Prospective Demand for an Index-Based Microinsurance in Sri Lanka

Heenkenda, Shirantha

Department of Economics, University of Sri Jayewardenepura, Sri Lanka

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Shirantha Heenkenda

Graduate School of International Development (GSID)
Nagoya University, Japan

Corresponding Author:
Department of Economics, University of Sri Jayewardenepura, Nugegoda, Sri Lanka.

Email: shiran@sjp.ac.lk , shiranheen@gmail.com

ABSTRACT

The objective of this study is to examine famers' willingness to pay for an index based microinsurance scheme (IBMS) for paddy crops to protect against production loss caused by natural disasters in Sri Lanka and to assess product preferences for this IBMS. The contingent valuation method (CV) was used to elicit the willingness to pay for the hypothetical IBMS. For product preferences, a conjoint analysis was conducted to study their relative importance and to discover the relationships between different attributes and the characteristics of the respondents. The results show that the interest in joining IBMS is 88% (*SD*=2.4%) overall. When willingness to pay is assessed, it is found that most potential purchasers would prefer a higher level than that offered by the existing conventional insurance plan. The results of the preference analyses demonstrate that for IBMS products can be adapted for specific locations in order to maintain demand. These findings provide strong support for launching IBMS in Sri Lanka.

Keywords: Conjoint analysis, Contingent valuation, Index based insurance, Microinsurance

INTRODUCTION

Risk is an unavoidable but manageable element through insurance. A growing body of literature on agricultural financial markets in developing countries reveals opportunities for innovative agricultural insurance. Microinsurance with an index based indemnification mechanism is increasing attention on present day agricultural risk management (Skees, and Barnett, 2006: Roth and McCord, 2008: Patt, Peterson, Carter, Velez, Hess and Suarez, 2009). The incorporation of these two concepts can be called Index Based Microinsurance Scheme (IBMS). However, in the case of Sri Lanka IMBS has not yet been tested. The main objective of this study is to examine famers' willingness to pay and preferences for product attributes of IBMS for paddy crops cultivated by small-scale (peasant)[1] farmers in Sri Lanka, in the context of production risk caused by natural disasters. The findings of this study will, it is hoped, be used to support the creation of a more efficient and realistic pricing policy and marketing for IBMS.

The study is motivated by the fact that Sri Lankan agriculture is highly vulnerable to risk and uncertainty. Sri Lanka frequently suffers from natural disasters, among which water-induced disasters such as floods, droughts and landslides are the most common and destructive types (DMC-SL, 2010). Currently, Sri Lankan farmers can insure most of their crops through the conventional crop insurance schemes conducted by the government-owned Agricultural and Agrarian Insurance Board (AAIB). Although the Board has been operating for more than five decades, voluntary participation has drastically decreased. Its level of penetration among potential clients is currently less than 5 percent. Among the main causes for low confidence in this scheme are the lack of transparency in loss assessment and underestimation in indemnity payments (Rambukwella, Vidanapathirana and Somaratne, 2007). Moreover, rain-fed areas are not targeted for insurance by the Board. However, looking at the paddy sown by irrigation types in the last ten years (2000-2010) at national level, it can be seen that rain-fed paddy sown extent contribution is 24 percent (DCS-SL, 2010). AAIB insurance products perform as individual contracts and indemnities based on the individual's own yield. Usually this type of contract suffers from asymmetric information problems like moral hazard and adverse selection; high administrative cost is another impediment. Moreover, the government schemes are not based on actuarial principles and are deemed unsustainable. Performance of publicly supported crop insurance has been inefficient when all costs are considered (Hazell, 1992). Traditionally, insurers have been paying claims that were assessed based on individual losses, the so-called indemnity-based insurance (Mechler, Linnerooth-Bayer, and Peppiatt, 2006). Due to the high costs of the claim settlement process, resulting from indemnity-based insurance relative to the values insured in developing countries, index-based schemes have become increasingly useful, particularly for smallholding farmers, with limited government involvement (Skees, Hazell, and Miranda, 1999). Therefore, this innovative insurance may have a huge potential for agricultural risk management in Sri Lanka.

Rice is the dominant crop in Sri Lanka, cultivated by a large number of small-scale subsistence farmers living in the rural areas. Ninety percent of poor households earn their living in the rural agricultural economy. Moreover, most farmers live under or close to the poverty line. In this context, Sri Lanka National Agricultural Policy (SLNAP) proposes to "introduce appropriate agricultural insurance schemes to protect the farmers from the risks associated with natural calamities" (SLNAP, 2006 p.6). The draft version circulated for comments further asserted that "a national agricultural insurance scheme will be implemented to cover all farmers and all crops throughout the country to insulate the farmers from financial distress caused by natural disaster and making agricultural [make agriculture] financially viable", emphasizing "collaboration with public and private sector" (SLNAP-D, 2006 p.11). This suggests, therefore, that agricultural insurance is a particularly important risk mitigation measure out of the many adopted in the country.

Emerging research has been conducted in several developing countries that focuses on innovative low-cost approaches to mitigate the conventional problems associated with crop insurance, and the affordability and sustainability of such products. The main theoretical and empirical arguments concentrate on index based products, the microinsurance approach, community-based financial intermediaries, and public policy, including the role of government in market-based insurance and in encouraging private sector agricultural insurance (Nieuwoudt, 2000; Dercon, 2005; Leftley and Roth, 2006; Skees , Barnett and Hartell , 2006; Bhattamishra and Barrett, 2008).

An Innovation in Agricultural Insurance

Index-based insurance products: The potential for the use of index based insurance products in agriculture is significant. Any independent gauge can be used and developed as an index for an insurance contract which is secure and must be highly correlated with agricultural losses (Skees, 2001). Various measures can be used as indices such as meteorological variables (rainfall, temperature, wind speed, etc.), satellite images, area yield and price, and even the mortality rate of livestock. In developing countries, the practical feasibility of more than 25 index-based risk transfer schemes has been reported and the start-up and implementation of pilot schemes has been investigated. The majority of these schemes are insurance products with payouts linked to a publicly-verifiable aggregate index. Most index-based insurance schemes address either production (yield) risk or price risk, and are aimed at a specific crop (Skees, Murphy, Collier, McCord and Roth, 2008).

