

DECISION MAKING IN SMALLHOLDING RUBBER : ATTITUDES TO REPLANTING IN SRI LANKA

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SUMMARY

This paper presents some early results of an enquiry into the major influences behind replanting decisions of the small rubber growers of Sri Lanka. It interprets farmers' responses within the framework of a multi period profit maximisation model and discusses the relevance of this type of approach for understanding smallholding investment behaviour.

In 1975 a survey of 165 smallholdings was conducted in the Colombo, Kalutara and Ratnapura Districts. The aim of the survey was to gain information about how smallholders made their decisions to replant rubber, the type of factors they saw as particularly relevant in influencing these decisions and what was their expected outcome. The responses gained showed a wide range of influences at work : the main ones encouraging farmers to replant were the promise of a steady flow of output and a reasonable income, low risk and a lack of viable alternative crops. Negative influences for replanting ranged from too great a need of current income (albeit very low) to cut down their trees, insufficiency of the replanting subsidy and the greater profitability of other perennials.

The responses are presented in a cross tabular form with levels of income, size and other characteristics of holding and the expressed choice of investment policy. Concluding comments are made on several of the main factors influencing replanting attitudes.

INTRODUCTION

An understanding of the decision making process of small farm-households plays an important part in the formulation and effective implementation of policies and programmes in the less developed countries. Aggregate figures on agricultural production are, to a large extent, reflections of the economic decisions taken, under various constraints, by hundreds of thousands of farm-households in the pursuit of their subjective goals and objectives. Their decisions cannot be adequately assessed without an appreciation of the factors which underlie them.

The long-term investment decision cannot readily be separated from a multitude of decisions, both short and long term, made by the farm-household. The choice of a particular crop (or activity) takes place in the normal course of the attempt to maximise some form of a multi-period utility function: it is only within such a framework that a synthesis can be achieved between the widely differing approaches made to the problems posed by smallholder behaviour. Such approaches range from those that virtually exclude all 'non-economic' factors to those that emphasise the primacy of such factors over the purely 'economic' factors. The weaknesses and inadequacies of such approaches are to a large extent the product of the difficulties of specifying a model that, while capturing all the complexities of the decision making environment of the smallholder farmer, is also conducive to mathematical manipulation and capable of empirical verification. All the normal problems of models with multiperiod utility maximisation become confounded with the intricacies and complexities of the smallholder farm-household with its own unique features which distinguish it from the firm, and often from the farm/firm as conceived in much of the literature.

We do not attempt to present such a model; our objective is much more limited. What is outlined is a simplified model of asset replacement having as its objective function profit maximisation, which has however, the desirable property of incorporating expectations and time preference. These can, to a certain extent, subsume the effects of some of the important non-economic factors that may influence decision making.

The implications of the model for the particular problem of rubber replanting are briefly outlined. As the overall relevance of the model to smallholders replanting performance should be assessed in the light of historical information as well, brief reference to the period 1953 — 74 is made. The paper presents some of the data obtained from the survey to give a general picture of the attitudes of smallholders to the replacement problem which in this context illustrates the problems associated with long term investment decisions.

DECISION MAKING

Given the assumption of a profit maximising decision maker, the relevant objective function for a long term investment decision involving considerations of time preference would be the (maximisation of) expected net present value of the future revenue(s).

Application of this to the problem of replacement of a productive asset produces an optimality criterion which reduces essentially to the following decision rule: the asset should be replaced when the expected returns from the present asset (when its productivity is declining) begin to fall below the highest annuity that can be obtained from its replacement by the best 'challenger' (Perrin, 1972). The replacement of rubber trees is an example of such a decision.

Consider the problem faced by a rubber grower, who owns trees with declining yields. Then the optimal replacement dates, under different sets of conditions can be illustrated diagrammatically (Fig. 1).¹

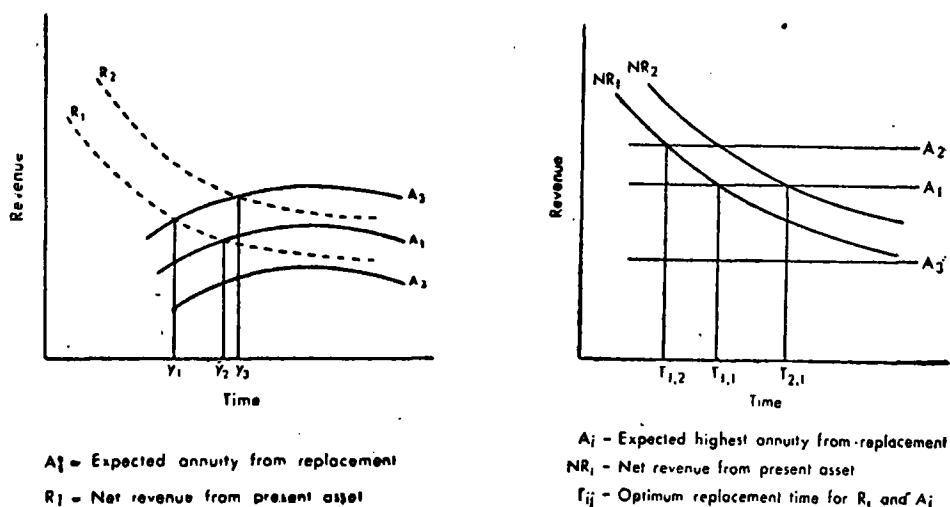


Fig. 1.

