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PROFITABILITY OF SEMI-SUBSISTENCE RICE FARMING IN THE KALUTARA DISTRICT UNDER RAIN-FED CONDITION

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ABSTRACT

Information on cost of cultivation in recent years indicates that farmers consistently incur losses from rice cultivation under rain-fed conditions in wet zone districts of Sri Lanka. When production is subsistence oriented, farm-gate prices do not reflect the marginal revenue (price) to the farmer. Therefore, this study develops a method to assess farm-output by marginal revenue of produce. Profitability parameters for rice-farming in the Kalutara district were re-estimated for 1990-2005 period using retail, wholesale, and farm-gate prices to assess the output portion consumed by farm-family, the portion sold after custom-milling and the portion sold as un-husked rice respectively. This study estimated that the gross returns, profit, returns to family labour, and returns to investment were significantly higher than the estimates of the conventional analysis. These estimates were attractive to the farmer and implied financial viability in a consistent manner. The previous studies on comparative disadvantage in wet zone rain-fed rice farming and the failure to respond to incentives were erroneous and may require further analysis.

KEYWORDS: Profitability parameters, Rice, Subsistence farming.

INTRODUCTION

Rain-fed rice farming in Sri Lanka, in general, is a semi or full-subsistence oriented crop enterprise of which major portion or all of the produce is consumed by the farm-family. The aggregate rice production within most of the wet zone districts such as Kalutara, Gampaha, Colombo and Kandy are adequate only to meet a small portion of the demand in the districts. Therefore, a relatively high margin between retail price of processed rice and farm-gate price exists in such districts due to the existence of high deficit demand and lack of economies of scale in assembling and marketing of un-husked rice. As such, farmers can earn an extra income by selling milled rice in comparison to selling un-husked rice. Therefore, farmers in such districts mill a portion of their rice in custom- mills and sell to the retailers. Farmers receive the wholesale price, which is substantially higher than the farm-gate price, from the retailer.

Since 1978, in the computation of cost of cultivation and profitability parameters in the Cost of Cultivation (COC) study series, the Socio-Economics and Planning Centre (SEPC) of the Department of Agriculture (DOA) has been assessing farm production by farm-gate price of un-husked rice. The opportunity cost of processed rice consumed by the farm-family is the retail price minus storage and processing costs. Somarathna,

(1987) and Rupasena, (2000) have independently reported that rice farmers in Sri Lanka generally receive only 60% of the retail price when sold as un-husked rice; and the balance 40% is spent on processing and marketing costs. Since the gap between the opportunity cost of family-consumed rice and farm-gate price of un-husked rice is sizeable, not incorporating family subsistence and value of output sold after custom-milling in computation of farm profitability might lead to substantial error when the production is primarily used for consumption by the household and the balance is sold generally as milled rice.

Cost of production and profitability estimates are directly used for making price policy decisions in Sri Lanka. In addition, they are used to measure economic efficiency of production and levels of incentives for production by researchers and policy analysts. Such analysis based on inaccurate estimates of cost of production and profitability would lead to misleading conclusions on comparative advantage, levels of protection and thereby to wrong policy recommendations. Hayami and Herdt (1978) showed the importance of taking family consumption into consideration in estimating welfare impacts of policy interventions on semi-subsistence crop enterprises. Shilpi (1995) also indicates that accounting subsistence is needed for accurate estimation of Domestic Resources Cost coefficients. However, previous studies on comparative advantage and analysis of social benefits of rain-fed rice farming (Aberathna *et al.*, 1990; Shilpi, 1995; Rafeek and Samarathunga, 2000) have not taken family subsistence into consideration in their estimations and all of them concluded that the rice farming in the wet zone districts does not have comparative advantage.

This study has the following objectives:

a) To develop a method of incorporating the benefits of family subsistence and selling custom-milled rice into the computations of profitability parameters
b) To re-estimate profitability parameters in the Kalutara district during the period from 1990 to 2005 using the above method
c) To compare the above estimates with the conventional estimates of profitability parameters to examine similarities/differences.