It is too early to draw any general conclusions about the long-run sustainability of these efforts due to the fact that the majority of these schemes are still in their preliminary stages. The experiences in Mexico and India suggests that, at least in some areas, these programs may be an effective risk transfer mechanism for the rural poor (Levin and Reinhard, 2006; Barnett and Mahul, 2007). However, scalability and sustainability depend on several factors. Scalability includes access or coverage participation and the operating and administering costs of products. For long term sustainability, a program should achieve several elements such as the willingness of farmers to contribute over the long term, fit with the country's regulatory environment, and private sector participation (Smith and Watts, n.d.).

Increasing interest to implement index based insurance products rather than traditional agricultural insurance is well documented. Index based products offer various advantages over other risk-coping mechanisms and traditional insurance programs including lack of moral hazard, lack of adverse selection, and low administrative costs. Moreover, index-based products feature standardized and transparent structure, re-insurance function, greater availability and the ability of parties to negotiate terms and conditions (Skees, et al., 2006; Roth and McCord, 2008). They also offer protection against numerous social perils including famine and other catastrophes (Skees, 2008).

The main challenge in index based insurance is called basis risk, where there is the possibility of a mismatch between the index and the losses of the insured (Miranda, 1991). However, a substantial number of suggestions to manage this problem have been proposed. Improved data and product design may be able to minimize basis risk (Roth and McCord, 2008). An Index based product is required to be developed for a small geographic area (Smith and Watts, n.d.). Conversely, spatial basis risk is lower for client associations relative to individuals due to aggregation (Varangis, 2002; Glauber, 2004).Farmer participation to design the product and government intervention through providing infrastructure and services would help minimize this basis risk problem (Clarke and Dercon, 2009). Many attempts have already been made to incorporate this index based indemnification mechanism and microinsurance concept. The following section briefly summarizes the microinsurance concept and its unique features.

Microinsurance Approach: Microinsurance, a subset of financial tools that belong to microfinance, is now widely recognized and is emerging as a flexible and powerful instrument in developing countries. In addition, it has some basis risk reduction features, including farmer participation in design, small groups' involvement, quick response, and small geographic implementation areas, and has certain characteristics (See Table 1). Microinsurance specifically sets out to provide affordable and accessible insurance to low-income people who cannot gain access to traditional forms of insurance (Churchill, 2006: Osgood and Warren 2007). Among the main attributes of this product are consideration of members' willingness to pay and low-cost transactions. Microinsurance involves payment of premiums in small amounts and is often designed to accommodate clients' irregular cash flows, in return for pre-specified payouts when specific conditions occur. Microinsurance can be implemented either on an individual basis or based on groups, but typically communities are involved in the important phases of the process such as package design and rationing of benefits. The essential role of the network of microinsurance units is to enhance risk management of the members of the entire pool of microinsurance units over and above what each can do when operating as a stand-alone entity. Microinsurance is implemented and distributed through various channels. Community-based and mutual insurance schemes now exist side by side with commercial insurers that have started to recognize the potential market among low-income clients (Churchill, 2006; Roth, McCord and Liber, 2007). In essence, microinsurance has the same purpose as traditional insurance. It draws on the same generally accepted practices as traditional insurance. For example, actuarial pricing, reinsurance, and claims handling practices follow traditional insurance. However, Experience of microinsurance in low income markets has shown that there are fundamental differences (See Table 1).

Table 1: Differences between traditional insurance and microinsurance

	Traditional insurance	**Microinsurance**
Clients	• Low risk environment • Established insurance culture	• Higher risk exposure/high vulnerability • Weak insurance culture
Distribution models	• Sold by licensed intermediaries or by insurance companies directly to wealthy clients or companies that understand insurance	• Sold by non-traditional intermediaries to clients with little experience of insurance
Policies	• Complex policy documents with many exclusions	• Simple language • Few, if any, exclusions • Group policies
Premium calculation	• Good statistical data • Pricing based on individual risk (age and other characteristics)	• Little historical data • Group pricing • Often higher premium to cover ratios • Very price sensitive market
Premium collection	• Monthly to yearly payments, often-paid by mail-based on an invoice, or by debit orders	• Frequent and irregular payments adapted to volatile cash flows of clients • Often linked with other transactions (e.g. loan repayment)
Control of insurance risk (adverse selection, moral hazard, fraud)	• Limited eligibility • Significant documentation required • Screenings, such as medical tests, may be required	• Broad eligibility • Limited but effective controls (reduces costs) • Insurance risk included in premiums rather than controlled by exclusions • Link to other services (e.g. credit)
Claims handling	• Complicated processes • Extensive verification documentation	• Simple and fast procedures for small sums • Efficient fraud control

Source: Adapted from Lloyds- Microinsurance Report 2009, http://www.lloyds.com

Due to its group-based nature, microinsurance can exploit informational advantages that are not available to private or public insurers that deal with individuals, thereby overcoming moral hazard and adverse selection problems. While moral hazard problems can be mitigated by peer monitoring, adverse selection problems are often addressed in a variety of ways, such as requiring a minimum pool size before insurance coverage comes into effect (Tabor, 2005). Although the microinsurance movement is relatively recent, it is becoming an increasingly popular way of addressing even disaster shocks. Agricultural index based microinsurance is an affordable risk management tool for smallholder farmers with limited government involvement. In this context, the index based micro approach has been tested in many developing countries in an attempt to address conventional problems. Index based microinsurance could guarantee a higher degree of community participation as a new way to stabilize the income of the rural poor (Levin and Reinhard, 2006; Mechler, Linnerooth-Bayer, and Peppiatt, 2006). The best example is Andhra Pradesh in India, where a microfinance institution (BASIX) has collaborated with an insurer (ICICI-Lombard) to provide index coverage to farmers (Gine, Townsend and Vickery, 2007).

