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RESEARCH ARTICLE

Coconut land fragmentation in Sri Lanka: an inquiry into the potential moral hazard behavior of landowners seeking for the approval

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ABSTRACT

The Tea, Rubber and Coconut Estates (Control of Fragmentation) Board was set up under the Act No: 20 of 2005 (An amendment of Act No: 2 of 1958) to control transferring of the ownership of coconut lands of more than four hectares as a single unit or sub divisions. The owner of a coconut land who wants to fragment her block is, thus, required to undergo a formal procedure to get approval to which the first step was the submission of a duly filled application explaining the characteristics of, and management practices used in, the coconut land to be fragmented. The specific objective of this study was to examine whether this process is associated with moral hazard and/or adverse selection behavior of owners, because any applicant may tend to manage her coconut land incongruously to gain advantage in the selection process. The outcome of analysis, which used first hand information from 50 applications submitted to the regional offices of the Coconut Cultivation Board from July 2005 to January 2008, showed that nearly 22% owners did not maintain their plantation up to their capacity, although their lands belonging to the best and moderate suitable soil classes with high productivity. This implies the need for evidence-based assessment criteria in the process of selection of coconut land for fragmentation to avoid potential failures in the process, and in turn, the Act.

Keywords: Adverse selection, Land fragmentation, Moral hazard, Soil suitability classes

INTRODUCTION

Coconut sector plays an important role in the national economy and ensures food and nutrition security to a larger segment of the population. It accounts for about 1.7 – 2.0 percent of the Gross Domestic Production and contributes to nearly 2.8 – 3.0 percent, on an average, of foreign exchange earnings of the country. Today, Sri Lanka ranks fourth in the global coconut producing countries and facilitates the livelihoods of about 5 percent of the Sri Lankan workforce, i.e. about 500,000 people, directly or indirectly involved in the industry.

The extent of land under coconut is about 20 percent of the total land utilized for agricultural purposes in Sri Lanka, i.e. an estimate of 394,836 hectares in 2002. The national coconut production has, however, remained stagnant at around 2800 millions of nuts. At present, the smallholding sector dominates the industry which is proven by the fact that coconut cultivations with less than 8 hectares occupy nearly 75 percent of the area under cultivation in 1982, while the estate sector accounts for the rest. By 2002, the size of the smallholding sector has increased up to 82 percent with the decrease of estate sector from 25 percent in 1982 to 18 percent. The aggregate extent of land under coconut has decreased by about 7 percent during the period from 1982 to 2002 (Fernando *et al.*, 2005; Liyanage, 1999; Plantation Sector Statistical Pocket Book, 2009; Sri Lanka Coconut Statistics, 2009).

Coconut land fragmentation, i.e. sub division of farm property into undersized units that are too small for rational exploitation, has become a prominent issue in Sri Lanka that led to considerable decrease in the national coconut production. It was estimated that 260 coconut palms are lost per day in the country due to fragmentation of lands which is prominently observed in the Gampaha district with nearly 24 percent of reduction of extent of cultivated lands in 1982 (Pieris and Kularatne, 2005). The reasons for reduction of extent of land including the fragmentation of lands into small pieces for residential purposes, conversion of coconut lands into industrial pursuits, lack of availability of labor on time, high wage rates, and cost of production etc. can have a greater impact on returns to scale of coconut industry in Sri Lanka (Fernando *et al.*, 2005;).

In light of these, the government introduced a set of new regulation to the plantation sector with the aim of preventing an excessive fragmentation of lands. The Cabinet of Ministers granted approval to a memorandum submitted by the Minister of Plantation Industries for amendment to the "*Tea, Rubber and Coconut Estates (Control of Fragmentation) Act*". The Act No. 02 of 1958, which was amended by the Act No. 20 of 2005 on July 22nd of 2005. Further, the Tea, Rubber and Coconut Estates (Control of Fragmentation) Board was appointed under this Act to control the transferring of ownership of coconut lands greater than four hectares in size. The provisions given in the Act however, vary to some extent within the jurisdiction of Provincial Councils due to interim constitutions. Under the provisions of the Act, the approval of the Board must be obtained for fragmentation of coconut lands with more than four hectares. The owner of land who wishes to fragment his/her land is, in turn, required to follow a formal procedure to obtain approval for fragmenting the land

through the submission of a duly completed set of applications to the Coconut Cultivation Board (Gazette of the Democratic Socialist Republic of Sri Lanka, 2005).

