrangement with the provision for enforcement of the terms decided in the contract. The availability of enforcement mechanism might be helpful to overcome the barriers faced by the small and marginal farmers.

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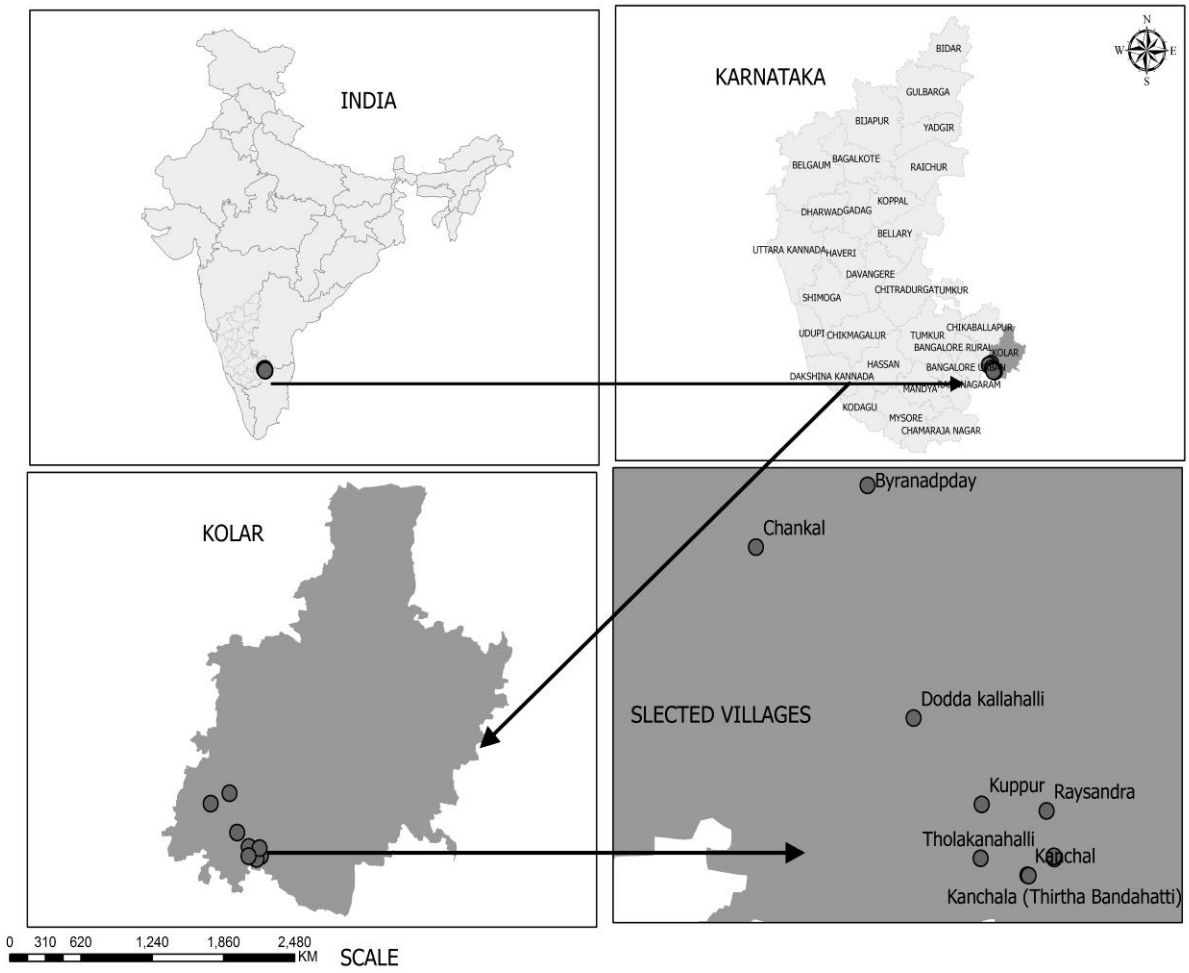
Figure.1: Selected area for conducting the primary survey



Source: Authors Primary survey (2017)

Table 1: Variables used for measuring TCs incurred by farmers

Sl No.	Variable	Individual Transaction costs	Nature of the measurement
01	Information costs -arise prior to an exchange)	Search for buyers and reliability of potential buyers	Actual
	- incur due to uncertainty and asymmetric information	Price uncertainty	Actual
		Quality standard/ product quality uncertainty	Actual
		Other information required on (seeds type + Packaging materials etc.)	Actual
02	Bargaining/ Negotiation costs (during exchange)	Lack of control over sale order [a]	Relative
		Unequal Bargaining Power	Relative
		Frequency of sale	Actual
		Cost and time spent on negotiation the prices and quality of the product with the company	Actual
		Monetary value due to opportunist behavior [b]	Actual
03	Monitoring Costs (incurred to ensure that the conditions of an exchange are met)	Product Quality	Actual
		Grade uncertainty	Actual

[a] Possible responses were 1, not a problem; 2, minor problem; 3, a problem; 4, relatively significant problem; 5, major problem.
[b] Mostly applicable for those quality which would have been accepted by MFRCs.