METHODS

Study Area, Sample and Data Collection: Ampara district, on Sri Lanka's eastern plain was selected to conduct the field survey. The selection of the study area was carried out through a multi-stage screening process based on multi hazard risk and paddy production. Ampara has considerable exposure to natural disaster risks (Zubair, Ralapanawe, Tennakoon, Yahiya and Perera, 2005) and is the highest rice producing district among the paddy producing districts in Sri Lanka. Out of 29 agrarian service centers in Ampara district, ten agrarian service center divisions[2] were selected to collect the primary data. This selection also particularly based on disaster occurrence within the last ten years.

The study was able to capture three different stratums based on irrigation types, which represent risk disparity. Approximately 75 percent of paddy cultivation lands are under the major irrigations systems. About 6 percent and 18 percent of land are under minor irrigation systems and rain-fed systems, respectively. A semi-controlled method was used to select a sample of 60 households within each of the irrigation types (stratums). In this sample, 25 percent of households were at least one time members of the AAIB insurance scheme and of the other 75 percent were non-members of any crop insurance scheme. The households were chosen through a simple random sampling technique. The AAIB member list and election registration list (excluding the names of the AAIB members) were used as the sampling frame with the total sample size being 180 farmers. The sample households depend on paddy cultivation for their livelihood.

The study of willingness to pay is often done using with hypothetical questioning. We used face to face interview methods with a structured questionnaire schedule for data collection. Before each interview session, a brief education session for explaining how insurance works was conducted. Furthermore, an illustrated handout was used to educate and explain core concepts of index insurance with all possible indexes for a particular area and to explain the benefits and implementation procedure with microinsurance attributes for farmers. The surveys were conducted by trained university postgraduate students together with local enumerators to interact with farmers, clarifying any doubts to minimize non-response rates and judging their sincerity.

Measurement of Variables and Method of Analysis: The contingent valuation method (CV) is used to elicit individual's WTP for the hypostatical index based insurance. However, very limited research has been done on WTP studies using CV methods for agricultural insurance. Patrick (1988) and, Vandeveer and Loehman (1994) used a single dichotomous (yes/no) choice question to study producers' demand for multiple peril crop insurance, rainfall insurance and other modifications of crop insurance. In the developing country context, McCarthy (2003) as well as Sarris, Krfakis and Christiaensen's (2006) studies have examined willingness to pay for rainfall index based on crop insurance by using single and one-and-a-half CV questions based on Morocco and Tanzania, respectively.

We model a farmer's willingness to pay for IBMS as four distinct decisions, which were included for 50 percent and 25 percent tolerance levels and 100 percent and 80 percent coverage contracts. Each contract has a lower and upper bound value; this study used initial or stating values as existing AAIB premiums. Maximum premium amount and minimum amount were used to construct the bid value range. The lower bound coincided with the existing AAIB contract premium value minus 15 percent load. The upper bound was equal to the AAIB premium value plus 15 percent load. All fractional numbers were rounded. The upper (lower) bound of the WTP thus reflects the minimum (maximum) offer price that households gave in response to the willingness to pay question.

Table 2: Contract parameters

		Premium - Sri Lanka Rupees (SLRs)./acre per full crop season					
		Major Irrigation		**Minor Irrigation**		**Rain-fed**	
Trigger	Coverage	Lower Bound Bid value (Rs)	Upper Bound Bid Value (Rs)	Lower Bound Bid value (Rs)	Upper Bound Bid Value (Rs)	Lower Bound Bid value (Rs)	Upper Bound Bid Value (Rs)
25% Trigger	100% Coverage	1900	2600	600	775	500	700
25% Trigger	80% Coverage	1500	2000	460	625	450	600
50% Trigger	100% Coverage	775	1000	425	575	340	460
50% Trigger	80% Coverage	250	350	212.5	290	170	230

Source: Author's calculations based on the AAIB data

In this study, we used the one and half bound dichotomous choice format by following up questions for the purpose of the statistical efficiency and reliability (Saleem, Coble, Hudson, Miller, Hanson and Sempier, 2008). Under this design farmers were first asked to select two contracts and educated to consider each contract as if it were the only choice available. Of the above four possible combinations, the first offered a higher coverage (100% level) and lower damage (25% from strike level) contract, and, if the farmer declined, then we offered the lower coverage (80%) for similar damage level. If the farmers are still not interested in the product, we offered the higher damage (50%) design and followed likewise.

Then, moving to applicable bid questions constructed in terms of irrigation type, each farmer was asked if s/he is willing to pay an upper bound contract, and then offered a follow- up question. If s/he said 'no' to the first bid, a lower bid would be given and her/his willingness to pay is asked and offered a follow- up question if the response was "yes". This follow- up question was open ended. If s/he said 'no' to the upper bound bid, then s/he would be asked to how much s/he is willing to pay. If s/he said 'yes' to the lower bound bid then s/he would be asked to mention the maximum that s/he is willing to pay. Under this elicitation procedure, one potential limitation of contingent valuation method is related to the bias which may arise from the starting point of the bid. In this study, this bias is reduced by using an open ended follow- up question (McCarthy, 2003).

The choice experiment conjoint analysis was used to evaluate and determine consumer preferences for certain insurance product attributes. The applicability of conjoint techniques and related stated preference methods to recovering consumer preferences has been widely demonstrated in diverse applications, including farmers' preferences for crop insurance attributes (Haefele and Loomis, 2001). Finally, examining the relationships between the socioeconomic characteristics of paddy famers and their product choice behavior is vital for developing product design and for justification of microinsurance necessity. Therefore, to determine the impact of farmer characteristic on a different alternate product attributes according to the product choice ranks, we considered only group plan preferences in this study.

Explanatory variables: The basic description and the definition of explanatory variables used in the analysis are presented in Table 3 in the following section.