MATERIALS AND METHODS

Conceptual model

A conceptual model regarding semi-subsistence rice farming is illustrated in Figure 1. All quantities are expressed in un-husked rice form. The annual rice production is Q; farm-family consumption is q_c; farm-family consumption plus the quantity sold to retailers is q_r; and direct sales of un-husked rice at farm-gate prices is $Q-q_r$. The average cost is given by

S'ABGKHS line where average cost of home consumption (S'A) is higher than the average cost of rice production (KH) due to additional costs of processing, storage, and storage losses. The additional costs of marketing keep the average cost of selling to retail stores (BG) above the average cost of consumption (S'A). DCEFLI line is the stepwise marginal revenue (demand) curve of the farmer. After keeping the quantity (q_c) for family consumption aside, the farmer will save q_r- q_c portion for selling to retailers and sell the balance Q- q_r only as un-husked rice. The home consumption (q_c) portion receives an implicit marginal price of P_r (retail price) and, thus has equal marginal revenue. The portion sold after custom-milling receives wholesale price (P_{wh}) and the portion sold directly as un-husked rice receives farm-gate price (P_{fg}). The profit for the farmer is represented by areas S'ACD (home consumption) + BGFE (retail selling) - LIKH (loss in selling un-husked rice). However, the traditional farm profit estimate is area MHIN, a loss in most years due to farm-gate price falling below the average cost of production.

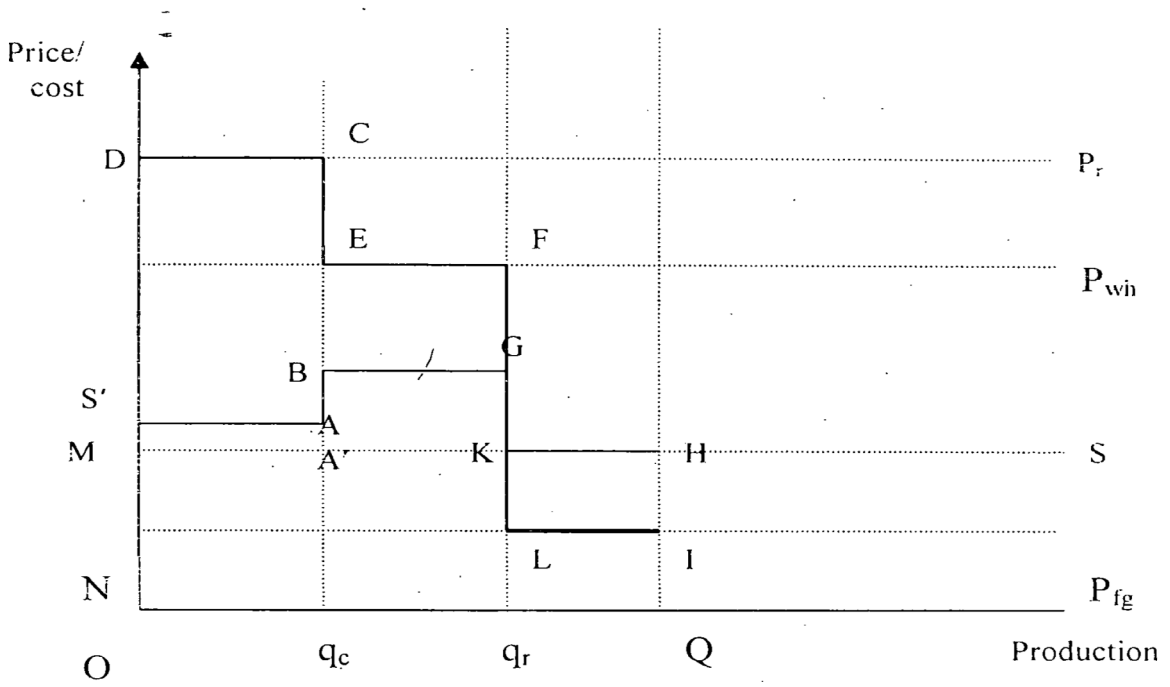

Figure 1. Farm profits with semi-subsistence rice farming.

