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Effectiveness of Contract Farming: Evidence from Cultivators of Onion in Maharashtra, India

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A B S T R A C T

Contract farming based on a contract between farmers and agro-processing and/or marketing firms is catching on in Indian agriculture due to increase in the demand for processed products, change in consumption habits and conducive policy environment. The concept behind the promotion of contract farming is to encourage private investment in agriculture and to reduce market risks as well as post-harvest losses, especially risk-oriented fruits, vegetables and high value crops. The private sector may play a role in providing a range of services to small and marginal farmers from input supply to marketing of produce. In this context, the present paper attempts to quantify the benefits of contract farming on farmers' income and investigates the determinants of participation in contract farming. This is based on a survey of 180 farmers engaged in cultivation of onion from Maharashtra State. The study reveals that contract farming, by connecting smallholders to high-end international market, ensures them with higher returns to the tune of Rs. 12.5 per kilogram over independent farmers. It is seen that to some extent contract farming would remove the constraints faced by the small and marginal holders in Indian agriculture and help them to move out from the poverty trap. Access to institutional credit, extension services, farm-size, own transport, and migration significantly affected farmers' participation in contract farming. The empirical evidence on benefits from contract farming in high value export commodities should induce conducive policies for promotion and up scaling of contract farming in India. It was observed that contract farming cannot be seen as a panacea for all the problems afflicting the Indian agriculture while it has the potential to address the problems relating to access to market (input and output), new technology and price stability. A need is suggested for better institutional mechanism to make contract farming more inclusive and sustainable.

Keywords

Contract farming (CF), agricultural transformation, asymmetric information

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Introduction

Contract farming (CF) has played important role in promoting modernization and commercialization of agriculture, globally. It has long been well established in the developed countries and is receiving considerable attention in developing countries in recent years. Contract farming has come up as a key component in the

process of agricultural transformation that facilitates direct firm-farm linkages. Contract farming may help farmers in overcoming the high transaction costs in marketing of their produce. It provides farmers with opportunity for nonspot transactions, which are useful when the transaction costs are high or markets fail. Markets fail due to factors like imperfections in credit market, economies of scale in transportation and marketing, asymmetric information about market prices, and lack of capacity for smallholders to absorb risk. Further, spot markets, mainly due to problems of asymmetric information, have lower ability to deliver efficient solution to quality and food safety issues than CF.A number of studies show that CF can increase agricultural productivity, profitability, farmers' income, and reduce food insecurity (Kumar *et al.,* 2006).

Even though potential benefits of CF are considered significant for both contractors and contracted, particularly when quality and safety are critical issues, its role and possible impacts in the developing countries are still controversial. A serious contentious issue in CF is the threat of exclusion of smallholders, particularly when the higher transaction cost, along with stringent demand for quality and safety, may prevent participation of small and marginal farmers in CF. India has gone through significant rural transformations and institutional changes that have shaped today's agricultural sector and agricultural policies. According to Chand (2005), CF's benefits to smallholders, who represent about 80 per cent of the rural population, include access to credit, inputs, and extension services; another benefit is the linkage between input markets and providers and the international markets by organizing the production of high-value food crops (HVF).

The evidence of CF's impact in the context of India has been mixed. For instance, Dev and Rao (2005); Nagaraj *et al.,* (2008); Kumar and Kumar (2008); Tripathi *et al.,* (2005); Birthal *et al.,* (2005); Kumar (2006) all found that contract producers earned profits almost three times higher than independent producers, due to higher yields and assured output prices. On the other hand, Singh (2002) found negative impact of CF on the environment, welfare of farmers, and the power structure between contractors and farmers. This study is aimed at identifying the factors that motivate farmers' participation in contract farming in an overwhelmingly smallholder-dominated context; it also assesses the impact on farmers' economic welfare.

India is a leading producer of fruits & vegetables in the world due to its diverse agro-climatic conditions that favour cultivation of a variety of crops. India is the second largest producer of dry onion (19.4 million tonnes) and shares 21 per cent in the world production (93.2 million tonnes) (FAO, 2018). Among States in India, Maharashtra is the leading State in production of onion (6.5 milliontonnes) in 2016 (GoI, 2017a). Maharashtra accounted for 31 per cent of onionin the country in 2016.

