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Demand for Crop Insurance by Tea Smallholders in Badulla District: An Analysis of Willingness-To-Pay

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ABSTRACT

Tea growers face many risks due to weather conditions, plant diseases, price volatility and policy changes. Crop insurance is one of the potential management tools to manage these risks. The purpose of this paper was to investigate the demand for tea crop insurance with respect to factors affecting the decision to adopt insurance for tea cultivation. Data was collected from 150 tea smallholder farmers randomly selected from three Divisional Secretariat divisions. Conjoint choices were used to elicit preference for attributes of insurance. The insurance policy was defined by four attributes: damage assessment rule (index-based, indemnity-based), type of damage (drought, non-drought), premium, and mode of compensation (by money, by plants). Data was analysed using logistic models. According to the results, age of the farmer, gender, age of cultivation, and asset level were the variables that influenced the willingness to adopt insurance. Drought damage, monetary compensation, low monthly yield, high cost of production and extension services were significant variables that influenced the level of premium. On the other hand, the significant variables that influenced willingness to buy index-based insurance were drought damage, monetary compensation, age of farmer, and high asset ownership.

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INTRODUCTION

Various natural disasters such as floods, droughts and excessive rainfall have affected agriculture sector in Sri Lanka during the recent years. Unexpected changes in climate patterns have worsened the situation. In order to combat the risks, promoting effective risk management among farmers is important. There are several ways of risk management. Those are avoiding risks, reducing risks and sharing risks. Risk sharing in the form of insurance has received much consideration but shows poor adoption at the farmer level (Tadesse *et al*., 2015). Farmer unawareness seems to be a major barrier for taking up insurance in the rural areas (Hazell, 1992).

Tea was first introduced in 1824 to Sri Lanka and Ceylon tea has received special attention in the world tea market for over the last 100 years. In Sri Lanka, tea is classified into low-country, mid-country and up-country, on the basis of elevation. The up-country holdings are located above 1200 meters. The mid-country and the low-country holdings are located between 600-1200 meters and below 600 meters respectively. The tea produced in these regions are referred to as high-grown, mid-grown and low-grown tea respectively. There are other spatial identities such as Uva tea (signifying that tea is grown in Uva province which has a unique agro-climate). For a number of developing countries such as Sri Lanka, tea is important in terms of employment and export earnings. Tea sector earns 18 percent of total export earnings of the country (Central Bank of Sri Lanka, 2018). Tea production techniques are labour intensive and the tea sector provides around 10 percent employment opportunities to Sri Lankans (Wijayasiri *et al*., 2018).

Tea is cultivated in plantations or in smallholder plots. In Sri Lanka, there is an increasingly higher percentage of tea coming from smallholders replacing the earlier dominance of plantation-grown tea. There are several definitions for a tea smallholder in Sri Lanka. According to the Tea Control Act no 3 of 1983, tea lands less than 10 acres are considered smallholdings (GOSL, 1983). However, at times, the Sri Lanka Tea Board has implemented development activities pertaining to lands between 10 and 50 acres under the name of smallholder development (Sri Lanka Tea Board, 2015). Esham and Garforth (2013) have stated the presence of a vague definition for tea smallholder category in Sri Lanka.

The average productivity of tea plantations in Sri Lanka has shown an overall increase since 1930s even though there have been fluctuations between years. The productivity of tea lands is greatly influenced by rainfall and temperature (Wijeratne *et al*., 2007). Being a rain fed plantation crop in Sri Lanka, tea depends greatly on weather for optimal growth. Therefore, both levels and the volatility of weather conditions affect tea production (Wijeratne, 1996). Heavy rainfall typically causes considerable damage to tea plantations through soil erosion, poor growth due to lack of sun, and increase in disease incidence. Old seedling tea stands, pruned tea fields, and young tea fields during the first two years are more vulnerable to soil erosion due to inadequate ground cover. It has been estimated that more than 30 cm of top soil has already been lost from Sri Lanka's tea plantations, especially in the uplands (Krishnarajah, 1985). The main climatic variables influencing the yield of tea are temperature, the saturation deficit of the air and, through their influence on plant and soil water deficits, rainfall and evapotranspiration (Carr and Stephens, 1992).