In a situation where the approval of the formal authority to the application forwarded by an agent become a "must", he/she may tend to provide false information in it with regard to the activities that the he/she carries out in the coconut land for which the approval is seeking for fragmentation. Such behavior may be attributed to, from one hand, "hidden action" with respect to the adoption of management practices in the land and/or "hidden information" provided with respect nature of the land such as the soil type and water availability etc., on the hand, to gain an added advantage in this process. The applicant may, for example, not adopt the recommended agronomic practices in his/her land "to be evidence for" that it is "unproductive"; so, fragmentation of the land does associate with minimum social cost. Such behavior of an agent, in the economics literature, is interpreted as *moral hazard* (hidden action) and *adverse selection* (hidden information), respectively. The prospect that a party insulated from risk may, thus, behave differently from the way it would behave if it were fully exposed to the risk arises since the individual or institution involves with so does not bear the full consequences of its actions. T he individual or institution may, therefore, possess a tendency to behave less carefully than it otherwise, which would leave another party to bear some responsibility for the consequences of those actions. The outcome would be that the low quality products / consumers / producers may drive the higher quality products / consumers / producers out of the market due to the difficulties associated with distinguishing the quality by search and/or by experience (Demsetz, 1969).

The purpose of this study was to investigate this phenomenon in the context of fragmentation of coconut lands in Sri Lanka. It utilizes the first hand information available in formal applications forwarded by landowners seeking approval for fragmentation of their lands. The specific objective is to investigate the fraction of applicants who may have shown moral hazard behavior by managing their coconut lands incongruously over the years to gain an advantage in the process of selection for fragmentation.

MATERIALS AND METHODS

We hypothesized that the productivity of a coconut land has a significant relationship with the fertility of its soil – hereinafter "soil fertility" – and the owner's personal actions with respect to management of his/her land (i.e. field planting, fertilizer application, irrigation, cropping system, cultural practices, and pest & disease control etc.), thus: Productivity = $\int$ (Soil Type, Management Practices). In this expression, soil fertility can be considered an exogenous variable with minimum control, but the level of adoption of management practices can be altered. We assume that, for a given coconut land, the level of soil fertility, and in turn, the Soil Suitability Class to which it belongs to is "fixed" in the short to medium term. Coconut lands are classified into several Soil Suitability Classes based on a number of soil properties, including the soil depth, drainage and texture (Table 1).

Table 1: Classification of soil suitability classes

Soil Suitability Class	Potential Yield (Nuts\Acre\Year)	Classification Used in the Analysis	Mean Expected Yield (Nuts\Acre\Year)
Highly Suitable (S_1 and S_2)	6000 – 5000	Best	5500
Suitable (S_3)	5000 – 4000	Moderate	4500
Moderate Suitable (S_4)	4000 – 2000	Poor	2500
Marginally Suitable (S_5)	2000 – 1000		

Source: Somasiri *et al*., 1994

However, for the purpose of this analysis, the Soil Suitability Classes were categorized into three groups: (1) "*Best*" (i.e. the highly suitable soil classes S_1 and S_2); (2) "*Moderate*" (i.e. soil class S_3), and (3) "*Poor*" (i.e. marginally suitable soil classes S_4 and S_5). The mean expected yield of the "Best", "Moderate" and "Poor" soil category was 5500, 4000 and 2500 nuts/acre/annum, respectively, and in general, a coconut grower can increase the productivity of his/her land to this level with the proper application of good management practices. However, the management practices applied to a given coconut cultivation that falls into a particular Soil Suitability Class is highly subjective and mainly depend on the personal action of owner. For example, the owner may maintain the land with appropriate management practices to harvest the best yield from one hand, or fully neglect making the cultivation unproductive; thus, unprofitable to gain the mere advantage in the selection process for fragmentation.

The secondary data required for the analysis were obtained from the Coconut Cultivation Board via the Coconut Research Institute of Sri Lanka. The total number of applications (n=200) forwarded to the Tea, Rubber and Coconut Estates (Control of Fragmentation) Board since enforcement of the Act in 2005 July 22nd up to 2008 January to get the approval for fragmenting the coconut lands located in Kurunegala, Gampaha, Puttalam, Colombo, Kalutara, Galle and Matale districts were sorted out according to Soil Suitability Classes listed above and the size of land. Given time and financial constraints associated with conducting an extensive empirical analysis that involved several field visits to clarify certain information included in the application submitted, we have resolved to select 50 out of 200 applications (i.e. 25% of sampling framework) randomly. Several rounds of informal discussions and interviews, in person and over the phone, were carried out with the officials attached to the Coconut Cultivation Board in this process to clarify the information included in the applications and to gather additional information, if required and was permitted.

A database was prepared to include the answers provided to all the questions included in the application, including general information of the applicant, productivity, land size, land suitability class, management practices used and reason/s for land fragmentation etc. The data pertaining to only one land was removed from the database due to significant inconsistencies; hence, the final database consists of data from 49 applicants.