Materials and Methods

The study is based on the data from a survey of 180 farmers, cultivating onion. The survey was conducted in Maharashtra during 2020. The list of contracting farmers for the year of the survey was obtained from one contracting firm (henceforth the sample firm) in onion. The survey for onion was conducted in Nashik and Jalgaon districts, located in Northern region of Maharashtra. Farmers in Jalgaon district had formal contracts for the production and supply of white onions with Jain Farm Fresh Foods Limited. Contract onion farmers were from the, Vadali, Pasardi, Nashirabad Wakadiand Shirsoli villages in Jalgaon district. The independent farmers were selected from the Nashik district, adjacent to the Jalgaon district.

Nashik is the largest onion-producing district in Maharashtra, contributing more than 25 percent of state onion production. Jalgaon and Nashik are located in the same agroclimatic zone i.e. Western Maharashtra Scarcity Zone. Data collected from 90 contract onion growers and 90 independent onion growers. A majority of the total contract farmers were surveyed. For selection of independent farmers, we randomly identified three blocks from the Nashik district, namely Lasalgaon, Nifadand Sinnar. 30 samples are selected from each blocks. Then we selected five villages from each block. Finally, we chose sample households in proportion to the village population for detailed investigation.

The econometric analysis conducted to identify the factors which motivate farmers' participation in contract farming and assess impacts of contract farming on the farmer's profitability, a proxy for farmers' economic welfare. We employed a 2-Stage Least Squares (2SLS) model with instrumental variables: (i) to examine the impact of factors associated with a farmer's willingness to opt for contract farming (in the first stage of regression); and (ii) assessed the impact of participation in contract farming on farmers' profitability (in the

second stage of regression). The equation for the 2SLS regression is $\pi i = \alpha + \delta di + \gamma Xi + \varepsilon i$ (1) where, πi is the net profit per kg for a farm household involved in cultivation of onion, di is a dummy variable that equals 1 if a farmer is under contract and 0 if not under contract, Xi is a vector of farmer characteristics and εi is the error-term.

Results and Discussion

Characteristics of contract and independent farmers of onion

Table 1 presents average values of key household characteristics for farmers of onion. The average age of farmers ranges from 45 years to 48 years. 97 per cent of the household is headed by male. The average years of education of farmers range between 9.2 years to 11.2 years, for farmers of onion. Around 99 per cent of farmers have farming as their main occupation. The average farming experience ranges from 20 years to 21 years. The average size of family farmers is around 6. Average dependency ratio ranges between 0.5 to 0.6 for cultivators across crop types.

The average farm size is 1.8 ha. About half of onion farmers have access to institutional credit. One third of sample farmers are members of a cooperative.71 per cent of onion growers have their own means of personal transport. Some characteristics exhibit significant differences between contract and independent farmers. For example, contract and noncontract farmers of onion differed in terms of education, operational holding size, access to institutional credit, membership of cooperative, crop insurance, number of annual visits by private extension official and own means of personal transport;

The average years of education of contract onion farmers (11 years) were higher than that of independent farmers (9 years). The operational holding size was much higher among contract farmers (3.1 ha) than noncontract farmers (1.4 ha) of onion. The access to institutional credit was significantly higher for contract onion growers (70 per cent) than independent growers of onion (47 per cent).

Over half the number of contract onion farmers belonged to some cooperative or organization than about quarter of the independent farmers. 22 per cent of contract onion growers had crop insurance than 1.5 per cent of independent growers. Onion contract farmers were visited 6 times annually by private extension officials while independent farmers were visited once. 65 per cent of contract onion growers had own means of transport compared to 75 per cent of independent farmers.

Table 2 presents data on yield, production cost, output prices, and profits of both contract and independent farming household's onion.

The average onion yield is higher for contract growers (243.2 q/ha) than noncontract producers (192.6 q/ha) and it differs significantly at 1 per cent level. Additionally, the average price realized by onion contract farmers (Rs. 815.5/q) is significantly higher vis-à-vis noncontract farmers (Rs. 690/q). The cost of onion cultivation was significantly lower for contract farmers (Rs. 595/q) than noncontract farmers (Rs 766/q). The higher yields, better prices and lower cost of production achieved by contract farmers made onion cultivation more profitable. Further, the prices for onions had crashed in open market due to increased production in 2018. Therefore, the independent onion growers incurred a loss of Rs 75/q. The contract farmers got cushion against price fluctuation due to price fixed in contract and earned a profit of Rs 220/q.