Tea is one of the largest exchange-earning industries in Sri Lanka, upon which a large number of families are dependent. However, the real value of primary producer prices has fallen sharply over the past decades and this is observed in the tea sector as well. Low output prices have created pressure on the sustainability of the tea sector, negatively affecting the livelihood of the plantation workers and leading to poor working conditions (Perera, 2014). The literature on tea smallholders in Sri Lanka have identified several constraints related to productivity, technology and government support. Studying issues related to business development of tea smallholders in Sri Lanka linked to technology transfer, Samaraweera *et al*. (2013) found that level of technical knowledge as very poor among tea smallholders. They noted that tea smallholders had minimal knowledge related to pest and disease management, planting material selection and nursery management, which are vital for achieving high productivity. Poor extension service in the tea smallholder sector was also a key drawback (Samaraweera *et al.*, 2013). Problems related to tea extension services were identified by Karunadasa and Garforth (1997).

Crop insurance is one of the alternative tools that could be used to manage risk in yield loss by the farmers. Primarily, a crop insurance is a means of protecting farmers against the variations in yield resulting from uncertainty of factors beyond their control such as rainfall (drought or excess rainfall), flood, hail, wind, pest infestation, etc. Crop insurance is a financial mechanism to minimize the impact of loss in farm income by factoring in a large number of uncertainties, which affect the crop yields. It is a risk management alternative where production risks are transferred to another party at a cost.

Annual crops are the usual targets for insurance. However, perennials could be equally vulnerable. Tea producers face many risks due to weather conditions, plant diseases, price volatility, and policy changes to name a few. Among the recent factors threatening the tea industry, drought and landslides are also having negative impacts on the industry and living conditions of the people depending on the industry. Previous literature on demand for crop insurance had mainly analyzed farmers' or farm characteristics as factors that may affect participation in agricultural insurance. However, less attention was given to farmer's preferences for crop insurance attributes. In this study, we investigated farmers' preferences for crop insurance with special reference to tea cultivation.

Crop cultivation is an inherently risky activity. Making it more vulnerable, in recent years, natural disasters, particularly climate-related ones, have increased in both frequency and magnitude. Agriculture sector has been affected negatively in every type of extreme condition, i.e. flood or drought, in addition to other biological risks. Collectively, the effect of natural factors has made agricultural output highly variable (Mishra *et al.*, 1996). In addition, market risks associated with both on the input market side and output market side generate risks to all stakeholders in the supply chain. Measures such as micro-insurance or crop insurance have been suggested as risk management strategies.

Insurance is important for economic development because uninsured losses lock vulnerable populations in poverty. Unfortunately, agricultural insurance and disaster insurance are either unavailable or prohibitively expensive in many developing countries (Miranda and Farrin, 2012). Kumar *et al*. (2003) indicated that crop insurance is the best tool in sustaining income stability of the farmers, which in turn facilitates technological advances, investments and credit facilities in agricultural sector. Skees *et al.* (1999) have emphasized that other mechanisms (non-insurance) lead to depletion of public funds. In an early publication, Crawford (1979) highlighted the problems faced by developing countries in implementing crop insurance, limiting both the probability of success and the level of benefits realized.

Index insurance is a relatively new and innovative approach to insurance provision that pays out benefits on the basis of a predetermined index (e.g. rainfall level) for loss of output/income, resulting from weather and catastrophic events, without requiring the traditional services of insurance claims assessors. It also allows for the claims settlement processes to be quicker and more objective. Before the start of the insurance period, a statistical index is developed measuring deviations from the normal level of parameters such as rainfall, temperature etc. On the other hand, indemnity-based insurance products determined claim payment based on the actual loss incurred by the policy holder. If an insured event occurred, an assessment of the loss and a determination of the indemnity were made at the level of the insured party (Pasaribu and Sudiyanto, 2016). A major area of difficulty in setting indemnity and premium levels was the lack of data linking the incidence of adverse weather events and actual losses in the field (Roberts, 2005). Weather-based crop insurance uses weather parameters as a proxy for crop yield in compensating the cultivators for crop losses. It provides a good alternative to both farmers and government. Farmers receive an actuarially fair insurance with faster payouts at fewer administrative costs to the government (Singh, 2010).