¹ Under the assumption that a tree's salvage value is insignificant, the revenue curves will refer to revenues from the exploitation of the tree for latex.

There are three alternative choices facing the farmer.

- (a) If the expected annuity from replanting is greater than the revenue from his present stand of trees he will replant.
- (b) If the revenue from his present stand of trees is higher than the expected annuity he will delay replanting.
- (c) If he expects a higher annuity from an alternative (crop) than both the revenue from the present trees and from possible replanted trees then he will shift from rubber.

It is useful to discuss the manner in which the optimal replanting date changes with changes in the expectations of prices, yields, and costs, and of discount rates (subjective) and subsidies (and taxes).

(1) *Yield expectations* will be influenced mainly by technological changes. However, depending on whether such changes are embodied or disembodied their effect on the replanting date will vary.

- (a) Embodied technological change (improved clone) will raise the expected yields of a stand of replanted trees. Other things remaining constant the effect is to raise the annuity curve (A) while the net revenue (NR) curve remains at the same level resulting in *earlier* replanting.
- (b) The effect of disembodied technological change (stimulant) is to raise both the net revenue and the annuity curves. Since the effect is not only to raise the curves but change their shapes (e.g. possibly making the annual profit function more or less steep in the final years) the direction of change in the optimal date cannot be predicted.

(2) Since the impact of a change in cost expectations will, in general, be the converse of a change in price expectations, only the latter case will be outlined here.

When discussing the effect of changes in *price expectations* it is important to distinguish between long term and short term expectations. A rise in long term price expectations, without a corresponding change in short term expectations will shift (A) upwards without affecting the NR curve and will result in an *earlier* replanting. A rise in the short term price expectation only (or, if a change in current price is not seen as continuing for any length of time) will similarly result in a *delay* in replanting. The case where a short term price change induces changes in long term expectations is ambiguous and the result will depend on such factors as the relative magnitude of the change and the rate of discount.

Thus there is no simple relationship between a change in price and the replanting decision. Care should be taken in the specification of the price replanting (or new planting) relationship in the theoretical models and also in the use of price changes to attempt to achieve quick changes in replanting rates.

(3) The *subjective discount rate* will be affected by a large number of factors, including :

- (a) the level and source (s) of revenues.
- (b) attitudes towards risk, risk bearing capacity and changes in expectation about future yield/price/cost variability.

The discount rate and the level of the annuity curve are inversely related ; therefore, a rise in the discount rate will induce a *delay* in replanting.

(4) The result of a *subsidy* for replanting is more clear since it affects only the annuity. An increase in the subsidy will induce earlier replanting and will also make rubber a more attractive investment thus influencing persons to replant.

THE SMALLHOLDER

The term smallholding rubber farmer tends to give the impression that one is dealing with a group whose major economic *activity* centres around rubber. While such cases are not uncommon in Sri Lanka, when applied to all those who own and farm small rubber holdings it tends to give a somewhat misleading impression. Many individuals who fall into this category do not consider rubber farming to be their primary occupation, even though their dependency on the *income* from rubber may be relatively high. If asked to name their occupation they would often mention occupations other than 'rubber farmer'. Whilst the owner may, in general, not reside on his rubber holding, except where it happens to be his only plot of land, it would almost always (over 90 per cent of cases) be in his village.

The average size of holding, which tends to be quite small, is partly a consequence of inheritance laws, which give equal shares of the land to one's children, or, in their absence, to members of one's immediate family. Since, by tradition, either land has been used in common by members of the family or, if divided, has been done so on an *ad hoc* basis, ownership problems are widespread. Since some clarification of ownership is made at the time of a land sale, those who have bought land tend to have firmer (and clearer) titles (and there is evidence that government servants, school teachers and the like have bought land during the past 40 years in the villages contributing to a skewed distribution of land ownership). These conditions have produced small rubber growers of a type which is in many important respects different to those encountered in countries like Malaysia, Thailand and Indonesia. Therefore, the category of 'smallholding rubber farmer' is far from a homogeneous one.

The most common feature is a total rubber holding size of less than 10 acres. There are commonly used divisions on the basis of size ; for example, the smallest of the smallholders (< 2 ac) are differentiated from the rest. Whilst the former group constitutes 65.8% of the total number of smallholders in the country, they own only 2.6% of the total area under rubber. Their average size of holding is only 0.8 ac and as the average size of each plot is 0.7 ac it is reasonable to assume that most of the smallholder farmers in this group have their land in one parcel. By comparison, in the 2 — 5 ac group, the average size of holding is 2.8 ac with the average plot size being 1.5 ac, indicating that such farmers would, in general, have more than one plot of land. In production and processing the smallest farmers use mainly their own family labour (87.7%) and depend on others implements (93.8%) for processing. While precise data is not available there is no doubt that most of them depend largely on rubber for their cash needs, perhaps supplemented by casual work elsewhere (Ministry of Plantation Industries, 1971 — 1972 Survey).

