AN ANALYSIS OF IMPACT OF CONTRACT FARMING ON FARM PRODUCTIVITY AND EFFICIENCY

THE CASE OF HYBRID PADDY SEED CULTIVATION IN SOUTH INDIA

BRAJA BANDHU SWAIN[1]
INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE (ILRI)
NEW DELHI-INDIA
EMAIL: BRAJACDS@GMAIL.COM
ID 656

The adverse impact of globalisation on farmers in developing countries especially in India needs to be seen against the fact that agricultural sector is not internationally competitive on account of low productivity, high cost of production, lack of institutional support and other related factors. For addressing these issues, appropriate institutional innovations/platform is required in agriculture sector in delivering new technology, knowledge, inputs and a better market for farmer's harvest. The private sector could play a role in providing a range of services from input and technology supply to crop assembly and marketing. The studies have shown that contract farming can increase the crop productivity and output growth in agriculture sector by delivering better technology, coordinating producer's and consumer's market as well as strong grass-root linkages. However, the effectiveness of contract farming in terms of farm productivity and efficiency in India has not received much attention among scholars.

In this context, the paper would like examine the farm productivity and efficiency by taking a case study of hybrid paddy seed cultivation under contract farming in Southern India. Heckman sample selection model is estimated to examine productivity difference between contact and non-contract farmers and production frontier was used to measure the technical efficiency. The results indicated that contract farmers are efficient in growing contract crop while non-contract farmers are efficient in growing non-contract crop. Small farmers were found to achieve higher level of efficiency compared to large farmers. The main determinants to attain a higher technical efficiency for growing non-contract crop are region, pesticide use and education level of the farmers, whereas, region, number of times fertilizer application and pesticide use were the main determinants for hybrid paddy seed. The result open up many avenues for future research: for instance, the autonomy of farmers in contract farming and the spill-over effect of technology.

Key Words: Contract farming, Small farmer, Productivity, Efficiency

[1] I am thankful to my PhD Supervisors Prof. K. J. Joseph and Dr. V. Santhakumar for their valuable suggestion in developing analysis and paper.

1. INTRODUCTION

The adverse impact of globalisation on farmers in developing countries especially in India needs to be seen against the fact that agriculture sector is not internationally competitive on account of low productivity, high cost of production, lack of institutional support and other related factors. To address these issues, appropriate institutional innovations/platform is required in delivering new technology, knowledge, inputs and a better market for agriculture output. The private sector could play a role in providing a range of services from input and technology supply to crop assembly and marketing. The experience of the West as well many African and Asian countries discovered that contract farming, where private sector play major role, helped increasing in crop productivity and output growth in agriculture sector by delivering better technology, coordinating producer's and consumer's market along with strong grass-root linkages (Key and Rusten, 1999; Bauman, 2000; Eaton and Shepred, 2001; Narayanan and Gulati, 2002; Singh, 2002; Key and William, 2003) and bring higher efficiency among small farmers (Dev and Rao, 2005; Ramswami et al., 2005) due to the better organizational pattern.

The effectiveness of contract farming in terms of farm productivity and efficiency in India has not received much attention among scholars. Some studies have examined the average efficiency across contract and non-contract farmers (Dileep et al., 2002; Kumar, 2006; Ramaswami et al., 2005) and no study has measured the individual farm efficiency and determinants. In addition, these studies are lacking not only in terms of their approach but also in terms of methods that are used. In this context, the present paper seeks to examine the following research questions: 1) does contract improve the crop productivity and efficiency of contract farmers? 2) If so, what are the factors that induce farmers to achieve higher efficiency? The paper is divided into four sections including the present one. Section two presents the data and method while section three discusses the result. Section four concludes.

2. DATA AND METHOD

The analysis of this study based on 150 farm households collected from four[2] villages in Karimnagar district of Andhra Pradesh State in Southern India in 2008 with following of two stage sampling method (1st selection of village and 2nd selection of farmers). Among them 81 farmers have an agreement with seed processors (Pioneer and Pro-Agro) for supplying the seed pre-agreed price[3] while 69 farmers don't have a contract and also they don't grow the contract crop. Since the contract crop is only grown by the contract farmers so it is difficult to assess directly the impact of contract farming on farm productivity and efficiency. A comparison has been made between contract and non-contract farmers in growing a similar crop (normal paddy).