Area selection

At the time of data analysis, published information on cost of production and profitability information was available only up to year 2005. Therefore, this study was limited to a 16-year period starting from 1990 to 2005. The COC publication series of the SEPC, DOA has consistently covered only Kalutara and Kandy districts to represent rice cultivation under rain-fed condition. In that publication series, missing seasonal data on cost of production and profitability was less in the Kalutara district relative to the

Kandy district during the period of analysis. Therefore, Kalutara district was selected for this study.

Missing information

The COC survey of the SEPC, DOA collects only production, cost and price data. Therefore, to complete the estimation procedure, average family size, amount of rice consumption by the average farm-family, and average farm size had to be estimated for each year.

Estimating average annual un-husked rice production of farm household

Farm household production level depends on average farm size and average yield in *maha* and *yala* seasons. The number of rice land holdings in the Kalutara district has increased from 42113 in 1982 to 60953 in 2000 (Office of the Advisor on Sustainable Development, 2003) which is equivalent to a uniform growth rate of operators of 1.975%/year during this period. This growth rate was used to extrapolate the number of rice farm operators of 60953 reported for year 2000 in the Kalutara district (Department of Census and Statistics, 2003) to the period starting from year 1990 to year 2005. The gross harvested extent published by Department of Census and Statistics for each season during the period of analysis was divided by number of operators to obtain average farm size for the season and farm size was multiplied by average yield reported in COC study for the particular season to obtain average seasonal production by the farm household. Average annual production by the household was estimated by summing the seasonal production of the two seasons.

Estimation of gross value of household consumption to farm household

The opportunity cost of family consumption (Comvalue) depends on retail price of rice, and household consumption of rice. The latter depends on family size and per capita consumption. Therefore, average monthly per capita consumption is multiplied by family size and retail price (adjusted to incorporate processing costs). Comvalue is represented by area $ODCq_c$ - MS'AA' in Figure 1.

$$Comvalue = C.Hh\sum_{j=1}^{12} P_{rpsj} \qquad (1)$$

Where C is the monthly per capita consumption, Hh is the household size; P_{rpsj} is the retail price of husked rice in j^{th} month after adjusting for processing costs and storage costs.

Estimation of the value of the sales of un-husked rice

The COC survey data indicated that farmers sell only about 5% of their produce directly as un-husked rice. Therefore, 5% of the annual production was assessed at farm- gate price to estimate the value of the sales of un-husked rice.

$$Paddyvalue = 0.05(P_{fgy}.Q_y + P_{fgm}.Q_m) \quad (2)$$

Where, Paddy value is the gross value of direct sales of un-husked rice, P_{fgy} and P_{fgm} are the average farm-gate prices in *yala* and *maha* seasons, and Q_y and Q_m are average farm productions in *yala* and *maha* seasons. Paddy value is represented by area q_rLIQ in Figure 1.

Estimation of value of rice sold to retailers after milling

$$Milledricevalue = \sum_{1}^{12} P_{Whj}\{[(0.95Q_y + 0.95Q_m)/12] - [C.Hh] - [STL_j]\} \quad (3)$$

Where, Milled rice value is the value of rice sold to retailers after custom milling, and P_{wij} is the monthly wholesale price adjusted for processing and marketing costs, k is the conversion factor for converting un-husked rice to processed rice, and STL is the monthly storage loss. Since farm-households generally use slack family labour for marketing operations, marketing costs are neglected in this estimation. Milledricevalue is represented by q_cEFq_r area- A'BGK area in Figure 1. The term $[(0.95Q_y + 0.95Q_m)/12]$ represents monthly availability after sales of un-husked rice, whereas the term $[C.Hh]$ represents monthly household consumption.

Estimation of gross value of annual rice production

$$Annualvalue = Comvalue + Paddyvalue + Milledricevalue \quad (4)$$

Where, Annual value is the value of annual rice production to the household.

