Agricultural Insurance in India: Approaches and Challenges

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As an alternative to the existing area approach based short-term credit-linked crop insurance scheme, this article advocates peril-indexed insurance and options as a risk management technique aimed at stabilizing the revenue of farmers, which is highly dependent on Indian weather conditions. Rainfall derivatives with premium as a function of adverse deviation of rainfall from the threshold are discussed vis-à-vis traditional crop insurance which brings out the clear advantages of the former both in terms of providing assurance to the farmer and ensuring financial viability to the insurer. The potential for the active involvement of re-insurers in establishing a secondary market for securitized weather derivatives is also examined.

India continues to be a predominantly agrarian economy with agriculture contributing about one fifth of GDP and providing about two-thirds employment. Due to the weather-sensitive nature of crop cultivation with 60% of net sown area under rain-fed farming, an adverse climate affects not only agriculture-dependent livelihoods but also the overall economy. In India, this adverse climatic effect has traditionally been addressed by ex-ante as well as ex-post household level initiatives by farming communities and government responses in the form of waivers and postponement of loan and interest payments, additional credit dosages etc. Since only 27% of farmer households have access to formal financial sources (NSSO, 2005) the impact of government support which mainly targets non-loan farmers, remains restricted. The majority of farmers, primarily small and marginal farmers, follow ex ante risk mitigation measures such as intercropping and crop diversification while ex post initiatives range from borrowing from moneylenders, distress sales, mortgages or sale of assets, decumulation of grain stock or past savings, the entry of weaker members of the family into the labour market and even migration. This leads to severe long term distress for small and marginal farmers. Due to India's climate vulnerability, risk transfer mechanisms like insurance and weather derivatives are of the utmost importance.

A historical look back

Discussion on insurance in agriculture dates back to 1947 just after independence, resulting in a study during 1947-48 which advocated a "homogeneous area approach" over an individual approach. Under a homogeneous area approach, different agro-climatically homogeneous areas are dealt with as a single unit and individual farmers, irrespective of their individual level of crop loss, receive the same benefits while the premium also remains the same. The crop insurance bill circulated by the central government in 1965 did not gather much enthusiasm among states because of the involvement of financial obligations. After receiving comments from state governments, in March 1970 the draft bill and model scheme was referred to an expert committee under the chairmanship of Dharam Narain. In its August 1971 report, it recommended that crop insurance should not be introduced even on a pilot basis because of the financial non-viability of the scheme.

Upon detailed examination of the arguments on which the Dharam committee declined crop insurance, Dandekar (1976) strongly advocated crop insurance on the following grounds:

(a) Independent risks and time diversification

The expert committee argued that agriculture risk does not meet the basic condition of the pooling of risk of a large number of individuals independent of each other as in agriculture risk, there is a significant systematic component which it is not possible to diversify by pooling. Dandekar advocated that, "in many years the amount of premium received will nearly balance the amount of indemnities paid, though in some years the premium received will exceed the indemnities paid out and vice-versa". He argued that though the scheme may not be viable on a single year basis, it would break even over a number of years.

(b) Individual vs homogeneous area based approach: Under the homogeneous area approach, different agro-climatically

homogeneous areas are dealt with as a single unit. Individual farmers are treated as identical risks and losses are indemnified by similar claims against identical premiums. Under the individual approach, premium determination depends on individuals' ex ante risk assessment and ex post loss assessment to settle claim payments. The 'area' approach was preferred to the 'individual' approach by both Dandekar and the expert committee. Even though the individual approach is a better option in terms of reducing basis risk - deviation of individual losses from the average, the area approach was preferred because the administrative costs were lower.

(c) Compulsory insurance: Dandekar argued that a "crop insurance scheme should be linked, on a compulsory basis, with the crop loan system…. The entire amount of the crop loans should be insured. Premium should be deducted while advancing the loan. Indemnities when they become payable should be adjusted against the recovery of the loan''. The prime advantage was that, "not only the scheme can immediately get off the ground but there will be hardly any administrative costs involved." However, the coverage of crop under the insurance scheme remained optional for the non-loanee farmer.