Output is the total production (in quintals) per acre produced in the reporting season. Labour is the number of man days actually used for the contract and non-contract crop, which includes both family and hired labour. Power represents the amount (in rupees) spent on both animals[4] and machines such as tractors and harvesters. Chemicals and manures include the value (in rupees) of fertiliser, pesticides and manure used for a contract and non-contract crop.

Production function is estimated to measure the crop productivity and technical efficiency of the sample farms (both contract and non-contract. A Cobb-Douglas production function in log-linear

[2] Only a small number of farmers—around 15 to 20—were engaged in contract production in a village, and so to get an adequate number for the analysis, four villages were selected. Non-contract farmers were selected randomly from peripheral areas with a similar cropping pattern as that of the contract farmers have.

[3] The contract between paddy seed grower and processing firms are very simple. Farmers are provided with free foundation seeds and extension advice and must deliver paddy seed especially female seed to respective processors.

[4] The value of owned animal power is estimated by imputing the payment made for hired animal power. The value of farm-produced manure is evaluated at the prices/rates prevailing in a village.

form is fitted to the observations using ordinary least squares. The estimation of production function involved two steps. In first step, production functions for individual crops e.g. hybrid paddy seed and normal paddy which is grown by contract and non-contract farmers is estimated. In second step, the sample contract and non-contract crop grown by the contract farmers have pooled and regressed output as well as output interacted by a contract dummy (one is for a contract crop and zero is otherwise) in an additive form for the intercept. Further, the non-contract crop (normal paddy) grown by both contract and non-contract farmers have pooled together and regressed output in an additive form for the intercept as well interacted by a contract dummy (one is for contract farmer and zero is otherwise).

3. Results and Discussion

3.1. Productivity

Cobb-Douglas production function is estimated through ordinary least square (OLS) method to examine the impact of contract farming on farm productivity. More than 95% of variation in output is explained by selected direct inputs in the analysis of contract and non-contract crops. Labour, agro-chemicals and region have shown a significant contribution to total output of the contract crop while the variables like labour, agro-chemicals, power and region have significant impact on output achieved for non-contract crop grown by a contract farmer (Table 1). However, it is different in case of non-contract farmers that land, labour and power have shown a significant impact on output of the non-contract crop. The result indicated that output of both contract and non-contract crop grown by a contract farmer is mostly affected by the use of agro-chemicals while it is not the case of non-contract farmer. The productivity difference in growing of contract and non-contract crop bye a contract farmer is on an average 19% higher for the contract crop compared to the non-contract ones. However, the difference in productivity between contract and non-contract farmers in growing non-contract crop indicated that a non-contract farmer could achieved more output on an average 26% than the contract ones. Similar result observed after correction of sampling selection of Bias (Heckman, 1979). The estimated results discovered that contract decreases the productivity of a contract farmer in growing non-contract crops by 33% than a non-contract farmer (Table 2). It hints that there is a difference between the production functions of the two types of farmers, implying different technologies. This result suggests that farmers lose their control over own managerial decisions on farming when they produce crop under contract farming system. It could be the fact that though farmers follow the firm's advice; it becomes difficult for them to preserve their traditional knowledge or own method of cultivation.

3.2. Technical efficiency

The maximum likelihood (ML) method was estimated by using Cobb-Douglas functional form which allows us to obtain the best practical performance of output, e.g., where sample farmers used technology most efficiently. The mean efficiency of 89% was observed for the contract crop and 87% for the non-contract crop grown by the contract farmers, while the mean efficiency of growing non-contract crop by the non-contract farmers is 89.58%. The average technical efficiency between contract and non-contract farmers indicated that non-contract farmers could achieve higher efficiency level (89.58%) than the contract ones (87%) in growing of non-contract crop. The mean difference between the two is also statistically significant at a 1% level. This result is contradictory to our hypothesis that contract farmers will be more technically efficient than the non-contract ones due to the positive spill-over effect. However, this result could be the outcome of contract farmers fully depending on processing firms, leading to an erosion of their traditional knowledge. Glover (1984) argued that farmers may lose their traditional knowledge because of the innovations introduced in contract farming. Another explanation could be that though contract reduces the risk, it also reduces a farmer's autonomy, giving him no opportunity to develop entrepreneurial abilities and management skills. That too results in the farmer losing touch with his own techniques of production. Similarly, Chang et al. (2006) argued that under contract production

farmer lose control over their managerial decisions and the linkage of profit and input usage does not exist.