Estimating weighted average price of un-husked rice

$$Wtaprice = Annualvalue/(Q_m + Q_y) \quad (5)$$

$$\text{Wtaprice} = P_r.\frac{q_c}{(Q_m + Q_y)} + P_{fg}.\frac{(Q - q_r)}{(Q_m + Q_y)} + P_{wh}.\frac{(q_r - q_c)}{(Q_m + Q_y)} \quad (6)$$

Where, Wtaprice is the weighted average price. The average retail price was weighted by the household consumption converted to un-

husked form of rice to annual production ratio; farm-gate price was weighted by direct sales to annual production ratio; and average wholesale price of rice was weighted by the amount sold after custom-milling converted to un-husked form to annual production.

Re-estimating profit parameters

The farm-gate price received in each season was replaced by the estimated Wtaprice for the year in re-estimating gross returns per hectare in rice farming. Then all the profit parameters were re-estimated using re-estimated gross returns and other information on cost of cultivation and profitability statistics for the season. The study mean estimates of the profit parameters were compared with the means of conventional estimates by t-test.

Data and assumptions

The Department of Census and Statistics uses an annual loss of 6% in preparation of food balance sheets. Accordingly, a storage loss of 0.5% per month was assumed. Processing cost is available only for year 2000. Price index for machinery published by the Central Bank was used in adjusting year 2000 processing cost for different years. When monthly wholesale and retail price information is not available, the average prices were adjusted using monthly price index developed by Rupasena (2000). The average family sizes of the district were taken from Department of Census and Statistics. However, family size data were not available for all the years. An exponential trend projection from available data showed that the annual growth rate of family size was -4.85% /year, implying a decline. Accordingly, for years for which family sizes information was not available, projections were made based on the trend. The average monthly per capita consumption for the rural sector is 9.17 kg/year (Central Bank, 1999), and this was assumed to have prevailed throughout the period of analysis. Further, a perfectly inelastic demand for consumption by the household and perfectly inelastic household supply of custom-milled rice is assumed.

RESULTS AND DISCUSSION

Means of profit parameters

The means of estimated profit parameters for the period of analysis along with the means of conventional estimates of SEPC, DOA are presented in Table 1. The difference between the means of annual price, gross income, profit including imputed cost of family labour, and net return to capital were highly significant for both *maha* and *yala* seasons, and the differences of the means of the two categories of estimates were sizeable for both seasons for all profit parameters. The high percentage increases of this

study estimates over the conventional estimates indicated that neglecting the importance of family subsistence and arbitrage opportunity of selling custom-milled rice had led to substantial underestimation of the value of rice produced under rain-fed condition to farm-family. The return to family labour/wage ratio is above one in both *maha* and *yala* seasons in study mean estimates compared to ratio below one in conventional estimates. This ratio above one implies that the rice production business can pay the cost of family labour and retain some margin for land and management. The net returns to capital above 17% in the study estimates for both *maha* and *yala* seasons imply that rice farming is an attractive business venture for investment as this rate is comparable with market interest rates which prevailed during the period of analysis. We have not incorporated the food-security premium of the rice farmer in growing his staple food in our analysis.

Table 1. Means of estimated profit parameters (1990-2005) in 2005 prices.

Parameter	*Study*	*Conventional*	*Difference*	*% increase over conventional*
maha seasons				
Price Rs/kg	26.87*** (5.57)	19.27	7.6	39
Gross income Rs/ha	64485*** (-5.91)	48232.0	16523.0	42
Profit including imputed cost Rs/ha	9289*** (-3.88)	-5196.0	14485.0	
Profit excluding imputed cost Rs/ha	32058*** (-5.04)	12544.0	19514.0	156
Return to family labour Rs/day	642 (-5.83)	224.0	418.0	187
Return to family labour /Wage Ratio	1.80	0.63	1.17	
Net Return to Capital %	17.28*** (-4.19)	-8.62	25.90	
yala seasons				
Price Rs/kg	27.80*** (3.83)	21.58	6.22	29
Gross income Rs/ha	67973*** (-4.38)	52408.0	15565.0	30
Profit including imputed cost Rs/ha	12748*** (-5.92)	-7761.0	20509.0	
Profit excluding imputed cost Rs/ha	26010*** (-5.04)	13036.0	12974.0	100
Return to family labour Rs/day	637 (-4.46)	275.0	362.0	132
Return to family labour /Wage Ratio	1.72	0.74	0.98	
Net Return to Capital %	24.64*** (-4.19)	-14.33	38.97	

