Determinants of Farmers' Participation in Farmers-Agribusiness Linkage and Its Implication for Income Distribution in Sri Lanka

—A Case Study of Hybrid Maize Production—

Mohamed Esham (The United Graduate School of Agricultural Sciences, Tottori University)

Koichi Usami (Faculty of Agriculture, Yamaguchi University)

Hajime Kobayashi (Faculty of Agriculture, Tottori University)

Ichizen Matsumura (Faculty of Agriculture, Tottori University)

1. Introduction

In Sri Lanka, small farmers constitute the bulk of agricultural production and about 64% of all farmers own less than 0.8 ha of land. In the context of rural development and poverty reduction, the growth and commercialization of agriculture cannot be achieved without improving the efficiency and economic viability of the small farmers. Research throughout the developing world has shown a potentially strong relationship between agribusiness investments in small farmer agriculture and poverty reduction (Dorward et al., 1998). Accordingly, farmers-agribusiness linkages (hereinafter referred to as linkage) have received a renewed attention as a means of getting the agribusiness industry more involved in the development of small farmers. Given the failure of the public extension system in the country to address the problems of rural farmers, involvement of the agribusiness industry has become more imperative. Majority of such linkages found in Sri Lanka, however, are based on contract farming. Critiques of contract farming argues that contract farming as an institution favors larger wealthier farmers while marginalizing farmers and communities that do not participate in contracting (Korovkin, 1992; Little and Watts, 1994). In the context of such empirical evidence, the following two research questions were addressed in this paper. First, how can we increase small farmer participation in the linkage? Second, does the linkage contribute to poverty reduction in rural Sri Lanka? Thus, the present paper examines the determinants of farmers' participation and the impact on income distribution towards

developing a rural development strategy for Sri Lanka.

2. Methodology

2.1 Data and study area

The study area was located in three remote villages in *Moneragala*, one of the countries poorest districts, ranking well below the national average on household income, employment, literacy and access to safe water, electricity and sanitation (National human development report Sri Lanka, 1998). The main economic activity in the area is farming (maize and paddy). Farming is mainly practiced in the *Maha* season (October-March) under rain fed conditions while no major cultivation is done in *Yala* season (April-September) due to lack of rainfall. For the case study, one of the two largest contract farming operations in the country, hybrid maize production was selected. Data were collected by a field survey of participant farmers in hybrid maize production contract and non-participant farmers. From two farmer organizations (firm-initiated) in three villages 55 farmers participating in hybrid maize production and 45 non-participant farmers were selected and interviewed. The interview with farmers (participants and non-participants) consisted of three parts. The first part was about the demographic information. Second part was on crop production, farm income and non-farm income. The final part was to measure three entrepreneurial behavioral dimensions (investment preference, innovativeness and opportunity seeking) by a five point likert scale with nine statements¹⁾.

2.2 Model

It is necessary to take into account the issue of selection bias in estimating the impact of participation in the hybrid maize production scheme on household income. There may be reasons for participants in the linkage to earn a higher income than non-participants that are independent of the hybrid maize production scheme. For example, if the participants' management skill is unobservable and positively correlated with participation and income, they would earn a higher income irrespective of participation. Therefore, a simple regression of income on a dichotomous variable that indicates participation will overestimate the impact of participation on income. The most common method used to deal with this problem is Heckman (1979) two-stage approach. In this approach, in the first stage, a probit model is used to estimate participation.

$$P_i = \alpha Z_i + u_i$$

Where P_i is a dummy variable (1 for participants and 0 for non-participants). Z_i is a set of all observed factors that may account for participation in the scheme and u_i is a random error term, which is assumed to be normally distributed to take account of unobserved factors that influence participation in the scheme. From this equation, the inverse of Mill's ratio (M_i) is computed, which is then inserted into a second stage outcome equation to estimate impact of the scheme.

$$Y_i = \beta X_i + \gamma P_i + \delta M_i + \varepsilon_i$$

Where Y_i is household income. X_i are characteristics affecting household income. A similar approach was used by Warning and Key (2002) to estimate the impact of contract farming on the income of participants.

Figure 1 Operation of the contract farming scheme

Note: *: Extension is provided by maintaining demonstration plots.