The available national rubber replanting figures, published by the Rubber Control Department are not sufficiently disaggregated to explore any further differences that may exist between these two groups of smallholders. However the fact that 64.2% of the holdings in the < 2 ac are *new* plantings, whereas in all groups the replanted acreage is higher, does indicate that the smallest farmers have never performed well in replanting, which is both more expensive and demanding than new plantings. It is also significant that most of the smallest farmers appear to have planted rubber during the early 1950s which, under the impact of the Korean war boom produced extremely high price expectations.

Such differences between groups of smallholders may lead to significantly different patterns of economic behaviour, with important implications for planning and extension work. Models built try to explain peasant economic behaviour must pay these (and other) differences adequate attention.

The main government policies directed towards encouraging rubber replanting have been a subsidy, a replanting policy of three per cent per annum² and more recently, a floor price scheme. The subsidy is paid to all rubber growers based upon a flat payment over a number of years (calculated on a per acre basis) to replant with improved varieties. It has existed since 1953 and the present rate of payment is approximately Rs. 2,000 per acre. Its main objective has always been to expand the area replanted ; in this it has been successful, particularly in the years up to the early 1960s but with a welfare (distributional) cost which contributed in part to the land reform measures taken in 1973 — 5.³ The floor price scheme was introduced in 1973 and has encouraged replanting by removing some of the uncertainty about the level of future incomes.

Today, rubber farmers with trees which have reached the stage of comparatively low yields face a number of alternatives. They can choose one of the following :

- (1) abandon their land
- (2) sell their land
- (3) replant with rubber
- (4) uproot rubber and plant annual crops
- (5) uproot rubber and plant another perennial crop
- (6) continue to tap their present trees despite the relatively low yields

Whilst (1) has been considerable during the past decade, due to the impact of low rubber prices, very few such cases were encountered in this survey. In any case the survey was conducted in areas which have a relatively high population pressure and consequently this was not unexpected. In several cases abandoning of land was due to disputed ownership.

The holdings surveyed in this study were not selected randomly. The procedure followed attempted to include approximately *equal proportions* of farms with positive and negative attitudes to replanting and also a cross section of farmers by such factors as income, size of holding, sources of revenue, other employment and education level. At the time of the survey no information was available on the actual distribution of smallholding farmers in terms of these factors. Therefore the local Rubber Instructor (Extension Officer) was contacted and asked to locate farms with old rubber trees or low yields and which would be likely to be considering the problem of stand replacement. Every effort was made to cross check the reliability of the answers given within the bounds of confidentiality for the individual farmer and this method proved fairly successful. Where a farmer expressed his intention to undertake a

² The three per cent per annum replacement policy is calculated on a 33 year tree rotation. This policy implicitly assumes a uniform distribution of tree ages which is definitely not the case.

³ Figures reported in the Rubber Controller's Reports for Sri Lanka (1973), show that most of the subsidy funds for the period 1953 — 1974 have been taken up by the estate sector.

particular course of action it was felt that barring unforeseen circumstances, this intention would be carried out. Also it was felt that on average the period between a farmer's response and beginning of his chosen course (if it was not to tap on) was approximately one year. Even if there is some inaccuracy in parts of the data the orders of magnitude for input levels are most probably realistic.

However, as most of the required data consisted in gauging farmers' *attitudes* and *expectations* it was not absolutely necessary to check, say written records, although this was done whenever possible. The data gathered were largely of a subjective nature as decision-making is to a certain extent a subjective process, based nevertheless on a number of actual experiences, results and hopes. What was being sought was not only the attitude or expectation of an individual decision maker, but also the underlying physical and social features of each holding and its ownership group to try to account for why particular opinions were held and hence, why particular decisions were made. It is then, a backward moving process whereby an attempt is made to assess a number of farm/household characteristics grouped by a decision, rather than vice versa. Of course, if the process is 'successful' then the converse will be eagerly applied in other studies to try to justify the investment in time and energy made so far by us and others.

It should be stressed that the nature of the farm selection process was such as to *preclude* the possibility of using the sampled distribution of farmers as a basis for estimating the distribution of the population. In particular the proportion of higher size (Table 1) and income farms (Table 4) and the proportion of replanters in the sample (Table 6) probably overstates their actual proportion in the population.