Source: Authors Primary survey (2017)

Table 2: Characteristics of contract and independent Tomato producers, India 2017-2018.

Variable	Independent farmers	PCs	MCs p
Land area (*acre*)	6.49	6.96	8.72*
Age of head of household (HH, in *years*)	39.80	42.90*	45.92***
Farming experience of HH (*years*)	17.44	13.12	19.87
Household size (*number*)	5.0	8.0***	4.0**
Loan amount (Lakhs Per HH)	1.62	3.14*	2.12
Distance to input market (In Km)	10.7	6.43***	7.1***
Near road distant from agri. field (in kms)	2.0	1.43**	1.14***
Distance of HH agri. field from home (in kms)	0.68	1.17***	1.94***
Near other collection centers (in Kms)	13.84	18.39**	16.22
Near output market distance from agri. field (kms.)	16.70	27.16***	9.84***
HH member, perceiving high risk (*%*)	20.00	41.18	38.00
HH member, perceiving medium risk (*%*)	30.00	58.82	62.0**
HH member, lower medium risk (*%*)	46.00	0.00	26.00
HH member, perceiving no risk (*%*)	4.00	0.00	0.00
HH member, education (in *years*)	6.48	9.61***	7.42
HH member, illiterate (*%*)	12.00	2.00**	6.00
HH member, primary education (*%*)	32.00	16.00**	32.00
HH member, secondary school education (*%*)	22.00	37.25*	30.00
HH member, Tertiary education (*%*)	34.00	45.10	32.00
Area under tomato per acre	1.61	1.75	2.53**
Total labour cost acre (*Rs*)	7,684	9,554**	7096
Total input per acre (*Rs*)	41581.9	66342	56698
Total variable costs[a] per acre (*Rs*)	30828	25784*	26649
Total cost per acre (*Rs*)	80094	101670***	90443
Total revenue per acre (*RS*)	94082	177516***	110655**
Total profit per acre (*Rs*)	13988	75836***	20212*
Procurement Prices (Rs per Kg.)	8.06	12.57***	9.32
Yield (Kg. *per acre*)	13.17	19.06***	17.01***
Total cost per quintal (*Rs*)	608	533	532
Net profit per quintal (*NPR*)	106	398	119
Number of observations	*200*	*200*	*200*

Note: [a] Also known as operation costs, includes seeds, seed treatment, fertilizer (urea, potash, DAP), micronutrients, manure, and pesticides, and miscellaneous.

*Significant at the 10% level; **Significant at the 5%; ***Significant at the 1% level.

Source: Authors Primary survey (2017)

Table 3: Propensity score for PC MFRC farmers vs IF for Tomato (probit Estimation)

Variable	Model I		Model II	
	Coefficient	Standard error	Coefficient	Standard error
Ln Age (Years)	0.0211	(0.0212)	2.072**	(1.032)
HHs, illiterate [a] (dummy)	-2.456**	(1.072)	-1.870*	(1.439)
HHs, primary education [a] (dummy)	-1.731**	(0.820)	-1.031**	(0.700)
HHs, secondary education [a] (dummy)	-0.207	(0.612)	-	-
High Risk HH [b] (dummy)	0.889	(0.611)	0.902	(0.648)
Ln net sown area (Acre)	0.905	(0.800)	0.0220	(0.115)
Household size (Nos.)	0.142*	(0.0723)	0.592	(0.444)
Ln price received (Rs / kgs)	3.107***	(0.827)	3.053***	(0.842)
Ln plots (Nos.)	-0.103	(0.576)	-0.156	(0.478)
Ln loan borrowed (Rs.)	1.021***	1.021***	0.0493**	(0.0233)
Preference for fixed price [c] (dummy)	0.326	(0.430)	-0.512	(0.568)
Aware of MFRC contractors (dummy)	-1.178*	(0.610)	-0.804	(0.719)
Ln Distance to collection center (Km)	0.120***	(0.0435)	1.118**	(0.439)
Ln Distance of Input Market (Km)	-2.166***	(0.716)	-1.408***	(0.497)
Ln distance of agri. field from home (In kms)	-	-	1.021***	(0.392)
Ln Distance of nearest road from farm (Km)	-	-	0.250	(0.381)
Constant	-7.011***	(2.237)	-14.90***	(4.840)
Pseudo R2	0.5887		0.669	
Number of observations	*200*		*200*	

Note: [a] Base is farmers with primary/ illiterate/ Secondary/ (Tertiary or others education)
[b] Base is farmers with no risk
[c] Base household will not prefer fixed pries in advance
Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Source: Authors Primary survey (2017)