Table 3: Description of independent variables and hypothesized relationship

Variables	Explanation	Measurement	Hypothesized relationship
Age of farmer AGE_HH AGE_SQR	 the square of the age variable	A continuous quantitative measurement	The younger the people, the more the WTP
Education level EDU_LVL	Education grade completed by farmer	1 – no schooling 2 - up to Grade 5 3 - Grade 6 to 9 4 – GCE /Ordinary Level 5 – GCE /Advance Level 6– higher (college/ university)	Higher level of education will increase WTP
Labour capital LAB_CAP	15 to 65 years old members in household (Active members)	A continuous quantitative measurement	Higher numbers of household residents will lead to lower WTP
Farming experience FAR_EXP	Number of years of paddy cultivation	A continuous quantitative measurement	Higher experience in years will lead to lower WTP
Paddy farm size FAM_SIZE	Number of acres of paddy land owned by farmer	A continuous quantitative measurement of number of acres	The higher land holding the higher the WTP
Natural log of household expenditure per capita LOG_EXP-PC	Average amount that household spent on household needs per month divided by household size	A continuous quantitative measurement	The higher the expenditure, the higher WTP
Outstanding debt OUT_DEBT	Total value of all the outstanding debts SLRs.	A continuous quantitative measure	Borrowing money will lead to decreased WTP

Geographic location MAJ_IRR*** MIN_IRR** RAIN_FED*	Measures whether a farmer 's farm is located in major*** irrigation , minor irrigation** or rain- fed* area	1 = If farm is located in major Irrigation, 0 = otherwise 1 = If farm is located in minor Irrigation, 0 = otherwise 1 = If farm is located in rain-fed, 0 = otherwise	Rain-fed farmers will be more WTP for insurance than irrigated area farmers

Social capital index *(SCP_INDEX)*: In addition to the above typical demographics and socio-economic characteristics, we hypothesize that social capital would influence farmers' WTP for the IBMS. This concept and its influence on microfinance have been growing rapidly in the developing world. A recent piece of literature states that community or group based microinsurance schemes are able to mobilize social capital to encourage voluntary affiliation of resource-poor persons in the informal economy. It suggested that trust and community networks at the local level (proxies for social capital) have a significant impact on the effectiveness of activities within microinsurance programs (Dror, 2007). Therefore, we include a social capital index for our analysis. Social capital is measured by trust, reciprocity and associations, each of which is composed of seven questions with the answers scaled. Five point Likert scales were used to measure peoples' attitudes by asking them the degree of importance. We used a questionnaire related to social capital suggested by Grootaert, Narayan, Jones and Woolcock (2003) to choose the five questions for each. The variables were reduced using factor analysis. Each household level social capital was calculated by the sum of scores from each question divided by total maximum sum of scores.

Income diversification index *(IND_INDEX):* Similar methods were used to construct the other indexes as well. Regarding the diversification of income, the survey used 14 different incomes sources. For simplicity in analysis, income sources other than paddy income are divided into four categories. These are: - wage employment, self-employment, agriculture, as only income generating activity and other sources such as received social benefits or grants from government or other organizations. In all, the four variables were used together to construct the income diversification index. It was hypothesized that a higher number of income sources will lead to lower WTP

Assets index *(AST_INDEX)*: Assets base play a pivotal role among households, particularly in agrarian societies where incomes are closer to the subsistence level. We constructed an asset index which captures the ownership of physical assets within the last six years as a reflection of wealth and savings. The assets considered included consumer and farm durables such as colour televisions, CD players/radios, refrigerators, gas cookers, tractors, motorbikes etc. and are an indication of the level of disposable income in a household. It should be noted that constructed assets index using a weighted on the newest ones and zero-weighted on the assets which were more than six years old. We hypothesized that a higher asset index will lead to a higher WTP.

Awareness index *(AWR_INDEX)*: In addition, we also created an awareness index using the weighted to AAIB members and none-weighted for the rest of the farmers. Moreover, we combined different questions such as knowledge about types of insurance products, attitudes towards insurance, and numbers of insurance company known by names of the households, to build this index. We hypothesized that people with experience of insurance affairs will be more WTP than others.

Dependent variables: Based on the contingent valuation questions described above, we generated a series of dependent variables for analyses on difference aspect. All dependent variables are listed in Table 4.

Table 4: Description of dependent variables

Variables	Description	Measurement
WTP	Mean willingness to pay for IBMS	A continuous quantitative measure SLRs
BID	Willingness to preference for IBMS across the risk tolerance and coverage bid value	
1	25% Trigger, 100% Coverage	1 = Bid value 1 0=if otherwise
2	25% Trigger, 80% Coverage	1 = Bid value 2 0=if otherwise
3	50% Trigger, 100% Coverage	1 = Bid value 3 0=if otherwise
4	50% Trigger, 80% Coverage	1 = Bid value 4 0=if otherwise

Data analysis: The study employed a probit regression model to estimate the mean WTP interms of preference and geographical location with bid contract as an explanatory variable. Finally, we observed farmer characteristics to preference on bid scenarios and attributes using multinomial logit regression. All data is analyzed with STATA statistical software.

RESULTS AND DISCUSSION

In this section, before discussing the econometric analytical results, we will quickly summarize the descriptive characteristics of sample households. The age distribution shows that the majority of respondent farmers were slightly old; the average age of farmers being 52 years, and every farmer had completed some level of formal education. Almost 70 percent of respondent farmers fell in the primary education category (Passed grade 5 to grade 10) and the other 22 percent and 8 percent obtained GCE (O/L) and the GCE (A/L) qualifications[3], respectively. Most of the farmers average a total of 38 years of paddy farming experience and range between 14 to 70 years in the study area. This study also revealed that the majority of the households have large family sizes with an average of 5 individuals and range from 3 to 7 persons and that the average number of active members, who fall in the 15 to 65 years category, is 3 persons. The average farm operation size was 3 acres and the entire sample is owner cultivation. The class-size classification of agricultural holdings clearly reveals the dominance of small and marginal farmers in agricultural operation of the study area.

Farmers reported that they tend to rely heavily on farm income sources. Many rural households grow paddy for their own consumption and sell their surpluses. While 95 percent of the farm household members engaged in more than one off- paddy farm activity to support their livelihood.