An attempt has been made to examine the determinants of technical efficiency and the result shown in table 4. The results indicated that the number of times of agro-chemicals use has contributed significantly to the efficiency in growing contract crop. For non-contract crop that is grown by contract and non-contract farmers, the determinant of achieving technical efficiency is education. The estimated coefficient of education indicated that a farmer with higher education could achieve higher level of technical efficiency in growing of non-contract crop while it is not the case of contract crop. This result can be explained in the line of internalisation of knowledge by the processing firms (Glover 1984; Chang et al. 2006). Age of a farmer could not find a significant impact on efficiency level.

4. CONCLUSION

The literature and empirical studies of contract farming has discovered that crops grown under contract mode of production have better productivity and farmers are efficient as compared to non-contract ones. This is undoubtedly the case in the instance of our study – farmers are efficient in growing contract crop as compared to non-contract ones. In addition, contract farmers could achieve higher productivity in growing contract crops as compared to non-contract ones. However, non-contract farmers could achieve higher productivity in growing non-contract crop compared contract ones. Factors like labour, chemicals and region have shown a significant contribution to total output of the contract crop, while labour, chemicals, power and region have shown significant contribution to total output of non-contract crop that is being grown by contract farmer. On the other hand, factors like land, labour, power and region have substantial impact on the output of non-contract crop grown by non-contract farmers.

The estimated result of technical efficiency indicated that contract farmers are efficient in growing contract crops (mean efficiency level - 89%) than the non-contract ones (mean efficiency level -87%). However, contract farmers are inefficient than non-contract farmers when it comes to non-contract crop. The result open up many avenues for future research: for instance, the autonomy of farmer in contract farming and spillover effect of technology. Furthermore, the impact of modern technology in contract farming on traditional knowledge of farmer and local environment should be examined in greater depth. While contract is between weaker (farmer) and stronger (firm) party, the role of government in protecting the interest of farmers (especially smaller ones) cannot be over emphasized. The state could regulate market to ensure that firms do not abuse their market power.

REFERENCES:

- Baumann, P. (2000), "Equity and Efficiency in Contract Farming Schemes: The Experience of Agricultural Tree Crops", Development Institute Working Paper-139, Available at: http://www.odi.org.uk/resources/download/2022.pdf (Last accessed July 2007).
- Ching-Cheng C., Chi-Chung C., Min-Ching C., and Wei-Chun T. (2006), "Is Contract Farming more Profitable and Efficient than Non-Contract Farming: A Survey Study of Rice Farms in Taiwan", http://ageconsearch.umn.edu/bitstream/21374/1/sp06ch07.pdf (Last accessed: April 2009)
- Dev, S. M., and Rao, N. C. (2005), "Food Processing and Contract Farming in Andhra Pradesh: A Small Farmer Perspective", Economic and Political Weekly Vol. 40, pp. 2705-2713.
- Dileep, B. K., Grover, R. K., and Rai K. N. (2002), "Contract Farming in Tomato: An Economic Analysis", Indian Journal of Agricultural Economics Vol. 57, pp. 197-210.

- Eaton, C., and Shepred, A. (2001), "Contract Farming: Partnership for Development", Food and Agricultural Organization, Agricultural Services Bulletin, 145.
- Glover, D. J. (1984), "Contract Farming and Smallholders out Grower Schemes in Less-Developed Countries", World Development, Vol. 12, pp. 1143-1157.
- Heckman, J. J. (1979), "Selection Bias as a Specification Error.", Econometrica Vol. 47 (1), pp. 153-61.
- Key, N., and MacBride, W. (2003), "Production Contracts and Productivity in the U.S. Hog Sector", America Journal of Agricultural Economics, Vol. 85, pp. 121-133.
- Key, N., and Runsten, D. (1999), "Contract Farming Smallholders, and Rural Development in Latin America: The Organization of Agro-processing Firms and the Scale of out Grower Production", World Development, Vol. 27, pp.381-401.
- Kumar, P. (2006), "Contract Farming through Agribusiness Firms and State Corporation: A Case Study in Punjab", Economic and Political Weekly, Vol. 41, pp. 5367-5375
- Narayanan, S., and Gulati, A. (2002), "Globalization and the Smallholders: a Review of Issues, Approaches, and Implications", MSSD Discussion Paper-50, International Food Policy Research Institute, Washington DC.
- Ramswami, B., Birthal, P. S., and Joshi, P. K. (2005), "Efficiency and Distribution in Contract Farming: The Case of Indian Poultry Growers", Discussion Paper, Indian Statistical Institute, New Delhi.