TABLE 1 : LAND AREA

Type of Land	Area of Land (ac)	Average Size per Holding
Mature Rubber	331.65	2.01
Immature Rubber	85.80	0.52
Abandoned Rubber	84.15	0.51
Total Rubber	501.60	3.04
Other Land	315.15	1.91
Number of Holdings = 165	816.75	4.95

EXPERIMENTAL

The 165 farms surveyed contained 501.6 ac of rubber, with a mean holding size of 3.04 ac, and were situated in the three main rubber growing districts — Colombo, Ratnapura and Kalutara. These districts belong to the region known as the 'wet zone' with an annual rainfall in excess of 100 inches. This rainfall is not evenly distributed, there being markedly drier seasons in January, February, August and September. These, together with withdrawals of some labour for rice harvesting, largely account for seasonal declines in monthly rubber yields. The high rainfall means that interference with tapping is frequent, and more than 300 tapping days are rare; mostly there are around 250 tapping days. Fungal diseases are also more prevalent than in the drier climates of Peninsular Malaysia and Sumatra. The topography of the survey area is generally undulating, with rubber on the slopes and higher grounds, and paddy in the valley bottoms. The topography of the 165

farms accordingly covered a range of conditions, from flat land to steep slopes. All the farmers who were interviewed were Sinhala-Buddhists, reflecting the fact that the rubber smallholders of Sri Lanka are predominantly of this group.

The relationship of rubber with other crops was different in each of the three districts ; for example, in the Ratnapura District tea is grown extensively while in the Colombo District it is seldom grown in close proximity to rubber.⁴ Each of the three districts were adequately provided with extension services and planting materials, fertilizer, pesticides, weedicides and also farm implements were within easy access. Processing facilities (for converting latex into ribbed smoked sheets), when not available on the holding,⁵ were in most cases available at fairly low cost within a mile. Marketing channels were well established and daily price information was reported by radio and newspapers. Smoked sheets could be sold frequently (daily if desired) or stored to allow sales by the month.⁶

Tables 1, 2 and 3 indicate general features of rubber (mature and immature) and non-rubber land, the main types of labour used and the sales frequency. As is typical of most smallholding crop situation more family labour is used for the basic farm tasks than is hired labour, and within these categories there is a size factor which suggests more family labour is used on the smaller holdings and more hired labour is employed as holding size increases (Table 2). Holding size is often seen as a guide to the frequency of sales ; this is borne out by Table 3 where although the most popular sales period is by the month, of those farms selling every couple of days, the smallest farms make up the largest proportion. Alternatively, as holding size increases, so sales tend to be made fortnightly, monthly, or when the price is favourable. This relationship has been noted in other Asian countries⁷ and has to do with size of output, availability of storage space and need for immediate cash income. The importance of off-holding work to bolster total income by adding 'irregular' to 'regular'⁸ income can best be seen by considering Tables 4 and 5. Table 4 shows the breakdown of regular and total income levels by size of rubber holding. Only four holdings have a *total* of less than Rs. 1,000, whilst the next three income groups ranging from Rs. 1,000 — 10,000 have a fairly even total distribution. By size group most smaller holdings have total incomes of Rs. 5,000 or less whilst larger holdings tend to have incomes in excess of Rs. 5,000. If we look at the *regular* income levels of farms we find that 31 farms had an income of less than Rs. 1,000. By size group most smaller holdings had a regular income of Rs. 2,500 or less whilst larger holdings tended towards regular incomes of Rs. 5,000 or more. Therefore, as holding size increased the *irregular* component of total income *diminished* in importance. This point is further illustrated in Table 5 which shows regular income with irregular income. 135 farms had some form of off-farm income of less than Rs. 1,000. As regular incomes rose so the irregular component decreased.

⁴ Although it has not as yet been ascertained, it would not be surprising to find that when each district is examined that ready provision of employment has an important influence on a farmer's willingness to replace his present stand of trees.

⁵ Only 19% of holdings owned rolling equipment and 29% owned a smokehouse. A further 29% used the kitchen smoking technique.

⁶ Storage facilities were more widely possessed than rolling or smoking equipment.

⁷ A feature of studies in India, Thailand and Malaysia.

⁸ 'regular' income : income from rubber, other land or other employment received regularly ;
'irregular' income : casual jobs ; income received from irregular employment ;
Total income : regular plus irregular income.

TABLE 2 : TYPE OF LABOUR WITH AREA OF RUBBER

Type of Labour	Area of Rubber (ac)				Total
	0-1	1-2	2-5	>5	
Owner and Family	20	19	31	5	75
Share Cropping	10	4	9	5	28
Hired	3	8	19	13	43
TOTAL	33	31	59	23	146

(19 missing observations)

The cells in Tables 2 — 12 refer to number of holdings.

TABLE 3 : SALES FREQUENCY WITH AREA OF RUBBER

Sales Frequency	Area of Rubber (ac)				Total
	0-1	1-2	2-5	>5	
Greater than once a week	9	4	7	1	21
Weekly	5	6	8	2	21
Fortnightly	6	8	20	4	38
Monthly	13	12	17	15	57
Price	0	1	8	5	14
Other	0	3	0	0	3
TOTAL	33	34	60	27	154

(11 missing observations)

TABLE 4 : AREA OF RUBBER LAND WITH TOTAL INCOME
(REGULAR AND IRREGULAR) (RS.)