Determinants for farmers' participation in Contract Farming

Table 3 presents the results of the first stage of 2SLS regression that exhibits the determinants of farmers' participation in contract farming for onion cultivation. The variables farm-size, access to institutional credit, number of visits by government extension official, number of visits by private extension official, and own personal transport, have significant positive relation with participation in contract farming. On the other hand, migration of household members has negative impact on participation in contract farming.

Impact of contract farming on farmers' profit

Table 4 exhibits results of the impact of contract farming on profits of onion cultivators. It gives outcomes of the second stage of 2SLS regression along with OLS regression. Unlike OLS regression, the 2SLS regression takes care of the unobserved factors in regression and gives true impact of CF on farmers' profit. This means that estimates of 2SLS regression should be preferred over that of OLS regression.

Table.1 Household characteristics of farmers

Household characteristics	All	Contract	Independent	difference	t-Test value
Age household head (years)	47.5	45.5	48.3	-0.8	0.6146
Gender HH-Head (%) (Male=1, otherwise=0)	99.8	100.0	99.8	0.2	0.4214
Education HH-Head (years)	9.4	11.2	9. 2	2.0***	5.2335
% farmers with farming as main occupation (%)	99.5	100.0	99.4	0.6	0.7778
Experience in farming (Years)	20.0	21.9	20.9	1.0	0.7738
Household size	5.8	6	5.7	0.3	0.4947
Dependency ratio	0.62	0.56	0.64	0.08	0.7410
Operational land (ha)	1.8	3.1	1.4	1.9***	7.0284
Access to institutional credit (%)	49.6	69.4	46.1	23.3***	4.1185
Membership of cooperative or other organization (%)	30.2	51.2	24.7	27.1***	5.4185
Crop insurance (%)	5.6	21.8	1.5	20.3***	7.8921
No of visits per annum by Private companies	1.8	5.9	0.9	5.0***	10.2567
Own means of personal transport (%)	69.9	65.4	74.5	9.1**	2.6334

Source: Field survey

Notes: ***, ** and * represent significance at 1%, 5% and 10% levels, respectively.

Table.2 Economics of cultivation of onion for contract and independent farmers in Maharashtra

Economics of cultivation	All	Contract	Independent	Difference
Yield (q/ha)	199.8	243.2	192.6	50.6***
	(75.6)	(75.7)	(74.02)	
Price (Rs/q)	752.7	815.5	690.0	125.5***
	(190.3)	(392.5)	(888.6)	
Cost of production (Rs/q)	680.5	595.2	765.8	170.6***
	(220.3)	(185.2)	(244.3)	
Profit (Rs/q)	72.25	220.3	-75.8	296.1***
	(272.5)	(289.6)	(246.7)	

Source: Field survey (2022). Notes: ***, ** and * represent significance at 1%, 5% and 10% levels, respectively. Figures in bracket represent standard deviation.

Table.3 Determinants for farmers' participation in CF for Onion cultivators

Dependent variable: Participation in contract farming (yes=1/no=0)		
Variable	**Coefficient**	**S.E.**
Socio-Demographic variables **ln(Age of the household head) (Years)**	-0.151	(0.895)
Square of ln(Age of the household head)	0.0231	(0.129)
Gender of household head (Male=1, 0 otherwise)	0.0820	(0.0890)
ln(Years of education of the household head)	-0.0384	(0.0673)
Square of ln(Years of education of the household head)	0.0173	(0.0218)
ln(Number of economically active family members)	0.00612	(0.0175)
Migration (Yes=1, 0 otherwise)	-0.119***	(0.0501)
Ln(Operational land) (Ha)	0.0364**	(0.0168)
Own personal transport (Yes=1, 0 otherwise)	0.0847**	(0.0428)
Economic variables		
Main occupation (Farming=1, Other=0)	-0.00185	(0.135)
Access to institutional credit (Yes=1, 0 otherwise)	0.0752***	(0.0229)
ln(Number of visits by government extension officer)	0.0670**	(0.0314)
ln(Number of visits by private extension officer	0.0348**	(0.0160)

