

Overcoming Actuarial Challenges in Crop Insurance

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Crop Insurance

- Index Based – Assumptive losses based on standard indices
 - Area Yield Index Insurance
 - Weather Insurance
 - NDVI (other Satellite based Index) Insurance
- Survey based loss assessment
 - Multi Peril Crop Insurance

Index Insurance

- Index should
 - Represent systemic risks fairly and accurately
 - Be “underwritable”
 - Ratemaking
 - Reserving
- What is a systemic risk?
 - Varies according to client – Bank or a Farmer
 - Depends on the nature of risk
 - Precise statistical definition is important

Weather Index – Actuarial Challenges

Weather Index Insurance	
Representation of Risk	
<ul style="list-style-type: none">• Systemic	<p>Risks such as drought, excess rain are represented quite accurately</p> <p>Over-representation has extra costs</p> <p>Basis Risk has to be quantified and the cost of stations has to be weighed against it – How?</p>
<ul style="list-style-type: none">• Idiosyncratic	<p>Risks such as Frost, Hail can be captured but you need station(s) at the farm</p>

Weather Index – Actuarial Challenges

Weather Index Insurance	
Underwriting	
<ul style="list-style-type: none"> •Ratemaking 	<p>Simple burn analysis on historical weather data proving inadequate</p> <p>Assume seasonal/annual weather is independent of each other – not true, Trends in Means and Variance</p> <p>Detailed stochastic analysis that is necessary to capture extreme events in case of high unbalanced Exposures. Spatial variation for shorter time interval cover is high and needs to be factored in pricing</p> <p>Data for humidity, Solar radiation has to be estimated based on proxy estimates (e.g. satellite observations); Error in estimation has to be quantified – How?</p> <p>Appropriate discounts and loadings according to terrains – e.g. Soil texture plays a key role in water requirement. Product design issues.</p> <p>Need to factor in adverse selection</p>
<ul style="list-style-type: none"> •Reserving 	<ul style="list-style-type: none"> -Though short tail, disputes persist and linger, late payment of subsidies - Payouts have to be made at times to buy peace - Need to reserve - How?

Yield Index – Actuarial Challenges

Yield Index Insurance		
Representation of Risk		
<ul style="list-style-type: none"> Systemic 	<p>Risks such as drought, excess rain are represented quite accurately</p> <p>In the present system district averages do not capture the systemic risks at a smaller unit</p> <p>Farmers are not compensated for the costs they incur to maintain a specific yield. Product design challenges</p>	<p>How many crop cutting experiments are enough?</p>
<ul style="list-style-type: none"> Idiosyncratic 	<p>A few such risks can be covered but admin costs high.</p> <p>Attempts to use this as a proxy to cover farm level risks are misplaced</p>	

Yield Index – Actuarial Challenges

Yield Index Insurance	
Underwriting	
•Ratemaking	Time Series Modeling Reliability of Data – ? Yield Estimates for smaller units – blocks or GPs - ? Moral Hazard and Adverse Selection
•Reserving	- Though short tail, disputes persist and linger

MPCI – Actuarial Challenges

Multi Peril Crop Insurance	
Representation of Risk	
• Idiosyncratic	Meant to cover Idiosyncratic risks
Underwriting	
•Ratemaking	No credible historical farm specific data of the client. How do you make a rate in such case?

Way Forward

1. How many weather stations/ crop cutting experiment to accurately represent risk
 - Analysis on a data set of approx 1500 weather stations across the country to determine spatial variation in rain and other weather parameters from 100 m to a few kilometers
 - Survey in about 25 – 30 districts at village, GP, Block and District level to estimate yield variations and therefore the appropriate sample size of CCEs

Way Forward

2. How to make rates in absence of data

- Satellite Reanalysis data for all Indian Locations being compared with corresponding surface observations for parameters like wind, humidity, solar radiation
- Longer time series being analysed to model extreme events, Climatological simulations
- Yield datasets from multiple sources being collated and allocated Credibility Scores. Relative Ratemaking for various classes
 - Govt (Revenue and Insurance Claim), Private Seed Farming, Plantations
 - Agriculture Research Institutes Surveys

Way Forward

3. How to Factor in Adverse Selection and Moral Hazard
 - Controlled Simulations using Principal-Agent, Signaling and Screening methods
 - Analysis of data from other Insurance Business classes

Way Forward

4. How to do Loss Reserving

- Chain Ladder- BF – Premium reserving technique
- Analysis of data from other Insurance Business classes
- Legal settlements vs Provisional Peace Making Settlements

Thank You