Income Groups	Area of Rubber (ac)									
	0-1		1-2		2-5		>5		Total	
	Reg.	Tot.	Reg.	Tot.	Reg.	Tot.	Reg.	Tot.	Reg.	Tot.
0-1,000	13	1	10	2	7	0	1	1	31	4
1,000-2,500	10	17	7	12	17	15	2	0	36	44
2,500-5,000	9	11	9	10	16	21	4	5	38	47
5,000-10,000	7	9	7	8	11	14	12	13	37	47
10,000	3	4	3	4	9	10	8	8	23	26
TOTAL	42		36		60		27		165	

TABLE 5 : REGULAR INCOME WITH IRREGULAR INCOME

Irregular Income	Regular Income (Rs.)					Total
	0 - 1,000	1,000 - 2,500	2,500 - 5,000	5,000 - 10,000	> 10,000	
0 - 1,000	11	30	37	35	22	135
1,000 - 2,500	14	2	1	2	0	19
2,500 - 5,000	1	3	0	0	0	4
5,000 - 10,000	3	1	0	0	0	4
10,000	2	0	0	0	1	3
TOTAL	31	36	38	37	23	165

To introduce discussion of the applicability of the profit maximising model for this sample the responses to a number of questions will be presented. At this stage only Chi-square⁹ results from cross-tabulations are available but it is hoped that this preliminary work will establish the main types of relationships which will influence subsequent enquiry.

The responses to seven questions will be discussed :

- (1) Have you decided to replant ? (Yes, No). If (1) is Yes :
- (2) Why did you decide to replant ?
- (3) Is the replanting subsidy sufficient to cover your costs of replanting ?

If (1) is No :

- (4) What do you plan to do ?

If the answer to this question is option (a) to tap on ; then,

- (5) Why do you propose to tap for a longer time ?

Or, if the answer to (3) is option (c), to shift from rubber ; then,

- (6) Why would you shift from rubber and to what other crop ?

The options within each question that attracted a significant response will be discussed.

RESULTS

- (1) Have you decided to replant ?

Ninety-three farmers (56%) responded positively (Table 6). The lowest positive response (43%) came from the smallest size of rubber group, whilst the largest

⁹ These results are not reported, as the Tables presented are often composites of several others. However, all of the relationships presented have yielded significant results in their original form and would continue to do so in their present form.

positive response (85%) came from the group with more than five ac of rubber. The in-between size groups followed this trend with 44% and 60% favourable to replanting. The response rates were also tested against total land area, regular income, and irregular income with no appreciable alteration. Responses by total income, broken down into income groups, were also used with those replantings divided up into the type of labour that would be used to replant (Table 7). Twenty-nine farms responded that they intended to use all or mostly family labour for this task, and a majority of these farms had a total income of less than Rs. 2,500. On the other hand 62 farms were planning to use all or mainly hired labour for replanting and in their case total income was above average. As manual labour for replanting is viewed as a low status task it could well be that those farms with sufficient income expressed more interest in having the job done for them than undertaking it themselves. Of course, in practical terms the area to be replanted may have been too great to be handled by family labour, or the opportunity cost too high. There is a 'grey' element in the division of labour on income grounds alone, e.g. of the 24 farms with a total income less than Rs. 2,500, 29 per cent expressed preference for hiring labour. Whether this was to be on a reciprocal basis or had some relationship to distaste for the task or some other reasons, such as unavailability of family labour is unknown.

TABLE 6 : REPLANTING WITH AREA OF RUBBER (AC)

Replanting	0-1	1-2	2-5	>5	Total
Yes	18	16	36	23	93
No	24	20	24	4	72
TOTAL	42	36	60	27	165

TABLE 7 : BREAKDOWN OF TOTAL INCOME GROUPS AND THE REPLANTING DECISION BY THE TYPE OF LABOUR TO BE USED IN REPLANTING

	0-1,000	1,000-2,500	2,500-5,000	5,000-10,000	>10,000	Total
Mainly Family Labour	1	12	7	2	0	22
Mainly Hired Labour	1	5	9	9	2	26
Only Family Labour	1	3	1	1	1	77
Only Hired Labour	0	1	10	14	11	36
Total Replanting	3	21	27	26	14	91 ¹
Net Replanting	1	21	20	18	12	72

¹ Income data for two farms is missing.

(2) (if Yes to (1)) Why did you decide to replant ?

The two most popular responses were an 'expectation of high future yields' and a 'regular future income' from a replanted stand (Table 8). The commonly expressed attitude of small rubber growers that ease of maintenance and protection from theft and disease, is an important 'quality' of the crop ranked poorly as a

prime stimulus to replanting as did expectations of high future prices, value of land will go up, children will benefit in the future, rubber is the best of the available alternatives and the floor price is a guarantee against extremely low prices. It appeared from the attitudes expressed that the major deciding factors were those with which the farmer had experience, *i.e.* low risk or most probable outcomes. The two main responses did not markedly differ with each other by size of total income, apart from a slight tendency to prefer higher yields by smaller income groups and a similar tendency for steady income by larger income groups (Table 8). Certainly no significant preferences were revealed on the basis of total income between these two responses.