Given the above context, our specific objectives included assessing tea smallholders' preference for attributes of an insurance package and investigating the factors affecting the decision to adopt a designed insurance scheme for tea cultivation. We looked at the issue through a willingness to pay analysis, which falls under the methodology of contingent valuation, a class of stated preference analysis.

MATERIALS AND METHODS

Sampling approach

The target population of this study was smallholder tea farmers in Badulla district of Sri Lanka. Purposive sampling was adopted for the selection of study locations and random sampling was adopted in the selection of respondents for collection of data required for the study. Badulla district is one of major tea growing areas in Sri Lanka. Data was collected from 150 tea smallholder farmers from three divisions in Badulla district namely, Haliela, Ella and Lunugala. These are the three Divisional Secretariat divisions with highest tea acreage in Badulla district. This enumeration was conducted through a questionnaire survey. A structured questionnaire was prepared and was pre-tested before data collection.

Proposed insurance choice scenarios

In order to assess the willingness to pay for insurance, we used a randomized choice scenario assignment using four attributes of the insurance scheme. These attributes included damage assessment rule, nature of disaster, mode of compensation and the premium level. Each attribute was specified in two levels (Table 1). This approach is identical to choice experiment design structure. On every choice scenario, there were two different crop insurance products with varying attributes. Each farmer was asked to choose the most suitable crop insurance product within a pair of alternatives, repeated over eight random assignments of attribute levels.

Model estimation

According to the objectives, we used the evidence collected to model three outcomes, namely, willingness to adopt tea insurance, premium level and the preference for index-based insurance. Three models were estimated as follows. In each of the models, in addition to specified explanatory variables, location of the field (Divisional Secretariat division) was included as a factor variable in order to control for location specific unobservable factors.

Table 1. Attributes and levels used to measure farmers' preferences

Attributes	Levels Description
Damage assessment rule	Indemnity based crop insurance Index based crop insurance
Nature of damage	Drought Non-drought
Premium	Rs.100/= Rs.150/=
Mode of compensation	By plants By money

Model 1:

Decision to insure

$$= f\begin{pmatrix} \text{Farmer characteristics (age, gender, education, income, household size),} \\ \text{Crop characteristics (age, area, cost, yield),} \\ \text{decision environment (premium, extension service, risk perception),} \end{pmatrix}$$

Model 2:

$$\text{Premium level} \;\; = f\begin{pmatrix} \text{insurance type, type of damage covered, mode of compensaiton,} \\ \text{Farmer characteristics (age, gender, education, income, household size),} \\ \text{cost, extension service, risk perception} \end{pmatrix}$$

Model 3:

Preference for index based insurance

$$= f\begin{pmatrix} \text{type of damage covered, mode of compensaiton,} \\ \text{Farmer characteristics (age, gender, education, income, household size),} \\ \text{cost, extension service, risk perception} \end{pmatrix}$$

The data collected through field survey was analyzed using STATA software. To analyze the data obtained for pair-wise conjoint choices, logistic model was adopted.

RESULTS AND DISSCUSSION

Descriptive Results

Socio-economic characteristics are important predictors of level of adoption of practices that improve the level of output (Haruna *et al.*, 2010).

In our sample, majority (63.33%) of the farmers were male. About 76.67% of the farmers were within the range of 45 years and above. The mean age of the farmers was 54 years. Majority of tea growers represented a family of four members (38.57 %).

Majority of tea smallholders (68.57 % of the sample) considered tea as their main source of income, with supplementary income from paddy cultivation, spice cultivation, vegetable cultivation, and other occupations. The respondents who reported monthly incomes that ranged from 10000 to 25000 represented 22.14 %, those who reported incomes from 25000 to 40000 represented 25.71 % while 46.43 % of farmers reported an income more than 40000 LKR. 49 out of 150 tea cultivations included in the study were between 10 to 14 years old. Most of the farmers had less than one acre (75 farmers of 150).