(d) Subsidies: While Dandekar argued for breaking even over a sufficiently long period, he also kept room for subsidies on legitimate grounds. Farmers from more risky areas should be charged slightly higher premiums compared to their counterparts from relatively less risky areas.

Accepting most of Dandekar's arguments, a Pilot Crop Insurance Scheme (PCIS) based on an area approach was launched by the state-owned General Insurance Corporation (GIC) in 1979. Up to 1984-85, PCIS was implemented in 13 states and covered 6.27 lakh farmers for a premium of Rs 196.95 lakh against claims of Rs 157.05 lakh during the entire period.

Crop insurance schemes

A Comprehensive Crop Insurance Scheme (CCIS) was implemented in 1985. The scheme was based on the homogeneous area approach and linked to short-term credit. Coverage was restricted to 100%of the crop loan subject to a maximum of Rs10,000 per farmer. The premium was fixed at 2% for cereals and millets and 1% for pulses and oilseeds. Small and marginal farmers were eligible for a premium subsidy of 50%. The burden of premium and claims was shared by the central and state governments in a 2:1 ratio.

The scheme was criticized on the following grounds:

- Financial non-viability as low premium to claim ratio (17.28%) over the operational period due to non – actuarial based premium
- Exclusion of important horticultural and commercial crops
- Coverage restricted to loanee farmers
- Cross-subsidization across states (e.g., Gujarat received 48.8% for groundnut)

The present National Agriculture Insurance Scheme (NAIS) replaced the CCIS in 1999. NAIS was implemented in all states/union territories with premium rates that vary from 1.5 to 3.5% for food-grain and oilseed crops on an actuarial basis for annual commercial and horticultural crops. While CCIS was restricted only to loanee farmers, NAIS widened the coverage by envisaging voluntary participation of non-loanee farmers. NAIS has enabled farmers to choose indemnity limits of 60%, 80% or 90% of the threshold yields as indemnity limits. The limit of the sum insured was increased to the value of 150% of average yield against payment of an actuarial based premium. Though NAIS was launched to cover the short falls observed in CCIS, the scheme is far from breaking even or achieving the desired coverage. The following have been observed:

Financial non-viability – Up to the rabi season 2007-08, claims of about Rs. 11607 crore have been reported against a premium collection of about Rs. 3626 crore (Economic Survey, 2009). Thus the overall premium to claim ratio of NAIS stands at 31.24% which may be better than that of CCIS but is far from achieving self-sufficiency even after eight years of existence.

Limited coverage - Raju and Chand (2008) report that in different years from 1999/2000 to 2005/2006, NAIS covered 9-15% farmers, 8-16% crop area and 2.14 -3.57% of crop output in money terms.

Delay in claim settlement - Involvement of financial institutions as delivery channels and government departments in crop cutting experiment sand subsidy release resulted in a longer period of settlement, sometimes over a year.

Moral hazard –The area approach based NAIS fails to provide the right incentives to farmers. As crop yields are insured irrespective of the grower's efforts, the incidence of moral hazard could not be eliminated.
Adverse selection – One of the main drawbacks of NAIS is its failure to address adverse selection by non-loanee farmers (Ifft, 2001)
Comprehensive – The scheme ignores the fact that rainfall, whether deficient or excessive, causes 70% of crop losses in India (Parchure, 2002)
Cross-subsidization across states - While the claim premium ratio was less than unity in states like Assam, Goa and Haryana, NAIS paid claims more than ten-times of premium in Bihar and Jharkand (Raju & Chand, 2008).
Crop loan insurance scheme – Due to its very nature of linking insurance with short term credit, NAIS is arguably a crop loan insurance scheme instead of crop insurance (Bhende, 2005). Bhende also argued that the aim of NAIS is predominantly to underwrite agricultural credit and not agricultural risk.

Since NAIS provides only partial protection to farmers' income as it covers only production risks, the Farm Income Insurance Scheme (FIIS) was launched on a pilot basis during rabi 2003/04 to protect farmers' income by combining the mechanism of insuring both production and market risks. The scheme envisaged protecting farmers' income through ensuring a minimum guaranteed income. During the season, 1.8 lakh farmers were covered over an area of 1.9 lakh hectares. Implemented by the National Insurance Company (NIC), the scheme carried a subsidy of 75% on the premium, borne by the central government in respect of small and marginal farmers and 50% in respect of others. But the poor response from farmers resulted in the withdrawal of the scheme.