TABLE 8 : TOTAL INCOME WITH REASON FOR REPLANTING

Reason for Replanting		0 - 1,000	1,000 - 2,500	2,500 - 5,000	5,000 - 10,000	> 10,000	Total Yes No
Expectation of High Future Yields	Yes	1	17	18	15	6	57
	No	2	4	9	11	8	34
Steady Future Income	Yes	2	10	17	18	7	54
	No	1	11	10	8	7	37
Easy to Protect and Maintain	Yes	1	0	7	5	2	15
	No	2	21	20	21	12	76

(3) Is the replanting subsidy sufficient to cover your costs of replanting ?

Fifty-one farms said it was and 40 farms responded that it was not sufficient (Table 9). Those farms with total incomes of less than average and who predominantly used family labour for replanting replied that the subsidy was sufficient, whilst a majority of those farms which mainly used hired labour for replanting claimed that the subsidy was insufficient to cover costs (Tables 7 and 9). However, amongst those farms hiring replanting labour there was much more disagreement about the sufficiency of the subsidy ; it is suspected that most of those farms claiming insufficiency of subsidy for hired labour did so on the basis of size related problems rather than income grounds. In relation to the subsidy a further question was asked of those farmers who claimed it was insufficient, 'How will you finance the balance ; from savings, credit or current income ?' Of the 40 farmers in this category 29 replied they would be financing it out of current income, and as expected nearly all of this group had incomes in excess of Rs. 2,500. Only eight holdings intended to finance the balance out of savings, and only two holdings stated that they would be using credit facilities, probably indicative of the low level of savings and provision of suitable credit (Table 10).

TABLE 9 : IS THE SUBSIDY SUFFICIENT TO COVER COSTS OF REPLANTING ?

Type of Labour	Answer		
	Yes	No	Total
Mainly Family	18	4	22
Mainly Hired	15	11	26
Only Family	6	1	7
Only Hired	12	24	36
TOTAL	51	40	91

TABLE 10 : METHOD OF FINANCING THE DIFFERENCE BETWEEN REPLANTING SUBSIDY AND ACTUAL REPLANTING COSTS

Method of Financing	Total Income (Rs.)					Total
	0 - 1,000	1,000 - 2,500	2,500 - 5,000	5,000 - 10,000	> 10,000	
Savings	0	0	2	3	3	8
Credit	0	1	1	0	0	2
Current Income	1	1	9	11	7	29
Savings and Current Income	0	0	1	0	0	1
Subsidy Sufficient	2	19	14	12	4	51
TOTAL	3	21	27	26	14	91

(4) (if No to (1)) What do you plan to do ?

Of the 71 farms not replanting which fell into this category, 41 opted to uproot their old stands and plant other crops, 22 to tap on, 4 to abandon their land, 3 to sell and 1 only opted for another course of action. There was a clear size of holding relationship between the choice of tapping on, where 44% of those who chose this option were of the smallest size group whilst in the largest size group no farm chose to tap on. Only 4 farms chose to abandon their land and 3 farms to sell their land (Table 11).

TABLE 11 : AREA OF RUBBER (AC)

Not Replanting	0 - 1	1 - 2	2 - 5	> 5	Total
Tap On	10	5	7	0	22
Abandon	0	1	3	0	4
Uproot, Plant other Crop	12	12	13	4	41
Sell	0	2	1	0	3
Other	1	0	0	0	1
TOTAL	23	20	24	4	71

(5) Why do you propose to tap for a longer period ?

The 22 farms which expressed a desire to do this and were asked further questions relating to yields and income ; 23% replied that yields were still high and 77% responded that they needed current income too badly to cut down their trees and replant them. Of these latter farms most were in the lower income groups.

(6) Why would you shift from rubber and to what other crop ?

Forty-one farmers stated that they would be uprooting and planting other crops. One group of these farmers (63%) gave as their reason that they were looking for higher profits, and were all (with the exception of one farm) going to plant *other perennials* (Table 12). The farms in the smaller income groups tended towards *coconut*, whilst the larger income groups expressed more interest in *tea*. *Cinnamon* and

king coconut were preferred by only 4 farmers and their choice seemed independent of income group. The one farmer who switched to an annual crop was going to plant rice ; this farm was in the largest income group and could be described as an exceptional case and most probably the land would have been unsuitable for rubber.