Surveys revealed that most of these assets were purchased more than six years earlier and assets base is comparatively high in the major irrigation community. Assets also serve as a form of savings; however, as explains that the kinds of assets which may be used by a household at any point in time depends on the severity of the income failure and the liquidity of the assets. An average monthly expenditure was used as a proxy for income, which was 2500 SLRs per person at the 2010 price level in this sample. The majority (99 percent) of farmer households was below the mean national average income per person per month (SLRs6463) and 95 percent below the average income per person per month at the district level as well (SLRs4754) (DCS-SL, 2010). Most of the sample households (75 percent) live below the official poverty line at the national level for June 2010 (SLRs3098) defined by the department of census and statistics in Sri Lanka. The level of outstanding debt is an indicator that there are fewer resources to spend on the conventional insurance. Approximately 40 percent of the sample farmers had outstanding debt.

Farmers were well aware of the different types of insurance products in the study area. The survey revealed that households were aware of 92 percent of agricultural and crop insurance in the full sample. Even 71 percent farmers were aware of agricultural and crop insurance who were not members of the government AAIB. Moreover, out of all the farmers in study area, about 74 percent were aware of life insurance, 27 percent of funeral insurance, 44 percent of health insurance and 10 percent were aware of disability insurance. Only 5 percent of the households were not aware of any insurance products at all. Awareness is high in the major irrigation area, and very low in the extremely poor income group.

Encouragingly, according to the descriptive statistics, participants expressed a clear willingness to join for index based microinsurance, out of 180 farmers who entered, a sample of 88 percent were willing to join the proposed index base insurance scheme including microinsurance attribute.

Willingness to pay for hypothetical Index Based Microinsurance Scheme (IBMS): We constructed three deferent regression models across the irrigation types for examine households' willingness to pay pattern by using OLS estimation. The dependant variable is a maximum amount (SLRs) of willingness to pay for acre per full crop season in IBMS product. A summary of the final OLS models developed at irrigation types is presented in Table 5.

Table 5: Factors influencing farmers' willingness to pay for the IBMS by irrigation type

	Major Irrigation		**Minor Irrigation**		**Rain- Fed**	
	Coefficients	Robust Std. Err.	Coefficients	Robust Std. Err.	Coefficients	Robust Std. Err.
AGE_HH	**-290.635****	95.917	-28.007	65.457	**-112.422****	46.762
AGE_SQR	**2.213****	0.668	-0.208	0.336	0.855	0.433
EDU_LVL	**529.738**	279.448	142.472	149.291	1.321	109.599
LAB_CAP	-86.958	105.275	**-127.941***	85.879	**-1.540***	40.905
FAR_EXP	46.655	64.744	54.944	47.521	**25.806***	19.820
FAM_SIZE	-93.257	91.799	-35.506	42.300	**-50.192***	26.708
OUT_DEBT	0.014	0.580	0.048	0.387	**0.031****	0.116
SCP_INDEX	**13.897****	2.922	**15.886****	3.306	**18.685****	2.045
IND_INDEX	-1.130	3.615	**-3.801***	2.372	**-0.711***	0.986
AST_INDEX	**8.177***	5.277	0.269	4.449	7.788	4.436
AWR_INDEX	1.415	2.609	**2.716****	1.415	**1.711****	0.998
LOG_EXP-PC	**-401.220***	264.134	170.359	147.847	-179.803	128.611
INTERCEPT	**7299.234***	2151.053	**-671.860***	1317.765	**1495.585***	1067.860
R-squared	0.7711		0.7997		0.8522	
Number of obs.	60		60		60	

*P<0.10; **P<0.05; ***P<0.01.

As we expected, the younger farmers were more likely to pay than the elderly in rain-fed and major irrigation areas, but age was not a significant factor to WTP among the minor irrigation farmers while age square variable was positively significant only in the major irrigation community. We also hypothesized that younger and more educated farmers could understand the product more easily, and be more likely to pay; in this sense, education and asset bases were significant with positive sign at major irrigation areas. Farm size was not significant in irrigated areas because it may homogenize plot size. However, there was a positive significant relationship on farm size at rain-fed areas, which indicates that farmers who have more land to cultivate are more willing to pay a higher premium for insurance.

Outstanding debt index is a positive influence on the probability of farmers WTP in rain-fed areas ($p < .05$). This variable is insignificant for other areas. This could imply that farmers with rain-fed areas and more debt demonstrate higher demand for insurance since their risk is higher than other irrigated lands.

Awareness index was again an important determinant in minor and rain-fed communities, which is positively significant. But this index was not significantly associated with major irrigation farmers' decisions. A similar trend also appears in income diversification and labor capital indexes. One of the common characteristic of these models is the greater dependency on the social capital variable. As we expected, it indicates that there is enough possibility for a group formation to group based product. Its indication on society's social interactions is to facilitate farmers to act together more effectively to pursue shared objectives (Putnam, 1993). However, expenditure per capita was only significant at major irrigation areas. Its negative coefficient estimate implies that more expenditure results in less probability of WTP for insurance.

Preferences for Crop Insurance Contract Features and Attributes

This section assesses the relative importance of different features of a crop insurance product. According to insurance literature many attributes can generate to test for farmers' preferences. In this study, we select four most important crop insurance product characteristics. (1) Indemnification base- bid contract, (2) Insurance plan, (3) frequency of premium payment, and (4) Delivery choice.

Farmers' Preferences to Indemnification base - Bid contracts: The premium bids reflect the farmers' risk preferences, and major irrigation farmers are more risk averse than others farmers. Almost half of the major irrigation farmers were concentrated on the 25 percent trigger level; however, minor and rain-fed farmer's toleration capacities were comparatively high at 55 and 57 percent, respectively. Rain-fed farmers were highly attracted to the 80 percent coverage level and most irrigated farmers preferred the 100 percent coverage. Contract preferences percentages are reported in Table 6.