Table 4: Propensity score for MC MFRC farmers vs IF for Tomato (probit Estimation)

Variable	Model I		Model II	
	Coefficient	Standard error	Coefficient	Standard error
Ln Age (Years)	1.651**	(0.794)	0.109***	(0.0336)
HHs, illiterate [a] (dummy)	-0.322	(0.738)	-3.359***	(1.147)
HHs, primary education [a] (dummy)	-	-	-2.216***	(0.849)
HHs, secondary education [a] (dummy)	-	-	-0.975	(0.658)
High Risk HH [b] (dummy)	1.111***	(0.380)	0.330	0.330
Ln net sown area (Acre)	-0.653**	(0.317)	0.127	(0.286)
Household size (Nos.)	-0.530	(0.389)	-0.278**	(0.121)
Ln price received (Rs / kgs)	0.817*	(0.429)	0.151**	(0.0718)
Ln plots (Nos.)	0.378	(0.502)	0.139	(0.538)
Ln loan borrowed (Rs.)	-5.0408	(6.7407)	-0.0235	(0.0215)
Preference for fixed price [c] (dummy)	0.546	(0.419)	0.555	(0.552)
Aware of MFRC contractors (dummy)	-0.297	(0.399)	0.702	(0.619)
Ln Distance to collection center (Km)	0.0641**	(0.0252)	0.710*	(0.364)
Ln Distance of Input Market (Km)	-0.634***	(0.240)	-1.379***	(0.470)
Ln distance of agri. field from home (In kms)	-	-	0.0546**	(0.0229)
Ln Distance of nearest road from farm (Km)	-	-	-0.284	(0.473)
Constant	-7.453**	(3.281)	-6.067***	(1.991)
Pseudo R2	0.4148		0.6232	
Number of observations	*200*		*200*	

Note: [a] Base is farmers with primary/ illiterate/ Secondary/ (Tertiary or others education)
[b] Base is farmers with no risk
[c] Base household will not prefer fixed pries in advance
Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Source: Authors Primary survey (2017)

Table 5: Average treatment effects and results of sensitivity analysis- MFRC, Tomato

Matching algorithm	Outcome (Rs. per acre)	Treated	Controls	Difference	*t*-stats	Critical level of hidden bias Γ	Number of treated	Number of controls
(1) PC vs IF	Information costs per acre	1828	826	1002	2.28	1.65-1.70	50	50
Nearest neighbor matching (NNM)	Monitoring costs per acre	7505	2210	5295	4.91	3.25-3.30	50	50
	Bargaining costs per acre	7020	1463	5557.0	3.1	4.55-4.60	50	50
	Total Transaction costs per acre	16352	4498	11854	4.01	5.00-5.05	50	50
	Price Received (Rs per kgs)	12.50	7.98	4.51	4.03	3.75-3.80	50	50
	Yield (Ton)	19.26	13.78	5.48	3.71	2.25-2.30	50	50
	Cost per acre (C1) (including TCs)	121052	84353	36698	4.58	4.40-4.45	50	50
	Profits per acre (P1) (including TCs)	57299	15277	42023	3.65	1.90-1.95	50	50
	Revenue per acre	178351	99630	78721	5.54	5.00-5.05	50	50
	Cost per acre (C2) (excluding TCs)	104699	79855	24844	3.18	3.40-3.45	50	50
	Profits per acre (P2) (excluding TCs)	76831	22206	54624	5.12	3.15-3.20	50	50
	difference in Cost (C1-C2)	16353	4498	11854				
	difference in Profits (P1-P2)	-19532	-6929	-12601				
(2) MC vs IF	Information costs per acre	1000	893	107	0.55	1.6-1.65	50	50
Nearest neighbor matching (NNM)	Monitoring costs per acre	3383	1784	1599	3.19	1.65-1.70	50	50
	Bargaining costs per acre	2684	1328	1356	2.61	1.45-1.50	50	50
	Total Transaction costs per acre	7067	4005	3062	3.08	1.40-1.45	50	50
	Price Received (Rs per kgs)	9.49	8.39	1.10	1.18	1.60-1.65	50	50
	Yield (Ton)	17	12	4	2.59	1.90-1.95	50	50
	Cost per acre (C1) (including TCs)	87772	87766	5	0	1.20-1.25	50	50
	Profits per acre (P1) (including TCs)	18758	13414	5344	0.57	2.60-2.65	50	50
	Revenue per acre	106529	101180	5349	0.41	2.40-2.45	50	50
	Cost per acre (C2) (excluding TCs)	71821	78966	-7145	-0.93	1.75-1.80	50	50
	Profits per acre (P2) (excluding TCs)	25867	19886	5981	2	1.65-1.70	50	50
	difference in Cost (C1-C2)	15951	8800	7150				
	difference in Profits (P1-P2)	-7109	-6472	-637				

Source: Authors Primary survey (2017).