Simple quantitative techniques, including Mean, Standard deviation etc. were used to analyze data and reporting purposes.

RESULTS AND DISCUSSION

Characteristics of the coconut lands requested for fragmentation

More than 80 percent of coconut lands were located in the "coconut triangle", i.e. 45, 26.5 and 12 percent in the Kurunegala, Gampaha and Puttalam districts (Table 2). Also, nearly 85 percent of lands belonged to the 5 – 20 acre category highlighting the fact that smallholding sector was more vulnerable for land fragmentation. Almost half of the coconut lands possess coconut palms that are less than 30 years of age, or in other words, implying that these lands requested for fragmentation were highly productive as they were in the 'highly productive phase' of the life cycle of a coconut tree.

Reasons Behind Land Fragmentation

Figure 1 illustrates the key reasons driving owners toward the need to fragment their land. The graph depicts that only around 18 percent of landowners decided on fragmentation due to the fact that they did not perceive the maintenance of them to be profitable to keep with. However, almost three fourth of respondents were not in position to provide a valid reason or were reluctant to impart a clear reason for their request.

Relationship of Coconut Production and Soil Category

The mean productivity of coconut lands that belonged to the "Best" soil category (n=23; 46.7%) was 1965 nuts/acre/annum (SD = 1063, Median = 1875) with the minimum and maximum values of 500 and 4200 nuts/acre/annum, respectively. These values, respectively, for the "Moderate" soil category (n=19; 38.7%) were 1657 category (n=7; 14.2%) 760 nuts/acre/annum (SD=610, Median=700) with 36 (minimum) and 2000 (maximum) nuts/acre/annum. Table 3 reports that there was a significant gap between the "expected" and "observed" productivity of coconut lands belonging to the 3 different Soil Suitability Classes (see, Figure 2).

Table 2: Characteristics of coconut lands in the sample

	Parameters	*Frequency (N=49)*	*Percentage (%)*
Land size	Small holder (5- 20 ac)	41	83.7
	Estate(>20 ac)	8	16.3
Age of Plantation	< 30 yrs.	24	49.0
	> 30 yrs.	25	51.0
District	Kurunegala	22	45.0
	Gampaha	13	26.5
	Puttalam	6	12.5
	Colombo, Kegalle, Kalutara, Galle, Matale	8	16.0

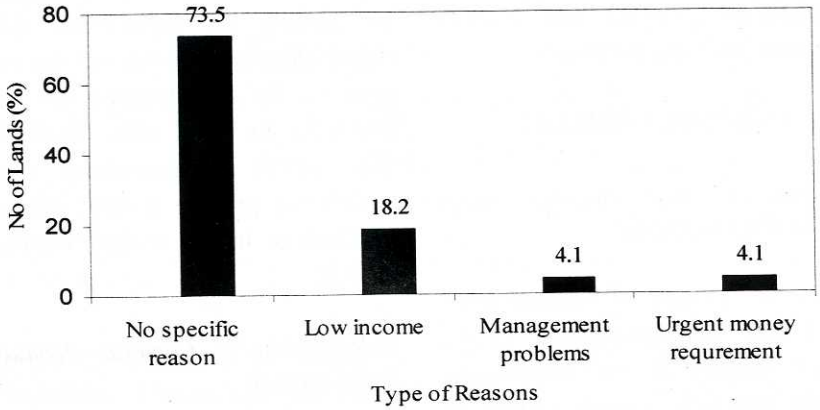

Figure 1 Reasons for coconut land

Table 3: Distribution of land owners

Soil Category	Best (Observed Mean=1965)		Moderate (Observed Mean=1657)		Poor (Observed Mean = 760)	
	Above Mean	Below Mean	Above Mean	Below Mean	Above Mean	Below Mean
"Best" (S_1, S_2)						
% (Within Group)	43.4	56.5	65.2	34.7	91.3	8.6
% (Within Sample)	20.4	26.5	30.6	16.3	42.8	4.0
"Moderate" (S_3)						
% (Within Group)	47.3	52.6	52.6	47.3	78.9	21.0
% (Within Sample)	18.4	20.4	20.4	18.3	30.6	8.1
"Poor" (S_4, S_5)						
% (Within Group)	14.3	85.7	14.3	85.7	28.6	71.4
% (Within Sample)	2.2	12.2	2.2	12.2	4.0	10.2

It shows that none of the coconut lands belonged to the "Best" soil category achieved the expected productivity of 5500 nuts/acre/annum, and interestingly, only one land in this particular soil category was above the expected productivity of the "Moderate" soil category. In simple terms, about 96 percent of lands belonging to the "Best" soil category did not at least reach the expected productivity of "Moderate" soil category. Further, only about 21 percent lands in the "Moderate" soil category were able to achieve the expected productivity of "Poor" soil category. Moreover, only 43 percent of lands in the "Best" soil category were above the its observed mean highlighting the fact the majority of lands in this category follow poor management practices.