Table 6: Preference for bid contracts by irrigation types- Percentage

	Major Irrigation		Minor Irrigation		Rain-Fed		Total
25% Trigger, 100% Coverage	38		27		16		
		48		**36**		**16**	**100**
25% Trigger, 80% Coverage	18		18		27		
		30		**33**		**36**	**100**
50% Trigger, 100% Coverage	27		42		27		
		29		**48**		**23**	**100**
50% Trigger, 80% Coverage	16		13		30		
		30		**27**		**43**	**100**
Total	100		100		100		

Source*: Microinsurance for Agricultural Risk Mitigation in Sri Lanka, Field Survey- 2010*

In further analysis, we measured other explanatory variables that may affect farmer's demand for insurance at four different scenarios. This multinomial logit model, highest risk bid contract (4^{th} bid contract - 50% trigger, 80% coverage) and rain-fed area are selected as the base cases and the influences of the explanatory variables are expressed relative to their influence in the base case. The results are presented in Table7.

Table 7: The factors influencing farmers' preference for the contract bids

Bid	**25% Trigger, 100% Coverage**		**25% Trigger, 80% Coverage**		**50% Trigger, 100% Coverage**	
	Coefficient	Robust Std. Error	Coefficient	Robust Std. Error	Coefficient	Robust Std. Error
AGE_HH	-.536542	.2286355	-.318295	.2361341	**-.1424839***	.2285926
AGE_SQR	.0048914	.0020812	.0027833	.0021294	.0013634	.0020876
EDU_LVL	**1.538475***	.8821999	.0126642	.6070897	.0542027	.5838011
SCP_INDEX	**.0479856*****	.0132559	**.0460936*****	.0134274	.0578491	.0125742
IND_INDEX	.0057868	.0105278	**-.0064772****	.010435	**-.0016619***	.0100819
AST_INDEX	.0037058	.0246507	**-.0097576****	.0221332	**-.0224276***	.0211446
AWR_INDEX	**.000145***	.0080371	-.0016731	.0075772	-.0021658	.0068933
LOG_EXP-PC	**.4370879***	1.121598	**-.5294897***	.8634272	**.3903087***	.8349556
LAB_CAP	.4454488	.3348031	.6252325	.3189738	.3847385	.2899588
FAM_SIZE	-.6391164	.2664661	-.5446482	.2565901	**-.3418533***	.236381
MAJ_IRR	.8120786	.7697659	.1060952	.7289062	.2157784	.7170418
MIN_IRR	**2.132335***	.9927099	**1.533167***	.9042899	2.062953	.8479137
INTERCEPT	**8.161169***	6.041402	**5.518685***	6.097014	**-.6990855***	5.738567
Numb Ob.	88		66		104	

Pseudo R2 = 0.7725
Log pseudo likelihood = -179.26841

Note: 50% trigger, 80% coverage bid contract was base value for contract scenarios (60 observation)
Rain-fed farmers were base value for irrigation types
*P<0.10; **P<0.05; ***P<0.01.

Of the main findings that emerge from the regressions' results in this sample, farm household log expenditure per capita (LOG_EXP-PC) was the most significant factor of a farmer's bid contract selection for the future risk reduction across all the communities. In addition to considering the marginal effects of the coefficient, if a one unit increase in farm household log expenditure per capita (LOG_EXP-PC) for the 1st bid contract (25% trigger, 100% coverage) relative to a 4th bid contract (50% trigger, 80% coverage), the 1st bid contract would be expected to increase by 0.43 units while holding all other variables in the model constant. Similar interpretations apply to 2nd bid contract (25% trigger, 80% coverage) which would decrease by 0.52 and 3rd bid contract (50% trigger, 100% coverage) which would be increased by 0.39 units.

The social capital index (SCP_INDEX) was significant in the models developed for 1stand 2ndbid contract samples. However, this variable was not significant in the 3rd bid contract relative to base contract. This index was positively associated with farmer preferences for risk-averse decisions compared to risk- taker bid contracts. Income diversification (IND_INDEX) and asset indexes (AST_INDEX) were negatively significant for the 2nd and 3rd bid contracts. Thus, other things held constant. As we expected, it may imply that more assets' base and income sources are less risky, which may shift preference towards risk tolerance contract decisions. The awareness index (AWR_INDEX) and the education level of a farmer (EDU_LVL) variables were positive and statistically significant, This coefficient estimate indicates that more aware farmers and more educated farmers are more likely to prefer low risk insurance contracts rather than higher risk contracts. It appears that way in our 1st bid contract model. The minor irrigation variable (MIN_IRR) was significant and had a positive influence on the preference of selection of the 1st and 2nd bid contracts compared to the rain-fed farmers. The marginal effects of the coefficient MIN_IRR implies that if a one unit increase in MIN_IRR for 1st and 2nd bid contracts relative to 4th rain-fed farmers, 1st and 2nd bid contracts would be expected to increase by 2.1 and 1.5units, respectively while holding all other variables in the model constant. However, major irrigation community was not significant any bid contract when compared to rain-fed farmers. Farmer's Age (AGE_HH) is negatively significant for the 3rd bid contract; it confirmed that younger farmers were more likely to choose a risk tolerance plan than their elders. Farm size (FAM_SIZE) also negatively influenced the on 3rd bid contract choices. It appears, therefore, that more farmers who own more land have a low in probability to choose more risky insurance contracts. The variables, labor capital (LAB_CAP) and age square (AGE_SQR) were not statistically significant in these models.

Preferences for Insurance Plan, Premium Frequency and Delivery Choice: The second examined attribute is an insurance plan preference, which is evaluated at two levels. It includes participating in insurance schemes as a group or an individual. The majority of the farmers in the three irrigation areas (87%) preferred to join a group rather than an individual plan. In the irrigated area, this group preference is very high.

Farmers were asked one question regarding their preference premium frequency. On average, farmers derive approximately 50% of their preference from a monthly premium collection method. This attribute is very much exhibited in irrigated areas. Farmers from rain-fed areas report higher proportions of weekly premium frequency than the others, even though a considerable amount of monthly payment preference is also reported. One-time payment for crop session is not significant in rain-fed area but farmer in irrigated area preferred this attribute.