3. Hybrid maize production scheme

This scheme was initiated in 1998 by the largest feed processing firm in Sri Lanka, Ceylon Agro Industries. At present, the firm provides inputs to about 3,000 farmers and Maize is cultivated in over 2,000 ha. In this operation, a forward contract between farmers and the agribusiness firm is signed. The forward contract is a legal agreement between the agribusiness firm and farmer, whereby the former agrees to buy maize of specified quality at a pre-determined price (a cost plus price is fixed by the agribusiness firm) on a future date, while the latter agrees to deliver the specified quantity. A bank facilitates the forward contract by requiring the farmers to voluntarily form farmer groups for obtaining credit. A farmer group consists of 5-7 members. Once farmer groups are formed, farmer group enters into a credit agreement with the bank. The bank channels the credit to the agri-

Table 1 Area cultivated, farmers participated and loans distributed

Season	Farmers (person)	Area (ha)	Production (metric ton)	Loan distributed (Rs million)
2000/01	143 (24)	98	-	0.8
2001/02	374 (59)	229	655	2.2
2002/03	477 (77)	310	860	3.3
2003/04	783 (117)	492	-	6.2

Source: Seylan Bank Moneragala.

Notes: 1) Numbers in parenthesis are the number of groups. The data are for 5 farmer organizations and 200 farmers in 28 farmer groups that are not organized into farmer organizations.

2) Value of Sri Lankan rupee: 1 US dollar = Rs 98 (December, 2003).

business firm and the crop insurance premium to the insurance company. The agribusiness firm provides inputs and extension service to farmers with the assistance of farmer organizations formed by aggregating the farmer groups. The major role of the farmer group is to monitor and ensure the loan agreement is implemented while the farmer organization coordinates and monitors the contract. The operation of this scheme is schematically presented in Figure 1.

Data relating to the entire operation of this scheme in the district of *Moneragala* is shown in Table 1.

4. Comparison of agricultural resource endowments of participant and non-participant farmers

As shown in Table 2, participants and non-participants do not differ in terms of family labour endowment, arable land owned, area cultivated, number of draft animals owned or value of agricultural equipments owned. Therefore, participant farmers cannot be distinguished statistically from non-participant farmers based on agricultural resource endowment. However, participant farmers are better off than non-participants with regard to resource utilization particularly labour use as participant farmers belong to farmer groups exchanging labour. Besides, they have advantages in tractor use as the participant farmers' maize fields are located close to one another.

5. Determinants of farmers' participation

The first stage probit analysis included variables related to household characteristics, resource endowment and entrepreneurship behavior that were thought to influence the decision to participate in hybrid maize production. The result

of the probit analysis is shown in Table 3. Among the variables, age, education, investment preference and opportunity seeking were statistically significant. Age is a proxy variable for farming experience while education is a measure of farmers' ability to interpret information. Age or farming experience was significant probably because maize was a traditional crop that has been cultivated for many years by these farmers (in a separate analysis²⁾, the age was found to be negatively associated with participation in non-farm employment). As a whole, the participants were experienced and better informed farmers. Among the entrepreneurial behavioral dimensions investment preference and opportunity seeking were statistically significant. Given few opportunities for the rural small farmers, the entrepreneurial farmers were likely to positively exploit the rare opportunities available to them. Neither credit constraint nor arable land owned was significant, indicating that resource endowment was not a decisive factor influencing participation. As expected, non-farm income was negatively related to participation, however it was not statistically significant probably because the influence of non-farm income on household income was less significant. The distance to the main road was not statistically significant. This is probably due to the role of farmer organization as an intermediary in delivering inputs, extension service and monitoring credit repayment.

6. Impact of participation on household income

As shown in Table 4, the primary source of household income of participants and non-participants is maize production. Due to the remoteness of the villages' opportunities for

Table 2 Comparison of agricultural resource endowments of participant and non-participant farmers

	Participant	Non-participant	t-statistics	p-value
Family labour (adult equivalents)	2.68	2.48	-0.755	0.452
Land owned (ha)	1.23	1.15	-0.931	0.354
Area cultivated (ha)	1.44	1.48	0.182	0.856
Number of draft animals (heads)	3.50	2.90	-0.767	0.445
Agricultural assets market value (Rs)	34,587.05	29,689.74	-0.157	0.876

Source: Based on authors' survey (2003) and analysis.
Note: Value of Sri Lankan rupee: 1 US dollar = Rs 98 (December, 2003).