The mean farm size was about 1.5 acres, implying that the farmers were medium scale farmers. Majority (75%) of the farmers had access to extension services. More than 50 % of the farmers reported access to other insurance products. Most of the farmers (70 %) reported a harvest above 150 kg per month. While this level was slightly below the national average of approximately 200 kg per acre per month, 150 kg and above was a good yield compared to the average value for Uva province (which is lower than national average). Table 2 lists the profile in detail.

Table 2. Socio-economic Profile of the Respondents (N = 150)

Variable	Category	Percentage
Gender	Male	63.33
	Female	36.67
Age of household head (years)	<30	1.33
	30-44	22.00
	45-60	43.34
	>60	33.33
Household Size	1	6.43
	2	14.29
	3	23.57
	4	38.57
	5	12.86
	6	4.29
Income (LKR per month)	<10000	5.72
	10000-25000	22.14
	25000-40000	25.71
	>40000	46.43
Age of cultivation (years)	5-9	15.33
	10-14	32.67
	15-19	24.00
	>19	28.00
Land Area (acres)	<1	50.00
	1-2	44.00
	>2	6.00
Yield (kg per acre per month)	<150	29.00
	150-400	53.00
	>400	18.00

Model Results

Table 3 represents the factors that influenced willingness to adopt crop insurance for tea. This was the first model specified under methods. It displayed reasonably high explanatory power (33 % of variation).

Age of the household head was significant at 1% level and negatively influenced the tendency to adopt insurance by farmers. This meant that older a farmer was, the lower the likelihood to participate in agricultural insurance scheme. This result was consistent with similar studies by Ibrahim *et al.* (2006) and Piyasiri and Ariyawardana (2002).

The coefficient of gender was positive and significant at 5% level. This implied that male farmers were more likely to take crop insurance than female. This may be due to that they were the decision makers in most of the families. The coefficient of main income of tea was positive and significant at 1% level, implying that those who depended on the cultivation of tea as their main income were more likely to adopt crop insurance.

Table 3. Factors influencing Willingness to adopt crop insurance for tea

Attribute	Coefficient	Standard error	P value
Age (years)	-0.013***	0.002	0.000
Gender (male=1)	0.103**	0.039	0.009
Education (years)	-0.018	0.061	0.767
Household size	0.012	0.014	0.388
Income	-0.038	0.031	0.219
Main income –tea (binary)	0.282***	0.477	0.000
Area cultivated (acres)	-0.036	0.057	0.518
Age of stand (years)	-0.004*	0.002	0.099
Yield (kg per acre p.m.)	-0.0001	0.001	0.382
Price	-0.010	0.007	0.168
Cost (categorical)	-0.039	0.029	0.188
Perceived risk (risky= 1)	0.073**	0.036	0.045
Asset level (high=1)	0.217**	0.072	0.003
Access to other insurance (yes=1)	0.048	0.044	0.275
Access to extension services (yes =1)	-0.032	0.043	0.449

Number of observations = 150
R-squared = 0.3978
Adj R-squared = 0.3304
*, **, *** Variable is significant at 10%, 5%, 1% level respectively.

Age of the stand was negatively associated, implying that the older the cultivation, lower the likelihood to join an agricultural insurance scheme. Perceived risk was significant at 5% level and had a positive impact on the tendency to adopt insurance. The farmers with more assets were more likely to accept crop insurance.

Table 4 displays the parameters estimated for model 2, which explained the choice of premium. The model displayed a good fit to the data (78 percent of the variation was explained). The coefficient of index-based insurance was positive and significant at 1% level. This implied that instead of indemnity based insurance, the average respondent was more likely to buy index-based agricultural insurance. Respondents reported a willingness to pay a higher premium for drought damage than for non-drought damages. It had a positive coefficient and significant at 1% level. The reason may be that they faced more risks in dry period. When comparing the compensation type, farmers would pay a higher premium if they got the coverage through money than plants. It had a positive effect on premium and it was significant at 1% level. Household size was significant at 10% level and negatively affected farmers' willingness to pay higher premiums for agricultural insurance. The coefficient of yield was negative and significant at 5% level. This implied that the lower the yield, farmer would pay higher premium. Cost of cultivation had a positive effect and was significant at 5% level. It denoted that the farmers who spent more on tea cultivation would also pay higher premiums. Access to agricultural extension services by the farmers was significant at 5% level and positively affected farmers' willingness to buy agricultural insurance.