Figures in parenthesis are t ratios
*** Significant at 1% level

Despite that deficiency in the analysis, the results implied that rice farming in the Kalutara district under rain-fed condition is an economically rational business venture for the family. Since the previous studies of comparative advantage and welfare analysis also have neglected the importance of family subsistence and arbitrage opportunity in selling custom-milled rice, conclusions reached in such studies also may have been erroneous, and may not have represented the reality.

The change of profit parameters over time

The time trends of the profit parameters of price, yield and gross income are presented respectively in Figure 2, Figure 3, Figure 4, and Figure 5. Figure 1 indicates that retail price of processed rice, weighted price, and farm-gate price of un-husked rice have been declining during the period. This situation is associated with trends in world rice prices, and the growth in domestic rice production during the period. The yields of both *maha* and *yala* seasons have shown a mild growth during the period (Fig. 3). The gross income per hectare also has been declining with annual fluctuations (Fig. 4). Apparently, the mild growth of yield has been offset by the decline of the real prices. Despite the decline in gross income, profit including family labour has not shown a clear declining trend (Fig. 5). Since the period of analysis is 16 years, farmers have reduced the cost of production by adjusting their resources use. They might have reduced inputs that had relatively higher growth in prices. One such example is labour where 0.7 bushels of un-husked rice was needed to pay daily wage in 1990 *yala* season increased to 1.1 bushels in year 2005. Farmers have responded to this situation by reducing labour use of 118 per hectare in 1990 *yala* to 75 units per hectare in 2005 *yala* season (DOA, SEPC). This implies that the farmers are rational in responding to changes in price structure.

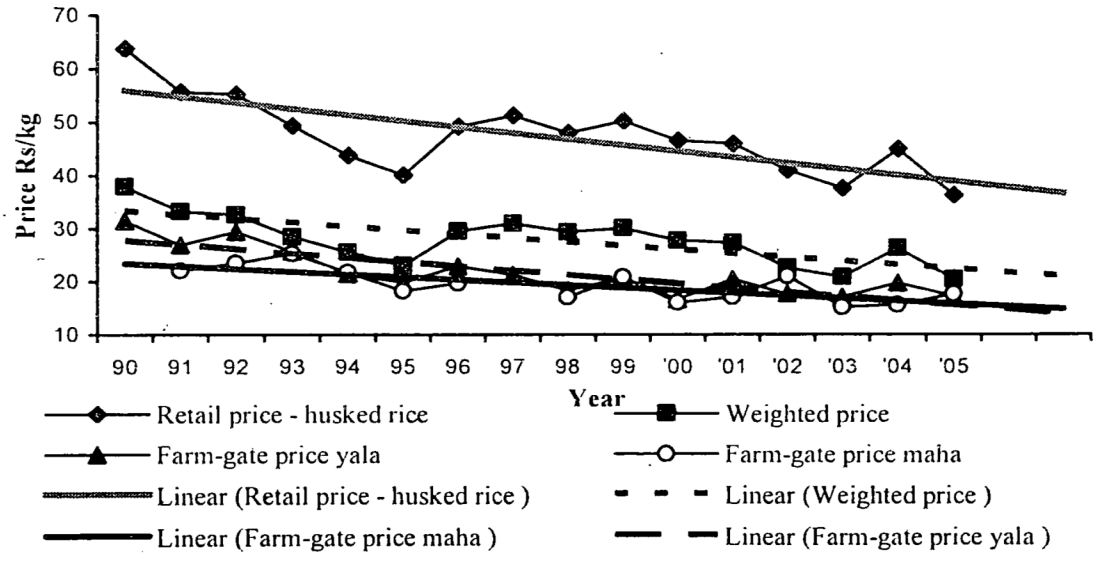

Figure2. Change of rice real prices in the Kalutara district during 1990-2005.