Table 3 Determinants of farmers' participation in contract farming of hybrid maize

Variable	Coefficient	S.E	Variable	Coefficient	S.E
Age of household head (years)	0.045**	0.018	Distance to main road (km)	0.019	0.119
Education level of household head (years of schooling)	0.171***	0.058	Investment preference ⁺	-0.227**	0.097
Family labour (adult equivalents)	-0.029	0.085	Innovativeness ⁺	0.041	0.089
Arable land owned (ha)	-0.001	0.126	Opportunity seeking ⁺	-0.157*	0.090
Credit constrained (yes = 0)	-0.301	0.324	Constant	0.082	1.369
Non-farm income (Rs per season)	-1E-05	1E-05	Model $\chi^2 = 100.703$		

Source: Based on authors' survey (2003) and analysis.

Notes: 1) *: 10% significance level. **: 5% significance level. ***: 1% significance level.

2) Sample size: 95 farmers.

3) ⁺: Entrepreneurship is measured by using a five point likert scale, ranging from strongly agree (scored as 1) to strongly disagree (scored as 5). Therefore, a larger score means less entrepreneurial and vice versa, see end note 1) for more details.

salaried employment is low, therefore non-farm income is mainly derived from wage labor in the seasonal agriculture sector (maize and paddy).

The second stage regression analysis included a dummy variable for participation in the linkage, household characteristics (age, education and number of non-schooling adults), farm management factors (area cultivated, agricultural asset value, draft animals, farm record keeping and tractor usage) and the inverse Mills ratio. According to the results shown in Table 5, the explanatory variables: area cultivated for the scale of operation and participation in the linkage were statistically significant. The inverse Mills ratio was not significant, indicating that there was no selection bias. The results indicate that by participating in the contract the farmers can significantly increase their income. The participant farmers by cultivating 0.86 ha of maize (average area of maize cultivated by participant farmers in the sample) are able to increase their household income by Rs 19,731 per season (net household income by Rs 11, 160³⁾ per season). Results from a sample selection model for non-farm employment²⁾ indicated that non-farm employment is equally rewarding as hybrid maize production. However, due to lack of non-farm employment opportunities in the area only 54% and 46% of

non-participants and participants respectively engaged in non-farm employment. Besides, majority of those engaged in non-farm activities were in wage labor in the seasonal agriculture sector with an unstable income flow. Hence, the impact of non-farm income on household income in the study area is less significant than the impact of farm income on household income.

According to Table 6, the farm income of participants was higher than non-participants and the difference was statistically significant at 5% significance level. However, the household income between participant and non-participant farmers was not statistically significant. Furthermore, the predicted household income of participant and non-participant farmers was statistically significant indicating that if the participants had not participated in the linkage their household incomes would be below the non-participant farmers. Therefore, the linkage has not increased income disparity between participants and non-participants but rather reduced income disparity by significantly increasing participant farmers' income in contrary to the results of many contract farming schemes in developing countries (Little and Watts, 1994). These findings further confirm that the linkage has not favored the wealthier farmers at the expense of

Table 4 Share of household income by source

	Farm income				Non-farm income			
	Maize	Paddy	Other	Total	Wage labour	Salaried	Self employment	Total
Participant	69.7(100)	14.8(70)	0.7(7)	85.2	7.4(32)	3.0(7)	4.4(7)	14.8
Non-participant	44.5(90)	20.2(87)	3.3(15)	68.0	17.0(44)	15.0(10)	0	32.0

Source: Based on authors' survey (2003) and analysis.

Note: Numbers in parenthesis are the percentages of farmers reporting involvement in the activity.

Table 5 Impact of participation on household income

	Coefficients	S.E	t-statistics
Dummy for participation (yes=1)	19,730.648*	11682.701	1.688
Age of household head (years)	-321.385	273.247	-1.176
Education level of household head (Years of schooling)	-139.345	934.499	-0.149
Number of non-schooling adults	307.581	2198.222	0.139
Area cultivated (ha)	15,299.843***	2363.449	6.473
Agriculture asset value/ha (Rs) ⁺	2.200E-03	0.024	0.091
Draft animals/ha (head) ⁺	-446.075	764.914	-0.583
Farm record keeping (yes=1)	-2,472.802	5214.363	-0.474
Tractor Usage (yes=1)	321.165	4977.387	0.064
Inverse Mills ratio	-4,478.956	7717.550	-0.580
Constant	23,208.026	13937.937	1.665
Adjusted R ² = 0.46 F (10,79) = 8.46			

Source: Based on authors' survey (2003) and analysis.

