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REVIEW OF LITERATURE

NEED/IMPORTANCE OF THE STUDY

STATEMENT OF THE PROBLEM

OBJECTIVES

HYPOTHESES

RESEARCH METHODOLOGY

RESULTS & DISCUSSION

FINDINGS

RECOMMENDATIONS/SUGGESTIONS

CONCLUSIONS

SCOPE FOR FURTHER RESEARCH

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APPENDIX/ANNEXURE

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IMPACT OF BASIS RISK ON THE PERFORMANCE OF RAINFALL INSURANCE SCHEME FOR COFFEE: A PERCEPTUAL ANALYSIS

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ABSTRACT

The purpose of this paper is to explore the impact of basis risk on the performance of Rainfall Insurance Scheme for Coffee in Karnataka, India. The method used is quantitative design with some qualitative elements. Data were collected through a field survey of 240 growers who have purchased the rainfall insurance contracts. Correlation and regression analyze were used to test the performance of RISC programme in view of plausible negative impact of basis risk. The study revealed the existence of high levels of basis risk impacting the performance of Rainfall Insurance Scheme for Coffee. It was found that the insurance company has not taken cognizance of existence of basis risk. The solution lies in the localization of automatic reference rainfall stations that could substantially minimize the basis risk and improve the performance of rainfall insurance scheme for coffee. The study highlights the problem of basis risk and the effects on the performance of RISC. The findings reveal the need for initiating steps to minimize basis risk. The paper is based on core findings of a pilot study that addresses the current gap in the understanding of basis risk and performance of rainfall insurance. It is particularly valuable for both the growers and insurance company.

KEYWORDS

Basis risk, Growers, Rainfall insurance scheme for coffee, Rainfall risk protection.

INTRODUCTION

Rainfall Insurance Scheme for Coffee was introduced by Agriculture Insurance Company of India Limited in 2007. This Scheme has been used to share coffee production risk and to stabilize the farm income of the growers. The insurance company will make a payment on the basis of variation in rainfall which leads to decrease in the coffee production. Of India's total coffee production, 70% of the coffee is produced by the Karnataka state. Coffee cultivation is confined mostly to hilly tracts of Western and Eastern Ghats of southern state of Karnataka with large differences in weather patterns within only a few miles. In highly spatially heterogeneous production areas, basis risk is likely to be so high as to make index insurance problematic. Under these conditions, index insurance will work only if it is highly localized (USAID 2006). This paper is based on a premise the basis risk is likely to hinder the performance of Rainfall Insurance Scheme for Coffee.

RAINFALL INSURANCE SCHEME FOR COFFEE (RISC) PROGRAMME

Rainfall insurance Scheme for Coffee is designed by the Agriculture Insurance Company of India Limited in consultation with Coffee Board, Central Coffee Research Institute and the coffee growers covering both varieties Arabica and Robusta.

This policy covers rainfall during the prime cropping season running approximately from March to August. The contract divides the cropping season into three phases corresponding to (1) blossom showers, (2) backing showers and (3) monsoon showers. Phase payouts are based on accumulated rainfall between the start and end dates of the phase, measured at a nearby reference weather station or rain gauge. Insurance payouts in the first two phases are linked to low rainfall. Insurance payout in the third phase is linked to excess rainfall.

REVIEW OF LITERATURE

Basis risk is defined as mismatch between coverage and the actual results. This risk is always there with weather index based insurance programmes since rainfall received at farm field may not always match with that received at weather station (Mapfumo 2007).

The rainfall measured at the local weather station is not perfectly correlated with rainfall at an individual plot. An important limitation of index insurance is that policyholders are exposed to basis risk. In this context, basis risk refers to the fact that the index and the losses experienced by the policyholder are not perfectly correlated. It is possible for the policyholder to experience a loss and yet receive no index insurance indemnity. Likewise it is possible for the policyholder to receive an index insurance indemnity and yet experience no loss (Sinha 2004: World Bank 2006; Skees et al., 2007: Gine,Townsend et al., 2007: Manfredo and Richards 2009).