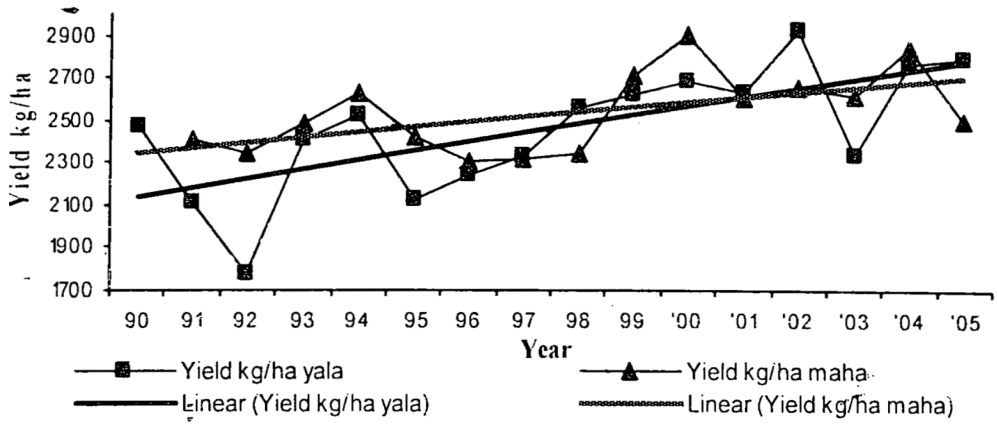

Figure 3. Yield of un-husked rice in the Kalutara district during 1990-2005.

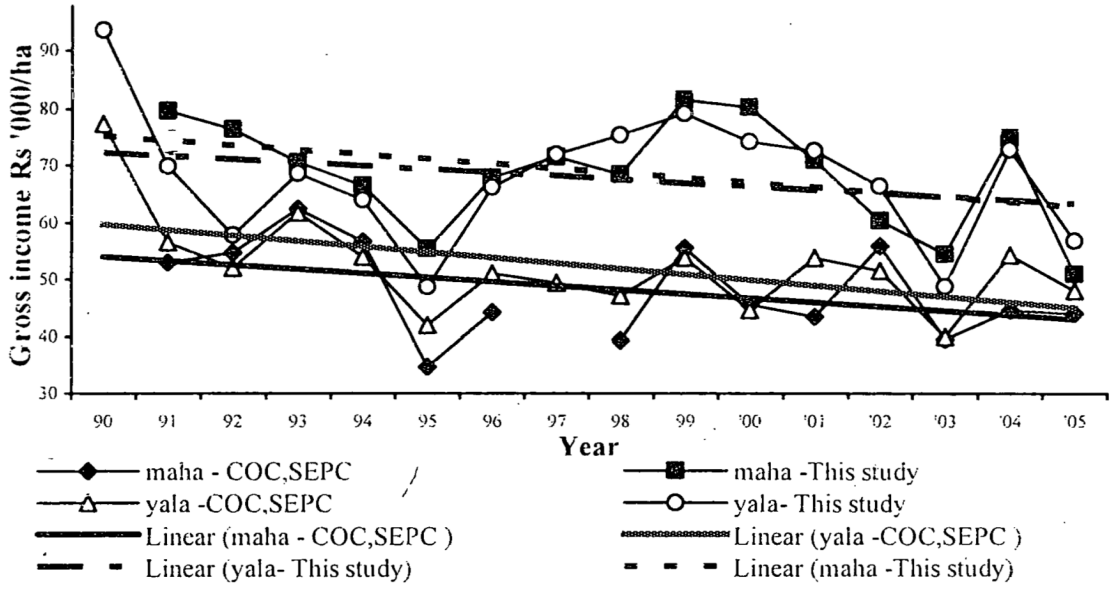

Figure4. Gross income (in 2005 prices) of rice farming in the Kalutara district, 1990-2005.