In the backdrop of challenges faced by NAIS in one hand to become self sufficient on the other hand to improve its coverage, there are suggestions put by researchers regarding its improvement to improve. Initiatives has also been observed among the researchers as well as the insurance companies to pilot the viability of weather indexed insurance scheme where unlike the threshold yield linked crop insurance claim would be linked to the underlying weather risk based on historical data. Weather-indexed insurance is advocated to support cultivators protect their overall farm income rather than the yield of particular crop and would reduce effect of climate vulnerability.

Upcoming suggestions on improvement of the scheme
Suggestions from the researchers are put forth in the following lines.
(a) Reduction of insurance unit: Till date NAIS follows 'homogeneous area' approach, where insurance unit in most cases is the Mandal / Taluk / Block or equivalent unit. These administrative units are considered as insurance unit with high degree of climatic variability and with higher variations in production. Though 'individual' approach would reflect crop losses on realistic basis would invite higher administrative cost due to nature of small size holding of Indian farming. Raju and Chand (2008) have suggested lowering the insurance unit to the Gram Panchayat (GP) level, as it would catch production losses with reasonable degree of accuracy.
(b) Viability of the scheme: To attain viability of a crop insurance scheme, the premium rate needs to cover (a) pure risks; (b) administration costs; and (c) reasonable returns. The question arises whether government would continue to subsidize the scheme. Premium rate based on pure risks is advocated to be very high for some farmers to afford (Jain 2004). On the issue of actuarial based calculation of premium rates Planning Commission (2007) has pointed the non availability of historical yield data at GP for reasonable longer period.
(c)Threshold Yield: In NAIS, threshold yield, based on which indemnities are calculated, is the moving average yield of the preceding three years for rice and wheat, and preceding five years for other crops, multiplied by the level of indemnity. Raju and Chand (2008) have argued that this approach does not lend sufficient protection to farming community, especially in places experiencing consecutive adverse climatic situation by reducing the average production. They proposed to include the best five yield figure from the preceding 10-years' data.
(d) Indemnity level: Presently under NAIS three levels of indemnity viz. 60 per cent, 80 per cent and 90 per cent corresponding to high, medium and low risk areas are covered. It is perceived that the, as losses get covered only when, it exceeds 40 per cent, the 60 per

cent indemnity level does not sufficiently cover the risk of small to medium-intensity climatic adversities. But heavy increase of the indemnity level from 60 percent would result into increased government burden researchers have advocated for up-gradation to 70 per cent level.

(e) Wider Coverage of pre-sowing and post harvest losses: Presently under NAIS the risk coverage is restricted from sowing to harvesting. Several times delaying sowing attributed by adverse climatic conditions result into loss of initial investment and even overall production loss. On the other hand spoilage of production due to adverse climatic condition as excessive hot or humidity would reduce the self life resulting into distress sell. The coverage of NAIS is suggested to be extended for pre-sowing and post harvest losses too (Raju & Chand, 2008).

(f) Early settlement of claims: As the time gap between loss occurrence and claim payment moves even upto one year, a part payment in case of adverse climatic conditions is advocated in literature.

(g) Encouraging participation of non-loanee farmers: NAIS is marketed to non borrower farmers through rural outlets of credit dispensing agencies. In a situation where farmers are not habituated in dealing with the distantly-located formal credit outlets agencies, dedicated rural organizations with better familiarity with the locality as well as people would be entrusted to provide such service (Planning Commission, 2007).