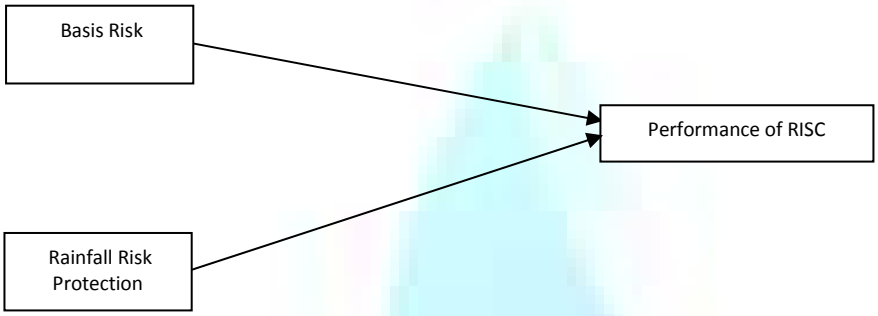
Barnett and Mahul (2008) opined that there are two potential sources of basis risk. First, losses may be caused by disease, insect infestation, or any number of factors other than the weather variable on which the index is based. Unless the index is based on a weather variable that is the dominant cause of loss in the region, basis risk will be unacceptably high. Second, the weather variable being used as the index may not be highly spatially covariate. Thus, the measure of the

weather variable at the farm or household may be quite different than the measure at the weather station. Basis risk can be reduced by offering weather index insurance only in areas where a particular, highly covariate, weather variable (e.g., drought or extreme temperatures) is the dominant cause of loss.

USAID (2006) report disclosed that, with an index insurance contract, there is basis risk. Too much basis risk will deter interest because individuals will feel that the index will not be representative of their loss experience and will therefore offer them poor protection against risk. Reshmy (2010) observed that the poor density of weather stations has been a major handicap in the spread of this product. Basis risk is perhaps the largest hurdle to successfully scaling up index insurance (Barrett and Barnett et al 2007). Skees and Hess (2003) argued that still, it is important to recognize where weather insurance products might add value and where they would not be the appropriate instrument due to large basis risk.

While studying RISC programme variables such as knowledge, risk protection, trigger rainfall, payouts etc., the following research model has been developed to study the impact of basis risk on the performance of RISC, which has been identified based on current state of literature. Figure 1 shows the impact of basis risk on the performance of RISC

FIG 1: RESEARCH MODEL



Source: Authors

OBJECTIVES OF THE STUDY

The objective of the present study is to examine the impact of basis risk on performance of RISC. In this framework, an attempt is made to achieve the following specific goals:

1. Analysis of rationale underlying introduction of RISC programme.
2. Evaluation of the degree of basis risk underlying RISC programme on the basis of perceptions of coffee growers.
3. Examining the extent to which the basis risk is factored into the RISC model.
4. Evaluation of performance of RISC programme.

HYPOTHESES

To achieve the objectives of the study, the following research hypotheses are formulated.

H_1: "There exists a high degree of basis risk that underscores RISC programme".

H_2: "Basis risk is not effectively factored into RISC model leading to inadequate risk protection".

H_3: "The performance of RISC programme is adversely impacted by high degree of perception of basis risk".

METHODOLOGY

The study is basically an analysis of perception of targeted stakeholder group concerning basis risk. It is based on the primary data gathered through actual field survey.

SAMPLE

The present study was designed with the co-operation of Agriculture Insurance Company of India Limited and the growers from three districts of Kodagu, Hassan and Chikkamangalore of Karnataka State. The number of insurance contracts purchased by the growers in the year 2007, 2008 and 2009 was 12,286/ 8,387 and 5,604 respectively of which 240 responses were collected from the growers.

RESEARCH INSTRUMENT

The research instrument used for the study is based on structured questionnaire. This questionnaire was pretested before the survey. It consists of 'Yes or No' questions and Five-point Likert Scale is employed with anchor ratings where 1= very low, to 5= very high. The questionnaire has four parts. Part 'A' (General) consists of the questions regarding the profile of the growers. In part 'B' (Rainfall risk) the questions were asked to know the growers perception of rainfall risk. In Part 'C' (RISC) questions were focused on various factors affecting the performance of RISC and in part 'D' (uninsured) the questions were asked to know the reasons for not buying the insurance contrasts. This study uses Part 'C' questions to know the performance of RISC programme.

DATA COLLECTION AND ANALYSIS

The primary data on 240 responses were collected from targeted group in Karnataka (i.e., Kodagu, Hassan and Chikkamagalur Districts) using the research instrument. The questionnaire was personally administered to the growers during the growers meeting and during the mass contact programme conducted by the Coffee Board. During meetings, the discussion was held with the growers to fill up the questionnaire and to collect the additional information.