Table 4. Factors influencing price of insurance (premium)

Attribute	Coefficient	Standard error	P value
Type of insurance (indexed=1)	12.053***	2.902	0.000
Damage (drought=1)	55.193***	2.751	0.000
Compensation (money=1)	76.060***	2.529	0.000
Yield	-0.018**	0.007	0.013
Area	4.143	2.680	0.122
Education	-2.576	2.575	0.317
Household size	-0.727	0.705	0.303
Income	-1.324	1.371	0.335
Cost (categorical)	3.680**	1.443	0.011
Assets (high=1)	4.388	3.297	0.183
Access to extension services (yes =1)	6.130**	2.039	0.003

Number of observations = 1200
R-squared = 0.783
Adj R-squared = 0.781
*, **, *** : Variable is significant at 10%, 5%, 1% respectively.

Results of the estimation of model 3 are given in table 5. This model also displayed a relatively high fit to the data (McFadden R squared value of 0.614 and a very significant chi square test statistic). It explained the farmer preference for indexed-based insurance in particular. Respondents preferred indexed insurance for drought impacts than for non-drought damages. The level of preference was 2.568 times higher than that with respect to the non-drought and was significant at 1% level. When comparing the mode of compensation, farmers associated index-based insurance with monetary compensation. The odds of preference were 1.808 times higher than for compensation by plants. Age of the household head was significant at 1% and negatively influenced the tendency to buy indexed insurance. Educational level was positively associated with accepting index-based insurance and was significant at 1% level. This implied that, higher the educational level of the farmer, the more likely it was that he/she would buy indexed insurance (rather than indemnity insurance). The farmers with lower yields were more likely to adopt indexed insurance and it was significant at 5% level.

Table 5. Factors influencing preference for Index-based insurance

Attribute	Odds Ratio	Standard error	P value
Damage (drought=1)	2.568***	0.728	0.001
Compensation (money=1)	1.808**	0.521	0.040
Age	0.964**	0.016	0.037
Education	4.163***	1.515	0.000
Household size	0.839*	0.076	0.056
Income	0.781	0.141	0.172
Main income- tea(binary)	1.067	0.328	0.831
Area	0.808	0.272	0.527
Yield	0.997**	0.001	0.033
Cost(categorical)	1.176	0.234	0.416
Assets (high=1)	2.902**	1.513	0.041
Access to extension services (yes =1)	0.675	0.181	0.144

LR-chi2 (15) = 786.42; Prob > chi2 = 0.000; Pseudo R^2 = 0.614; Number of observations = 1200
, **, * - Variable is significant at 10%, 5%, 1% respectively*

Overall, we observed that the premium and the preference for index-based insurance increased with the attributes of drought damage and monetary compensation. Such information is useful in targeting potential weather indexed insurance for tea cultivation.

CONCLUSION

The productivity of tea lands is greatly influenced by environmental factors. Therefore, it is essential to provide farmers with adequate risk management options, including possible insurance options. This study was conducted to identify tea smallholders' preference to adopt crop insurance and the factors affecting that decision. Insurance attributes were important when farmers made their choices. One of the major findings of the study was that farmers displayed a high preference for index-based insurance. Preference for indexed insurance was associated with drought damage (vs. non-drought damages), monetary compensation (vs. compensation by plants), education level, and availability of more assets. Furthermore, younger male farmers, farmers with main income from tea, short age of cultivation, farmers who faced more risks and farmers with more assets were willing to buy crop insurance. Drought damage, monetary compensation, lower yield, high costs of production and extension services were the significant variables that influenced farmers' choice of the premium level. Since farmers are willing to pay a premium, there is a need to generate a higher level of awareness about the available insurance options within the community. Results suggested that farmers were willing to absorb a part of the risk.

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