TABLE 12 : CHOICE OF ANOTHER CROP FOR INCOME REASONS

Other Crop	Total Income					Total
	0 - 1,000	1,000 - 2,500	2,500 - 5,000	5,000 - 10,000	> 10,000	
Coconut	0	2	1	2	0	5
Tea	0	2	6	4	5	17
Cinnamon	0	1	0	0	2	3
King Coconut	0	0	1	0	0	1
Paddy	0	0	0	0	1	1
TOTAL	0	5	8	6	8	27
Other Reason						14
TOTAL	0	5	8	6	8	41

DISCUSSION

The main alternative perennial crops that farmers consider are coconut, cinnamon and tea (where climatic factors are suitable and adequate marketing possibilities are open for the selling of green leaf). Of these, coconut is an important subsistence crop as well, and is quite often grown in home gardens. It has a longer immature period (6 - 10 years compared to 5 - 7 years for rubber). Whilst it is possible to harvest the nuts about once every two months, reasonable yields are often dependent on the level of fertiliser applications. Upkeep and maintenance is not very demanding and it is considered a 'familiar' crop. As for the initial investment for planting, coconut like tea and cinnamon is given a government subsidy towards meeting the costs of planting. In theory at least, HYV coconuts are available to smallholders. In practice this tends not to be the case ; certainly improved varieties are much more readily available for rubber than for coconuts.

Cinnamon, with an immature period of 2 - 4 years, needs relatively little attention for upkeep and maintenance. It is harvested twice a year and is normally done on a sharecropping basis by skilled workers (generally belonging to a particular caste). Tea is the most demanding crop in terms of both capital and labour use for establishment and production. Provided it is kept in good condition, tea can be very profitable and it is capable of continuous yields.

The areas where rubber is located are often not quickly (or successfully) converted to grow another type of crop ; for example, paddy requires irrigable lowland (only marginal rubber land). The alternative seasonal crops that could be planted include vegetables, fruits (such as bananas) and root crops such as manioc (*Cassava*) and sweet potatoes. The gestation period of such crops is very low and the capital investment necessary is also quite small and according to farmers in the areas surveyed, adequate marketing opportunities are available. However, these crops offered greater risks not only due to high rainfall and the possibility of crop damage or failure but also due to predatory animals, including man. These crops are labour intensive, with respect to both growth and protection.

It would seem likely that leaving rubber for another crop nearly always means moving to another *perennial* crop. The decision on this would be influenced by experience, location, cultural practices and often a lack of practicable alternatives. For instance, a farmer who has grown rubber for a number of years has experienced certainly of output and within the bounds of world price fluctuations, a fair degree of income certainty compared to that offered by non-perennial crops.

Common horticultural practices associated with being a rubber farmer do tend to mitigate against leaving the crop : 'sameness' with your neighbours is sought after in many walks of life. Furthermore, government encouragement in the form of subsidies to change to a food crop are not available except for paddy, and for other non-perennial crops only for passionfruit and some spices.

Asset replacement

From the above discussion we can turn briefly to the relevance of the profit maximising model. When using any modelling approach, be it deterministic or stochastic, a simple algorithm or a more complex framework, accurate specification of goals and inputs is essential. In this case our goal is to bring some more light to the subject of explaining smallholder behaviour by looking at one aspect of decision making : asset replacement. To achieve this goal the major influences (so called) on attitudes and opinions should be assessed and, if possible, quantified (specified) into a framework which will assist planners (therefore, hopefully, smallholders) to predict 'most likely' effects of alternative policies. This aim is obviously ambitious ; but if there are any useful byproducts from such efforts they may justify the exercise.

If we postulate that the small rubber grower is in some way a profit maximiser, then his concept or perception (definition) of profit is what we should first seek out. If we assume that he is perceiving profit in money terms then we are on what most economists would see as familiar ground. The main influences to profit making capacity in our present sample would appear to be :

- (1) Size of holding, number of plots ; full or part-time grower, owner or part owner
- (2) Prices ; at least medium to long term trend
- (3) Production costs ; wage labour, processing, transport
- (4) Income ; occupation, location, type of land
- (5) Labour resources ; type, number of family members directly, indirectly sharing/helping on the holding
- (6) Yields ; age of stand, density of planting, cultivation practices
- (7) Risk preferences
- (8) Assets ; apart from land

Other factors too will influence this capacity. Some are :

- (9) Age, sex of the farmer and family age
- (10) Experience, education
- (11) Government policies, profit margins of middlemen
- (12) 'Other' ; including beliefs, inheritance, luck

And if we assume that profit making capacity in some way influences investment decisions then accounting for a majority of the 12 points may take us closer to being able to specify a profit maximising model to explain asset replacement. However we have not progressed far enough to allow definite conclusions to be made on whether farmers are maximisers and if so, whether they maximise a more complex utility function. Furthermore, we have not established to what extent a farmer's decisions are influenced by others, such as village leaders, who may act as innovators in adopting new methods or new crops. What we can comment on are some of these factors that farmers see as important influences in their choice of whether to replant or not and see how these fit into a profit maximisation framework. Five of these factors only, holding size, income, type of labour and prices, the replanting subsidy will be briefly discussed.

Size of holding

As regards size of holding we noted earlier that size, ownership and the number of plots in a holding varies considerably in Sri Lanka. This similarly occurred in the sample, where the impact of size on type of labour, sales frequency, income and consequently on the replanting decision (Tables 2, 3, 4 and 6) was noted. This implies that to explain output levels and perhaps yields per acre, we should take into account size differences. A number of groups within the sample may show similar characteristics of significant difference from those of the population.