Descriptive statistics such as averages and standard deviations were used to know the rainfall risk protection and the performance of RISC programme. Correlation and regression analysis were used to test the relationship between dependent and independent variables. Statistical Software, SPSS (V 18.0) was used to tabulate and analyse the data.

TABLE 1: GROWERS PERCEPTION OF BASIS RISK

	Frequency	Percent
Yes	230	95.8
No	10	4.2
Total	240	100.0

Source: Field survey

Table 1 demonstrates the perception of growers about the basis risk. Majority of respondents (95.8 %) opine that their estate exists far away from automatic rainfall station. This implies that there exist high levels of basis risk.

TABLE 2: DESCRIPTIVE STATISTICS

Variables	N	Minimum	Maximum	Mean	Std. Deviation
Basis Risk	236	1.00	5.00	4.6059	.64198
Rainfall risk protection	240	1.00	5.00	1.4833	.64375
Performance of RISC	240	1.00	4.00	2.0250	.66550

Source: Field survey

The Basis risk average is 4.605. The rainfall risk protection average is 1.483 and the performance of RISC average is 2.025. These indicate that, the higher level of difference in the rainfall received in the automatic weather stations and individual plot, and the inadequate rainfall risk protection leads to the lower performance of RISC.

TABLE 3: CORRELATIONS BETWEEN THE VARIABLES

Variable	Variable	Correlation	Sig. (2-tailed)
Basis Risk	Rainfall risk protection	-.184**	.005
Basis Risk	Performance of RISC	-.545**	.000
Rainfall risk protection	Performance of RISC	.356**	.000

** Correlation is significant at the 0.01 level (2-tailed).

Source: Field survey

Table 3 highlights that there is a significant relationship among the variables at 0.01significance level. The results show that, there is a significant positive relationship between rainfall risk protection and performance of RISC ($p < 0.01$) and there is a significant negative relationship between the basis risk and rainfall risk coverage ($p< 0.01$). It was found that higher the basis risk lower the performance.

TABLE 4: MODEL SUMMARY

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.602[a]	.362	.357	.52844

a. Predictors: (Constant), Basis Risk, Rainfall risk protection,

b. Source: Field survey

Table 4 explains the model representing the relationship between the independent variables and dependent variable is moderately high with the R value of 0.602. With the standard error 0.5284, these variables explained 36.2(R2) percent of the variance in performance of RISC.

TABLE 5: COEFFICIENTS

	Unstandardized Coefficients		Standardized Coefficients Beta	t	Sig.
	B	Beta			
(Constant)	3.974	.280		14.202	.000
Basis Risk	-.511	.055	-.498	-9.356	.000
Rainfall risk protection	.263	.054	.258	4.852	.000

Dependent Variable: Performance of RISC. p<0.01

Source: Field survey

TESTING OF HYPOTHESES

For the purpose of testing, the following null hypotheses and alternative hypotheses are formulated.

TESTING OF FIRST HYPOTHESIS

H_{01}: "There is no high degree of basis risk that underscores RISC programme"

H_{a1}: "There exists a high degree of basis risk that underscores RISC programme"

TABLE 6: ONE-SAMPLE STATISTICS

	N	Mean	Std. Deviation	Std. Error Mean
Basis risk	236	4.6059	.64198	.04179

Source: Field survey

TABLE 7: ONE-SAMPLE TEST

	Test Value = 3					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
Basis risk	38.429	235	.000	1.60593	1.5236	1.6883

Source: Field survey

For testing of first hypothesis T test is used. As per table 6 and 7 the mean of the Basis Risk underlying RISC programme is 4.6059, which is statistically significantly different from the test value of 3 and as p-value equivalent to 0.000, null hypothesis will be rejected because p-value is less than the significance level 0.05. The first alternative hypothesis "There exists a high degree of basis risk that underscores RISC programme" stands proved.

TESTING OF SECOND HYPOTHESIS

H_{02}: "Basis risk is effectively factored into RISC model leading to inadequate risk protection".

H_{a2}: "Basis risk is not effectively factored into RISC model leading to inadequate risk protection".