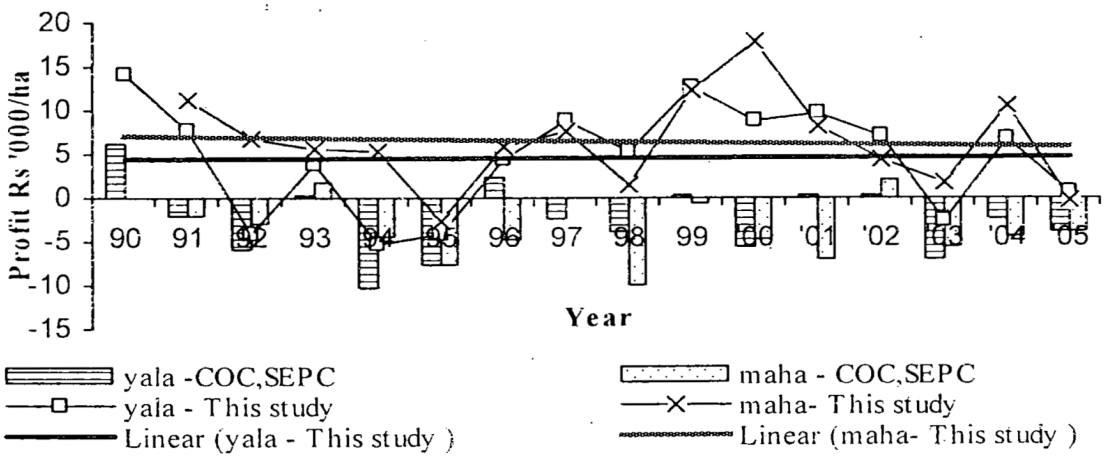

Figure 5. Profit (in 2005 prices) including imputed cost in rain-fed rice in the Kalutara district, 1990-2005.

CONCLUSIONS

A method was developed to assess the value of rice production by marginal revenue of the produce and the method was applied to the Kalutara district to estimate profit parameters during the years 1990-2005. The study estimates of gross returns, profit, returns to family labour, and returns to investment were significantly higher than published COC study estimates. Rain-fed rice farming in the Kalutara district has been profitable in most of the recent seasons and given reasonable returns to land, family labour and attractive rates of returns to investment. Apparently, it is a production business venture with positive profit expectations.

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REFERENCES

Aberathne, F., N. Edirisinghe, W.G. Somaratne and P. Wickramaarachchi. 1990. Efficiency of rice farming and issues relating to protection. Sri Lanka Journal of Agricultural Economics 1: 16-25.

Central Bank, 1999. Consumer finances and socio economic survey 1996/97. Central Bank of Sri Lanka, Colombo, Sri Lanka. 480-481p.

Department of Agriculture, Socio-economics and Planning Center. Cost of cultivation of agricultural crops. Agricultural economics study, Issues No.46-80.

Department of Census and Statistics. Bulletin of selected retail and producer prices. Issues between years 1990-2005.

Hayami, Y. and R.W. Herdt. 1978. Market price effects of new rice technology on income distribution. In Economic Consequences of New Rice Technology. Pp 283-301. International Rice Research Institute. Los Banos, the Philippines.

Office of the Advisor on Sustainable Development. 2003. Profitability and sustainability of rice production in Sri Lanka. Level 12, West Tower, World Trade Centre, Colombo 01. 48 p.

Rafeek, M.I.M. and P.A. Samarathunga. 2000. An analysis of the competitiveness of the rice sector in Sri Lanka. Annals of the Sri Lanka Department of Agriculture 3:263-267.

Rupasena. L.R. 2000. Review of paddy prices. In Hector Kobbekaduwa Felicitation Volume, Eds. S.G. Samarasinghe. Pp 257-269. Hector Kobbekaduwa Agrarian Research and Training Institute, Colombo 07.

Shipi, 1995. Policy incentive, diversification, and comparative advantage of non-plantation crop sector in Sri Lanka, World Bank Report, Sri Lanka. 1-48 p.

Somarathna, W.G. 1987. Some aspects of paddy/rice marketing in Sri Lanka. M Sc. Thesis. Department of Agriculture Economics. Wye College, University of London, England. 28 p.