The survey then asked their preferred most suitable and convince work organization for insurance delivery. The majority of farmers highlight that the farmer organization (FA) was the most suitable organization structure for work as stakeholder in the insurance supply chain. However, some farmers prefer other organization such as burial society, rotating savings and credit association (ROSCA).Therefore, such organizations were grouped together to construct a variable called “Others” for interpretation. Descriptive statistics are reported in Table 8.

Table 8: Farmers preference of insurance attributes by irrigation types- Percentage

Attributes of insurance design	Rain-fed (N=48)	Minor Irrigation (N=56)	Major Irrigation (N=54)	Total (N=158)
Insurance Plan				
Group	80	88	92	87
Individual	20	12	8	13
Premium Frequency				
One-time for crop session	10	27	30	22
Monthly	30	52	65	49
Weekly	60	21	5	29
Delivery Choice				
Farmer organization (FA)	85	90	93	89
Other organizations	15	10	7	11

Source*: Microinsurance for Agricultural Risk Mitigation in Sri Lanka, Field Survey- 2010*

Understanding the relationships between the all attributes and irrigation types, the multinomial and conditional logit models were estimated using STATA statistical software. The estimated parameters are presented in Table 9. Since the attributes had few levels each, one level was left out as base during estimation. This importance score gives the relative share of the rank influence that is due to each attribute of insurance product. The overall explanatory power of the estimate is good with a pseudo-R^2 of 0.76. The signs are positive on the level of each attribute that is more preferred.

The group based insurance plan is strongly significant ($p<0.01$) and has the expected positive sign in all the irrigation areas, implying that paddy farmers in the study area prefer grouped base rather than individual plan in this analysis too.

High relative monthly premium frequency has the expected positive sign for all the irrigation areas but is not significant for the rain-fed area ($p<0.05$). Weekly premium frequency has a positive sign in rain fed area and minor irrigation areas, indicating that respondents prefer weekly premium pay relative to one-time payment, which is not statistically significant and negative for the major irrigation areas. However, both premium pay options are significant in this study area compared to the one time pay option.

Table 9: Estimated Maximum Likelihood Parameter of Insurance Attributes

Attributes of Insurance Design	Rain-fed	Minor Irrigation	Major Irrigation	Total
Insurance Plan				
Group	**2.2623*** (0.2472)**	**2.5282*** (0.2864)**	**2.1590*** (0.2659)**	**2.2475*** (0.1899)**
Individual	Base value			
Premium Frequency				
Monthly	0.2578 (0.3063)	**1.1031*** (0.3193)**	**1.4826*** (0.2539)**	**1.2824*** (0.1883)**
Weekly	**1.2052*** (0.2899)**	**-0.9071*** (0.3642)**	-0.4071 (0.3808)	**0.5796*** (0.3231)**
One-time for crop session	Base value			
Delivery Choice				
Farmer Organization	**2.9552 *** (0.3732)**	**3.3246 *** (0.3657)**	**3.3274 *** (0.4101)**	**2.3816 *** (0.2898)**
Other Organizations	Base value			
Bid Combination				
25% Trigger, 100% Coverage 25% Trigger, 80% Coverage	-0.2451 (0.3110)	**0.3841* (0.2348)**	**0.6025* (0.2543)**	**0.3183* (0.2925)**
25% Trigger, 100% Coverage 50% Trigger, 100% Coverage	-0.4081 (0.3717)	**1.5672*** (0.2023)**	**1.3012*** (0.2991)**	**0.4879*** (0.2220)**
25% Trigger, 80% Coverage 50% Trigger, 100% Coverage	**0.3251 *** (0.4562)**	**0.5654 *** (0.3622)**	0.4757 (0.4293)	**0.6452 (0.2696)**
25% Trigger, 80% Coverage 50% Trigger, 80% Coverage	**0.3015 *** (0.2148)**	**0.3241* (0.2148)**	0.1491 (0.2556)	**0.1893 * (0.1623)**
50% Trigger, 100% Coverage 50% Trigger, 80% Coverage	**1.2652* (0.2471)**	0.2639 (0.2339)	0.0062 (0.2781)	**0.1924 * (0.1761)**
25% Trigger, 100% Coverage 50% Trigger, 80% Coverage	Base value			
Number of obs.	48	56	54	158
Pseudo R2 =	0.6248	0.811	0.5925	0.7622
Log likelihood =	-158.26	-126.84	168.41	-149.26

Note: *P<0.10; **P<0.05; ***P<0.01.

Results raveled that lower trigger (25%) values significant at irrigated area and higher tolerance trigger levels (50%) are observed in rain-fed area. However, whatever the trigger levels, 100% coverage option is highly significant at irrigated area. A 50% bid contract pair option is significant only at rain-fed area, which implies that farmers are less likely to choose costly options. However, this estimated results indicate that some of the farmers in all area, consider mix options to be beneficial since it shows the disparity of the market.

Delivery choice as a farmer organization has a positive impact and is also highly significant ($p<0.01$) in all the systems. This is implied and we can conclude that there is the possibility of linking the role of farmer organization and insurance markets more closely. This link can be facilitate to the adoption of a farmers centered, farmer owned, farmers managed participatory approach for insurance design, implementation, monitoring and evaluation strategies to insurance scheme.

Examining the relationships between the socioeconomic characteristics of paddy farmers and their product choice behavior is vital to developing a product design and justification of microinsurance necessity. Therefore, in order to determine the impact of farmer characteristic on a other product attributes according to the product choice ranks, we considered only group plan preferences. According to the results, 87 percent of farmers prefer this plan, and then select high ranked four realizable products for conjoint analysis, which represents 74% of farmers in the sample.

The regression coefficients are estimates of part-worth contribution of each insurance product combination. Coefficients for these combinations represent the contribution relative to the reference choices set or product combination. For convenience, product E or choice set (Group/Other/Monthly), which is ranked as five and rain-fed area was assigned as the references. Thus computed coefficients indicated the packaging options impact on liking relative to product E. Positive coefficients indicate that the option increases liking, while negative coefficients indicate that the option yields less liking than product E.