Table.4 Impact of contract farming on profits for onion cultivators in India

Dependent variable: Unit profit in production of onion				
	OLS		**2SLS 2nd stage**	
Variable	**Coefficient**	**S.E.**	**Coefficient**	**S.E.**
Contract Farming (Yes = 1, 0 otherwise)	1.728***	(0.330)	13.51**	(4.950)
Socio-Demographic variables				
Ln(Age of the household head) (Years)	-41.43	(32.43)	-42.33	(25.70)
Square of ln(Age of the household head)	5.512	(4.148)	6.554	(3.550)
Gender of household head (Male=1, 0otherwise	-2.612	(3.237)	-3.662	(4.550)
Ln(Years of education of the household head)	-0.411	(1.335)	0.155	(1.554)
Square of ln(Years of education of the household head)	0.8599	(0.847)	0.688	(0.812)
Ln(Number of economically active family members)	0.781	(1.301)	0.655	(1.169)
Migration (Yes=1, 0 otherwise)	-7.789*	(3.180)	-6.548*	(2.325)
Ln(Operational land) (Ha)	0.188	(0.494)	-0.292	(0.778)
Own personal transport (Yes=1, 0 otherwise)	-2.853*	(1.347)	-5.010	(1.899)
Economic variables				
Main occupation (Farming=1, Other=0)	5.988	(3.195	6.125	3.145)
Access to institutional credit (Yes=1, 0 otherwise)	0.145	(0.521)	-0.621	(0.695)
ln(Number of visits by government extension officer)	0.818	(1.231)	-0.195	(0.621)
ln(Number of visits by private extension officer	1.743	(0.910)	1.254	(0.741)
No. of observations				
R-squared	0.224		0.178	
Root MSE	13.987		13.828	

Source: Authors' analysis based on field survey (2022).
Notes: Standard errors in parentheses; ***, ** and * represent significance at 1%, 5% and 10% levels, respectively.

Table.5 The economics of cultivation of onion by sample contract and independent farmers

(Rs per ha)

Particulars of cost of cultivation	Contract	Independent	Difference
Labour	24,865	20,770	4,095***
Inputs:			
Seed	11,890	21,150	-9,260***
Fertilizers	14,755	13,120	1,635*
Irrigation	30,952	28,630	2,322
FYM	6,250	9,244	-2,994***
Pesticides	10,450	12,921	-2,471***
Other costs	0	22	-22
Rent for bullock pair / machinery	7,510	10,880	- 3,370***
Marketing costs	9,544	9,741	- 197
Total cost of cultivation	116,216	126,478	- 10,262**

Source: Field survey (2022). Notes: ***, ** and * represent significance at 1%, 5% and 10% levels, respectively. Figures in bracket represent standard deviation

The results in Table 4 show that contract farming has a significant positive impact on the profits of onion growers. The participation in contract enhances farmers' profit by Rs 12.5/kg. Migration has negative impact on the profits. However, the product fixed effect does not indicate significant difference in the unit profits of okra and pomegranate with respect to onion.

This study based-on survey data of farm-households cultivating onion in Maharashtra assesses the drivers for participation in contract farming and estimates impact of contract farming on profits for growers of onion. The results show that access to institutional credit, extension facility, ownership of transport, and farm-size have positive effect on farmers' participation in contract while migration has negative impact on the participation in Contract farming.

Conditional on participation, the contract farmers earn significantly higher profits in cultivation of onion. Contract farming plays important role in connecting smallholders to the international markets, ensures them with higher returns to the tune of Rs. 12.5 per kilogram over independent farmers. The higher profit comes mainly from higher yield and lower cost of production of onion. These findings have several important policy implications. The benefits of contract farming are product and contract specific, and therefore policymakers should design appropriate strategies and mechanisms to promote Contract farming in several agricultural commodities, especially in high value crops. A need is suggested for better institutional mechanism to make contract farming more inclusive and sustainable.

Author Contributions

Y. C. Sale: Investigation, formal analysis, writing—original draft. M. B. Nikam: Validation, methodology, writing—reviewing.

Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethical Approval Not applicable.

Consent to Participate Not applicable.

Consent to Publish Not applicable.

Conflict of Interest The authors declare no competing interests.

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