Interestingly, the productivity of nearly 8 percent of lands in the "Best" sub sample was even below the observed mean of the "Poor" soil category. This implies the fact that these coconut lands did not perform even up to the expected standards of lands in the "Poor" soil

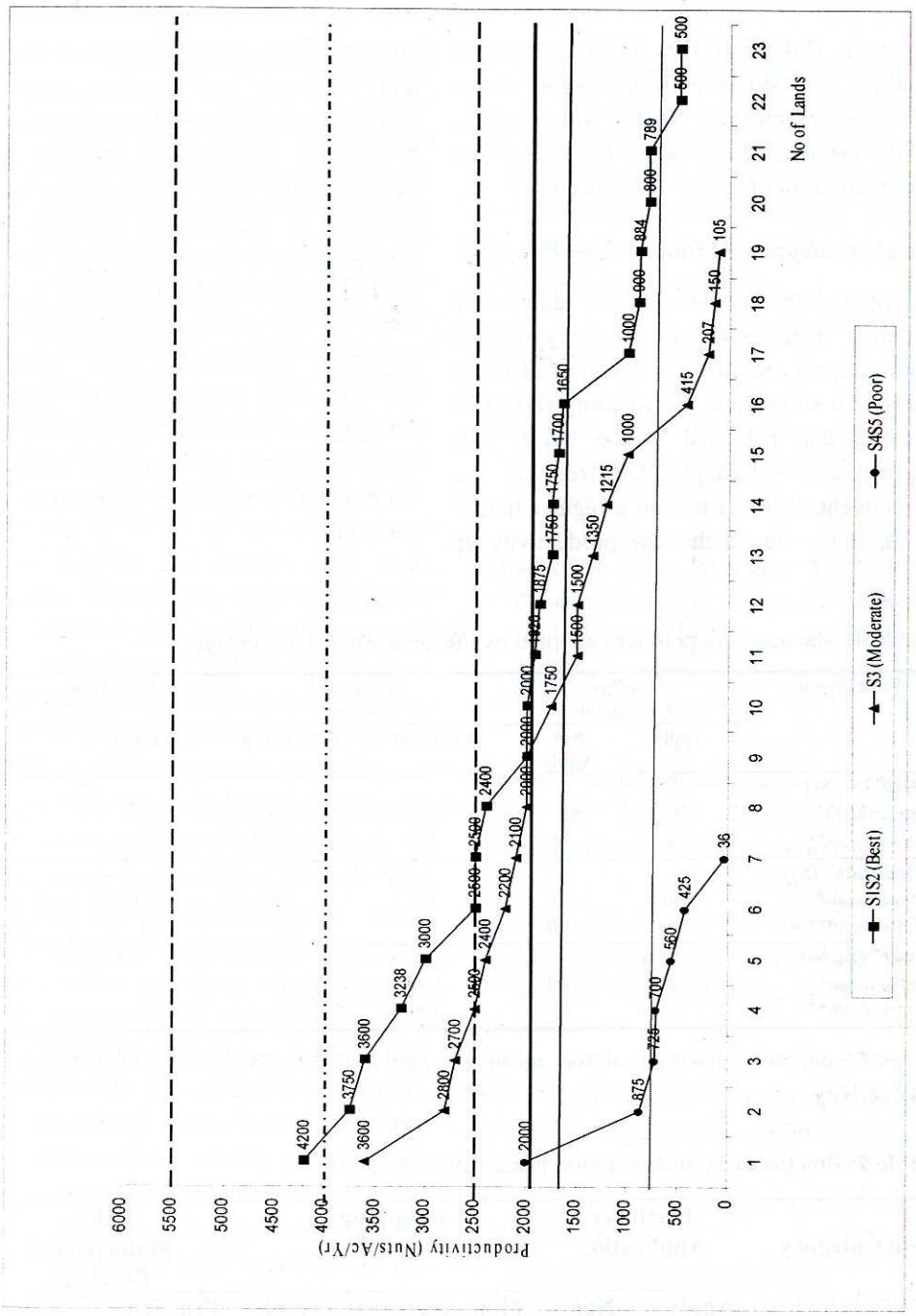

Figure 2 Relationship between productivity and soil suitability classes

category. Only half (i.e. 53%) of coconut lands in the "Moderate" soil category above the observed mean of "Poor" soil category, while the rest (47%) were fell below the observed mean of "Poor" soil category.