Table 10: The impact of farmer characteristic on a different other product attributes

Explanatory variables	**Product Choice Set**			
	A (3)	**B (1)**	**C(2)**	**D(4)**
AGE_HH	**-0.6623****	-0.5045**	-0.0190	**-0.6231****
AGE_SQR	0.0001	0.0001	0.0000	0.0000
EDU_LVL	0.1148	**0.0133****	**0.1468****	**0.1417****
SCP_INDEX	**0.2157****	**0.2162*****	**0.2210*****	**0.2443****
IND_INDEX	0.0502	**0.0885****	**0.1859*****	**0.1308****
AST_INDEX	**0.1604****	0.0037	**0.1102***	**0.2002****
AWR_INDEX	0.0373	0.0015	0.0368	0.0132
LOG_EXP-PC	**0.2148***	**0.0653****	**0.1948*****	**0.0601****
LAB_CAP	0.1258	0.0262	**0.2144*****	**0.1345***
FAM_SIZE	0.0006	0.0026	**0.2962****	0.0008
MAJ_IRR	**0.5373****	**0.5653****	0.03680	0.0132
MIN_IRR	0.0148	**0.2350****	**0.3948****	0.0601
INTERCEPT	4..6612	2.2077	3.3519	0.6231

Note: *P<0.10; **P<0.05; ***P<0.01.

The relative importance from the conjoint analysis indicates that Product B choice set (Group/FA/Monthly) has become a more important insurance product and is signified by the negative sign on the age of household head, but education, social capital, income diversification and expenditure variables are positively significant. , this product B is preferred for major irrigation and minor irrigation area. In addition to product C choice set (Group/FA/Weekly), is dependent on asset base and labor capital with farm size. It means the weekly premium is based on farmers' wealth. This product is also preferred in minor irrigation area farmer with rain fed area on comparatively. Product A choice set (Group/FA/One-time), One time premium attributes is likely to major irrigation farmers and it is significantly dependent on framers' assets base and social capital variables at 5% level, expenditure factor is significant at 10 % level.

Product D choice set (Group/Other/One-time), is presenting farmer's willingness to work with other organization than farmer organization and onetime payment methods. The preference of Product D choice set, age of household, social capital, education and expenditure variables are significant factors at 1 % level. In addition to the, labor capital capacity is positively significant for farmers' preference at 10 % level and not significant any irrigation areas.

CONCLUSION

This paper reports the results of a contingent valuation survey that elicits producers' willingness to pay (WTP) for Index Based Microinsurance (IBMS) and farmers' preferences for insurance attributes. There is robust evidence suggesting that this type of insurance scheme is well accepted by peasants, and that the potential demand for insurance in the survey area is very high. Results indicate that the strongest influence on willingness to pay is social capital variable and that demand is more concentrated in irrigated areas. Observed preferences affecting willingness to pay are highly location specific. Some classic explanatory variables were significant in the variation on spatial and insurance contracts. Furthermore, Choice experiments tool was used for the understanding of farmers' preferences for insurance attributes. Most farmers in irrigated areas showed more risk-averse behavior than farmers in rain-fed areas. In terms of farmers' perceptions about harm and coverage levels, irrigated area farmers preferred low damage contracts and high coverage levels, which were likely more important in their WTP decisions, as shown by the relatively high mean values in this category. We found that farmers in rain-fed areas were less likely to buy insurance and have a low mean WTP. However, the study exhibited more scattered WTP values, even within each irrigation type. Outliers in terms of WTP vales can be better served through innovative interventions. Farmers in the study area prefer grouped base than individual plan. However, premium frequencies were indicating considerable variability.

Participatory design attracts great attention from designers working within microinsurance. Social capital exhibited a high influence on famer's preferences. Therefore a participatory or community-based approach to insurance design where farmers are involved in design based on their own requirements is advisable.

These findings vividly demonstrated the complexity of the issues in the rural context and pragmatic barriers for participation to uniform insurance scheme, which also help our understanding for segmentation of microinsurance and gives invaluable insights to need of microinsurance scheme. However, this complexity can generate more economic welfare to farmer as well as insurer through the diversification. This demand-led approach may provide more benefits than a supply-led design. In this context we can conclude that a uniformly structured crop insurance product does not achieve maximum efficiency. Therefore, to improve effectiveness, products should be designed and implemented with the synergies of different approaches. For example, price discrimination and spatial discrimination with regard to disaster or peril, as well as farmers' other requirements.

Any index based insurance program requires well-developed infrastructure and institutional network arrangements in order to run an efficient and effective insurance system. Such conditions can be relatively difficult to find in developing countries. However, in Sri Lanka the well established high density network of meteorological stations, availability of historical data, favorable rural financial culture, and the comparatively well-educated and literate population can help bridge this gap. The high level of social organization, including a widespread network of banking and microfinance institutions, a postal network, an agrarian services network, an established telecommunication system and retail network offer a potential platform to deliver microinsurance products. Moreover, if well established farm organizations can be linked with the insurance supply chain and would be developed with more trust than if it were developed by a commercial insurance company. The survey reveals that farmers are more interested in working with the farmer organizations. Up to now microinsurance in Sri Lanka has mostly been concentrated on the health sector. Outreach seems to be rather limited. However, microinsurance providers will be able to reach a much higher number of clients in the agriculture sector by bundling health with crop-products or unbundling contract design. There are clear indications that the framework conditions are also favorable for microinsurance development in the agricultural sector, but further research is needed to investigate this supply side perspective in order to initiate IBMS in Sri Lanka.

Note:
[1] In Sri Lanka, the composition of agricultural land under small holdings is 80 percent and average farm is less than 2.5 acres. Agricultural Census -2002
[2]Agrarian Service Center is the lowest agricultural administrative unit in the Sri Lanka consisting usually of four to five villages
[3] The General Certificate of Education (GCE) Ordinary Level (O/L) and Advance Level (A/L) conducted by the Department of Examinations of the Ministry of Education in Sri Lanka.

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