Appendix

Table 1: OLS estimates of Cobb-Douglas production function for sample farmers

Variables	Contract farmers			Non-contract farmers	Contract and non-contract farmers[c]
	Paddy seed (CC)	General paddy (NCC)	Aggregate[b] (CC & NCC)	General paddy (NCC)	NCC
Constant (α)	-2.98 (7.8)*	-2.60 (-3.70)*	1.06 (0.96)	-6.74 (-4.14)*	-1.80 (3.16)**
Land (β_1)	0.10 (0.46)	0.10 (1.21)	0.77 (4.38)*	0.10 (1.55)*	0.10 (3.19)**
Labour (β_2)	0.59 (4.92)*	0.32 (2.76)*	0.016 (0.11)	-0.26 (-3.06) *	0.21 (2.39)**
Chemicals (β_3)	0.27 (4.16)*	0.13 (2.17)**	0.11 (1.60)***	0.10 (0.26)	0.10 (1.42)
Power (β_4)	0.10 (1.45)	0.43 (5.67)*	0.08 (1.68)**	0.56 (4.97)*	0.45 (5.93)*
Region (β_5)	0.15 (3.80)*	-0.10 (-2.00)**	0.01 (0.97)	0.26 (0.05)	-0.1 (-2.05)**
Dummy (β_6) Contract crop =1, Non-contract crop = 0			0.19 (1.60)***		
Dummy (β_7) Contract farmers=1, Non-contract farmers= 0					-0.26 (-5.09)*
Adjusted R^2	0.95	0.96	0.95	0.95	95
No of observation	81	81	162	69	150
F	0.00	0.00	0.00	0.00	0.00

Note: CC= Contract crop and NCC = Non-contract crop; Figures in parentheses shows the t-value
*, ** and *** shows the significant level at 1%, 5% and 10% respectively.
(b) In this equation both contract and non-contract crops grown by contract farmers pooled together and taken contract dummy as independent variable.
(c) In this equation both contract and non-contract farmer pooled together and taken the contract dummy as independent variable.

Table 2: Sample selection model maximum likelihood estimates: production function of rice among contract and non-contract farmers

Variables	Constant (α)	Land (β_1)	Labour (β_2)	Power (β_3)	Chemicals (β_4)	Type of farmer (β_5)
Coefficient	-1.49	0.13	0.10	0.49	-0.04	-0.33
Z-Value	-1.38	3.55*	0.47	2.89**	0.63	-2.79**
χ^2				0.00		
Rho				-0.01 (-0.02)		
Log Pseudo likelihood				-35.32		
Lnsigma				--1.88 (-18.98)*		
Number of Observation				150		

Note: The standard errors are robust.
*and ** shows the significant level at 1% and 5% respectively

Table 3: Frequency distribution of farm-specific technical efficiency in stochastic production frontier

Technical Efficiency (%)	Contract farmer		Non-contract farmers
	Hybrid paddy seed (CC)	Normal Paddy (NCC)	Normal paddy (NCC)
50-59	2 (2.5)	1 (1.2)	
59.01-69	2 (2.5)		1(1.4)
69.01-79	5 (6.2)	10 (12.3)	6 (8.7)
79.01-89	37 (45.7)	32 (39.5)	23 (33.3)
89.01-100	35 (43.2)	38 (46.9)	39 (56.5)
Total	81 (100)	81 (100)	69 (100)
Mean	89	87.47	89.58
Difference (t)	1.78***		2.11**

Note: **, ***shows the significant at 5% and 10% level respectively
Figure in parentheses shows percentage of total.

Table 4: OLS estimates of factors influencing farm-specific production efficiency

Variables	Contract farmers		Non-contract farmers
	Hybrid paddy seed (CC)	Normal paddy (NCC)	Normal paddy (NCC)
Constant	0.84 (8.04)*	0.85 (19.20)*	0.89 (22.15)*
Age of farmer (number of years)	0.01 (1.01)	0.01 (0.93)	-0.001 (-1.15)
Education (number of years)	-0.01 (-0.60)	0.01 (1.76)***	0.01 (2.18)**
Times of pesticide use	0.10 (2.67)*		
Times of fertilizer use	0.05 (2.03)**		
Family size (14-65 years)		-0.01 (-1.44)	0.002 (0.67)
R^2	0.20	0.23	0.30
	Prob > F*	Prob > F*	Prob > F*

Note: *, ** and *** show the significant at 1%, 5% and 10% level respectively.
CC = contract crop and NC = non-contract crop.
Figure in parentheses shows t-value.