Table 3 exhibits the correlation coefficient between basis risk and rainfall risk protection -0.184 (observed p value is0.000 which is less than set value 0.01) indicating that there is a negative significant relationship between basis risk and rainfall risk protection. It implies that basis risk is not effectively factored into RISC model leading to inadequate risk Protection. Hence, the null hypothesis is rejected. Therefore the second alternative hypothesis of the research is proved.

TESTING OF THIRD HYPOTHESIS

H_{03}: "The performance of RISC programme is not adversely impacted by high degree of perception of basis risk".

H_{a3}: "The performance of RISC programme is adversely impacted by high degree of perception of basis risk".

As per table 5 the beta co-efficient value for the third hypothesis is - 0.498. It indicates that there is an inverse significant relationship between basis risk and the performance of RISC. As p-value equivalent to 0.000, null hypothesis will be rejected because p-value is less than the significance level 0.01. The third alternative hypothesis "The performance of RISC programme is adversely impacted by high degree of perception of basis risk" stands proved.

DISCUSSION

The study covers various important aspects of RISC such as rainfall risk protection, basis risk and the performance. Majority of the respondents agree that there is a high degree of difference between rainfall received in the reference rainfall station and individual plot. It was found that the high degree of basis risk exists on mountain sides. Due to existence of high basis risk both insured and insurer are not happy with this programme, because insured growers who have suffered

a loss due to adverse rainfall were not able to receive the payout. The insurance company made the payout to those insured growers who have not actually suffered a loss. Therefore the payout ratio is more than premium collected. It leads to ambiguous operation of the RISC programme.

The results for the first hypothesis indicate that the average of basis risk is higher than the test value of RISC programme. This implies that there exists a high degree of Basis risk underlying RISC programme.

The results for the second alternative hypothesis indicate that a negative relationship between basis risk and rainfall risk protection of RISC programme. Since the basis risk is not effectively factored into RISC model, it is inadequate to protect the growers from loss due to adverse rainfall and adversely affects the performance of RISC.

The results for the third hypothesis show that the other independent variable the basis risk is significantly related to performance of RISC programme. There is an inverse relationship between the basis risk and performance of RISC programme. Therefore the performance of RISC programme is adversely impacted by high degree of basis risk.

THEORETICAL AND PRACTICAL IMPLICATIONS

Results from this study have potentially important implications for future research and practice. In general, the results of this research argue for examining basis risk and rainfall risk protection aspects related to the performance of RISC. The results of this study do support the view that basis risk and rainfall risk protection are critical variables to measure the performance of RISC. The basis risk is an important factor involved in the operation of rainfall insurance scheme; further research is warranted to establish the significant relationship between basis risk and rainfall risk protection, payouts etc., and also to establish the relationship between performance of RISC and other factors. It is also recommended that the localization of automatic reference rainfall stations could substantially minimize the basis risk and improve the performance of rainfall insurance scheme for coffee.

Further research is required to improve the results by carrying out an empirical analysis of data relating to rainfall at the gauge stations v/s individual plots and to make out cost benefit analysis of localization of automatic reference rainfall stations. It is suggested that the insurance company can select one taluk for localization of automatic reference rainfall stations as pilot project to see the cost and benefits to growers and the insurance company. On the basis of success of RISC, localization of automatic reference rainfall stations can be extended to other areas.

LIMITATIONS OF THE STUDY

The study has covered only 240 growers from among 5604 insured in Karnataka state in the year 2009. Hence, the sample size is 4.28% of the insured growers at present. The study covers only the plantation crop coffee grows on mountain sides; therefore, the research may not afford generalizability to other crops. The performance of RISC in the study has not covered the other factors i.e., impact of basis risk on payouts, sum insured, premium etc.

CONCLUSIONS

The performance of index based weather insurance depends upon the various factors. The important factor among them is basis risk. The rainfall insurance scheme for coffee operated on mountain sides involves high levels of basis risk, adversely affecting the performance and is likely to lose the confidence of the growers. This study reveals the need for initiating steps to minimize the basis risk. The problem of basis risk can be resolved with the help of localization of automatic reference rainfall stations. It implies that the automatic reference rainfall stations should be installed at the Grama panchayath level, which is nearest to the growers' individual plot. It is negating one of the advantages of index based rainfall insurance i.e. minimization of cost. But it substantially reduces the basis risk and leads to adequate protection against rainfall risk. This is likely to improve transparency and performance of the rainfall insurance scheme.

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