Contributing factors to *income* variation will include many of those listed earlier. We are concerned with these to see just why there are behavioural differences (expressed here as attitudes) between income groups. The role and changing mix of regular, irregular incomes (Table 5) should be properly understood to explain variation in behaviour by total income group (Table 4) and ultimately decision making (Table 8). Further, location (proximity to other employment, markets for other crops,) and type of land (size, ownership, physical qualities) will not only help explain the levels of income derived but how attitudes (including risk) to replanting are formed. The differences in *labour* resources for general tapping and maintenance tasks (Table 2) and specifically for replanting (Table 7) varies by size and income. It would be expected that particularly those farms hiring labour will do so on a profit maximising basis.

Prices

The impact of prices⁹ in the replanting decision has to be considered in relation to the price/yield variability of alternative crops. The appeal of rubber and other perennials lies in their relatively stable yields and (except for severe drops in price, levelled partially by the floor price) income flows. Once due account is taken on the influence to tree rotation, following a long gestation period, of a high subjective discount rate amongst most smallholders, then appreciation can be made of why those who think in terms of higher profitability remain with perennials (Tables 8 and 11). More weight is attached to the price *trends* than fluctuations where a continuous income stream is concerned. The impact of *current* price movements may well have no influence on decisions to advance the rate of rotation, in fact an increase in price may have the reverse effect (p. 5).¹⁰ In the 1960s general pessimism reigned regarding long term prospects and hence a substantial price rise in 1973 was still followed by a continued fall in the rate of replanting. This compares well

⁹ Output prices only.

¹⁰ Similarly observed in studies of Malaysian and Thai smallholders.

with the consistent increase in the replanting rate in the 1950s and early 1960s even though there were considerable fluctuations in price within each year. With replacement of an asset like a rubber tree, its quality (age, yields) changes slowly; hence price trends as a relevant factor would be in accordance with profit maximisation.

Replanting subsidy

Tables 9 and 10 illustrate differences in replanting *subsidy needs* between groups; a majority of those hiring labour claim insufficiency of subsidy whilst most users of family labour say it is sufficient to cover actual costs. A decline in the relative importance of the subsidy (through inflation) or an increase in the subsidy will have a different impact between groups; an increase for those who use family labour may well mean a cash surplus over replanting expenses which may help meet some of the real costs of foregone income. Secondly, those who employ labour have most of their costs met, thus encouraging them to replant. However, it is noteworthy that apart from covering actual costs the present subsidy to many small farmers does not sustain or provide enough incentive to them to compensate for having to forego six years of regular rubber income (albeit very low). In its present design it is tapered more to large scale producers who can replant part of their holding.

The information presented here also has implications for the national crop diversification programme which aims for a change in the present crop grown by the farmer. Farmers' preferences for rubber or other perennials is perfectly rational given the risks and uncertainties associated with alternative crops. Not only average expected returns should be considered but also the variability of these returns. Attention should be paid to the *variance* of yields and revenues from alternatives before they are recommended to smallholders.

CONCLUSIONS

To conclude we would like to suggest that using the replanting decision rules of the profit maximising model may well be viable for many smallholders. For others, due to a number of constraints influencing their attitudes, such a model may not be as relevant. For both groups of smallholders greater understanding of the reasons behind their decisions is overdue. If this were done it is possible that the generalisations (and inaccuracies) of the following quotation may be avoided.

'The cost of production and the replanting cost must for this size group (less than 10 ac) be calculated on a different basis as smallholders rarely hire labour to work on their holdings, with the possible exception of felling and clearing the old stand of rubber trees. On this basis the subsidy scheme with Rs. 1,500 /ac subsidy is most attractive. The smallholder must put in a good amount of work but at no time will he be without capital because of replanting his rubber'. (Special Industrial Adviser on Rubber, 1969).

The above is fairly representative of the aggregative approach to 'the smallholders' and has been employed without regard for differences between smallholders. The 'attractive' rate of return (calculated on the basis of a very low discount rate, 10%) did not explain why there was little enthusiasm for replanting at the time. Low yields do not always imply that replanting, although it may appear attractive, can be undertaken. For example, 77% of those farmers continuing to tap their low yielding trees said they did so because they badly needed their present income

From the preceding discussion we can make certain concluding observations.

- Almost all farmers display a general risk aversion — this is reflected in their choice of crop, which shows a marked preference for perennials which yield a continuous income stream.
- In the lower income group, where irregular incomes tend to have a comparatively greater weight in the total income structure, more importance is attached to present incomes, *i.e.* their subjective discount rates are higher.
- In all income groups, farmers based their decisions *primarily* on comparisons of the *monetary* returns from alternative courses of action, subject to their risk and time preference attitudes. This lends support to the hypothesis that in the farmer's utility function, profits (defined suitably) would be a major component.
- Research and policy should take into account the differences amongst smallholders in their physical resource endowments as well as in associated attitudinal and behavioural characteristics.

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