Notes: 1) ***: 1% significance level. *: 10% significance level.

2) Sample size: 94 farmers.

3) +: Values are per cultivated area.

Table 6 Comparison of farm income and non-farm income of participants and non-participants

	Participant	Non-participant	t-statistics	p-value
Farm income per season (Rs)	39,012	26,688	-2.371	0.020**
Non-farm income per season (Rs)	6,792	12,540	1.946	0.055*
Household income per season (Rs)	45,804	39,228	-1.183	0.240
Predicted household income per season without participation in the linkage (Rs)	27,215	37,450	2.536	0.013**

Source: Based on authors' survey (2003) and analysis.

Notes: 1) +: Prediction is done by using the actual values for regression variables except participation, which is taken as zero.

2) *: 10% significance level. **: 5% significance level.

3) Farm income = income from all the agricultural activities.

household income = total household income from agricultural as well as non-agricultural activities.

poorer farmers.

7. Conclusion

The participant farmers cannot be statistically distinguished from the non-participant farmers in terms of agricultural resource endowments or household income. However, the predicted household income of participant and non-participant farmers was statistically significant indicating that if the participants had not participated in the linkage their incomes would be below the non-participant farmers. The significant increase in the participant farmers' income has contributed to reduce the income disparity between non-participant and participant farmers. The success of the linkage in terms of income distribution can be attributed to two possible reasons. First, the role of farmer organizations involved in facilitating the linkage. Farmer organizations by assisting the agribusiness firm in selecting farmers, distributing inputs and

providing extension services have given equal opportunity of participation in the linkage for all the farmers. Besides, they have contributed to reduce contract management costs, thereby enabling the development of the scheme. Secondly, hybrid maize crop being a traditional crop that has been cultivated in the area for many decades, the farmers need little knowledge and investment compared to non-traditional high value crops, usually grown by farmers under contract farming. Furthermore, by participating in the linkage farmers were able to significantly improve farm productivity (average yields of participant and non-participant farmers were 3730 kg/ha and 1980 kg/ha respectively) by having access to new technologies like hybrid seeds and fertilizer. Given the chronic failure of the public extension system in the country, combination of farmer organization and contract farming together with cultivation of hybrid and improved varieties of traditional crops could be a possible solution to

increase small farmer participation by ensuring equal opportunity of participation for all the farmers in the community. Besides, strong farmer organizations are capable of overcoming the bias of contract farming towards larger wealthier farmers. The empirical analysis also illustrates the importance of entrepreneurship to increase farmer participation. In the context of rural development, rural entrepreneurship development should be given due consideration for further development of the linkage from the viewpoint of increasing the participation of the poor.

Notes

- 1) Entrepreneurial behavior was measured by a five point likert scale. For each item, there were 5 response categories, namely "strongly agree", "agree", "neither agree nor disagree", "disagree" and "strongly disagree" and scoring was done by assigning 1, 2, 3, 4 and 5 points respectively. The items were as follows: Investment preference (measured in terms of willingness to invest in farming) such as (1) take a loan to expand my farm business, (2) use adequate amounts of fertilizer to get an optimum yield and (3) buy higher quality seeds even if the price is high. Cronbach's alpha 0.79; Innovativeness (measured in terms of willingness to do something new) such as (1) practice new methods in farming, (2) crop cultivation during off-season and (3) try new fertilizer and agro chemicals. Cronbach's alpha 0.69; and Opportunity seeking (measured in terms of willingness to seek for new information) such as (1) read and listen to agriculture news in newspaper and radio, (2) decide the crops I plant based on market information and (3) attend farmer-training programs. Cronbach's alpha 0.69.
- 2) A two-stage sample selection model was estimated to determine the impact of participation in non-farm employment on household income. Age and arable land owned were negatively associated with the deci-

sion to participate while number of adults in the household and education were positively associated. The OLS regression indicated that by participating in non-farm employment income could be increased by Rs. 12,801 per season.

- 3) The credit provided per hectare of maize including inputs (seed and fertilizer) and the insurance premium is worth Rs 9,966 per hectare. On average participant farmers in the sample cultivate 0.86 ha of maize therefore the input cost including insurance premium is Rs 8,571 ($9,966 \times 0.86$). Thus, net returns of a farmer cultivating 0.86 ha would be Rs 11,160 ($19,731 - 8,571$).

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