Level of Adoption of Management Practices

Table 4 reports the levels of adoption of different management practices by owners with respect to different soil suitability classes. It shows that the majority (80%) of growers that belonged to the "Best" sub sample did not apply fertilizer on the recommended levels nor on a regular timely basis. It was found that the productivity of about 8 and 21 percent of lands in the "Best" and "Moderate" soil category, respectively, was below the observed mean productivity of "Poor" soil category, i.e. potential case of moral hazard. Table 5 reports the levels of adoption of management practices by the owners in these categories. It was found that the productivity of about 8 and 21 percent of lands in the "Best" and "Moderate" soil category, respectively, was below the observed mean productivity of "Poor" soil category, i.e. potential case of moral hazard. Table 5 reports the levels of adoption of management practices by the owners in these categories.

Table 4: Management practices adopted by the landowners (percentage)

Soil Category	*Fertilizer Application*		*Cropping System*		*Other Management Practices*	
	Apply	**Not Apply**	**Mono-crop**	**Intercrop**	**Practice**	**Not Practice**
"Best" (S_1, S_2)						
Above mean*	20	80	70	30	60	40
Below mean**	8	92	76	23	13	77
"Moderate" (S_3)						
Above mean*	30	70	60	40	60	40
Below mean**	0	100	89	11	0	100
"Poor" (S_4, S_5)						
Above mean*	0	100	100	0	0	100
Below mean**	20	80	100	0	20	80

Notes:*- denotes observed above mean productivity, **-denotes observed below mean productivity

Table 5: Practices of potential moral hazard showing group

Soil Category	**Fertilizer Application**		**Cropping System**		**Other Management Practices**	
	Apply	**Not Apply**	**Mono-crop**	**Intercrop**	**Practice**	**Not Practice**
"Best" (S_1, S_2)	0	100	100	0	0	100
"Moderate" (S_3)	0	100	100	0	0	100
"Poor" (S_4, S_5)	20	80	100	0	20	80

CONCLUSIONS

The results show that the majority of land owners who applied for fragmentation did not carry out proper management practices in their lands; thus, resulting in the productivity of those lands to fall well below what was expected from the standard type of the land of a certain soil suitability class. This behavior is common with those lands with the best and moderate soil fertility, where the performance is poor; thus, providing a false signal to obtain approval for fragmentation. The results show that nearly 22% owners did not maintain their plantation up to their capacity, although their lands belonging to the best and moderate suitable soil classes with high productivity. Though this type of behavior can be associated with inability of an owner to manage his/her land, because he/she does not possesses the resources needed for the purpose, i.e. labor, capital and managerial skills, it can also be linked with moral hazard behavior, where the owner purposely neglect the land with a potentially high productivity to flaunt its un productivity. The outcome suggests that the application process must take this criterion into account seriously, where the initial screening of applications must be supported and strengthened with evidence-based assessments, including initial field observations and fertilizer application history, pest control measures and use of the benefits of government subsidy program etc., as granting approval to fragment a potentially high productive land may ultimately fail the said purpose of the Act resulting in the diminished overall productivity of coconut production of the country.

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REFERENCES

Demsetz, H. 1969. Information and Efficient: Another Viewpoint. *Journal of Law and Economics.* 1-22.

Fernando, M. T. N., Jayalath, K. V. N. N. and Dissanayake, A.M.U. (2005). Changes in land extent under coconuts within two decades (1982-2002). *Economic Review*, 11-13.

Gazette of the Democratic Socialist Republic of Sri Lanka, (2005). Government publication bureau, Colombo 1.

Liyanage, M. D. S. (1999). *A guide to scientific cultivation and management of coconut.* Hitech Printers, Nugegoda, Sri Lanka.

Peiris, T. S. G. and Kularathne, J. D. J. S. (2005). 250 coconut palms are lost per day in Sri Lanka. Coconut Research Institute, Lunuwila, Sri Lanka. Online. Available from: http://www.cri.lk/landextent paperarticle.pdf. (Accessed 6 May 2008).

Plantation Sector Statistical Pocket Book, (2009). Ministry of Plantation, Colombo 2, Sri Lanka.

Somasiri, L. L.W., Nadarajah, N., Amarasinghe, L. and Gunathilake H. A. J. (1994). *Land suitability assessment of coconut growing areas in the coconut triangle*. Coconut Research Institute, Lunuwila, Sri Lanka.

Sri Lanka Coconut Statistics, (2009). Coconut Development Authority. Sri Lanka.