Alternative to Crop Insurance

While arguments and counter arguments are on the table regarding the merit of continuation of tradition area based short term credit linked crop insurance scheme discussion is on over the need of weather or any other particular peril indexed insurance offerings. Weather indexed crop insurance aims to mitigate the distress of the insured farmers against the likelihood of financial loss on account of anticipated crop loss resulting from incidence of adverse conditions of weather parameters like rainfall, temperature, frost, humidity etc. While crop insurance specifically indemnifies the cultivator against shortfall in crop yield, weather indexed crop insurance is based on the fact that weather conditions affect crop production even when a cultivator has taken all the care to ensure good harvest. It is a well-conceived fact that the crop output is conditioned by the quantity and distribution of rainfall during a year. Claim payout in rainfall insurance is not direct and are a function of the adverse deviation in rainfall from the threshold or mean (Parchure, 2002). For instance, rice, the major kharif season food crop which commands the highest insurance utilisation rate of 82.5 percent and a 326 percent claim rate (Veeramani, Mynard & Skees, 2003) is more sensitive to drought than flooding. Different limits determine the payment percentages for downside (drought) and upside (flood) risks. Payments are made when actual rainfall is above or below the strike rainfall. The rainfall requirement varies through different stages of rice cultivation and since rainfall distribution is uneven, daily accurate rainfall data should be used to determine appropriate strike values for each growth stage. Compensation is triggered by the deviation between actual and strike rainfall and premium subsidy will be a direct function of adverse deviation in rainfall from the mean Skees et al. (2001) suggested the following payment percentage, indemnity and premium rate:

Payment Percentage=$\frac{Strike\ Rain - Actual\ Rain}{Strike\ Rain}$ for drought

And $\frac{Actual\ Rain - Upper\ Strike\ Rain}{Actual\ Rain}$ for flooding

Indemnity= Payment percentage times Liability

Premium Rate = (Average Indemnity/Average Liability) times Loading; where loading is the premium hike to cover losses due to unforeseen events.

The premium maintains a downward slope on both sides of the strike in case of adverse deviations. As the deviation of rainfall from the threshold becomes higher, the premium charged by the insurer becomes lesser thus resulting in a counter cyclical payment mechanism which is decoupled – it does not affect the production decision of the farmers or their risk orientation. Also the decrease in premium for adverse deviation in rainfall is more for higher revenue elasticity with respect to rainfall.

Parchure (2002) explicitly recognized uneven rainfall as the dominant adversity to crop yield and designed an insurance system whose premium is linked to adverse deviation in rainfall from the mean, to immunise farm incomes. He also suggested strengthening the primary insurance mechanism by a reinsurance system whereby capital markets

can accept the risk return of farm income in order to strengthen their own risk return balance. Linking crop loss to the predominant factor viz. rainfall effectively eliminates moral hazard problem as the farmers now have no control over the loss events and also adverse selection problem with an objectively measurable index which is same for all farmers. Further, the loss amount can be quantified in financial terms, thus satisfying critical conditions of effective insurability. Premium rates structured in terms of rainfall would be translated into premium in terms of interest rates of crop loans by a multiplier.

Effective Interest rate = Gross Interest rate- k × (percent deviation in rainfall from threshold)

Gross Interest Rate = Regular Loan Rate + Premium Rate on crop Insurance

The multiplier k is basically the income or output elasticity of crops wrt. rainfall, estimates of which have been provided by Ray, Rao and Ray (1988).

Risk packaging and risk transferring

The efficiency of the rainfall insurance can be enhanced through risk packaging and risk transfer by the primary insurer. The rainfall and outputs in different regions are never perfectly correlated. Study by Ray, Rao and Ray (1988) has shown that lower variance is exhibited by groups of commodities in terms of output than individual crops thus giving rise to the possibility of greater portfolio efficiency by proper diversification among crops and growing regions.

The insurer can pass on some portion of his risk to reinsurers in the form of securitisation of the amount receivable under rainfall linked loan and creation of a special purpose vehicle to place the securities (rainfall bonds) among financial institutions and individual investors (Parchure, 2002). They can also be listed and traded. Some intrinsic investment merits which could make rainfall bonds attractive to investors are:

(a) One part of return is linked to rainfall which is unaffected by general interest rate risk and another part depends on crop loan rate which is not as volatile as the market rates, so investment in rainfall bonds lead to reduction in total risk of a bond portfolio

(b) Rainfall Bonds can fill the gap that exists in the capability of banks and financial institutions to build proper infrastructure and distribution mechanisms in the rural sectors

(c) Rainfall Bonds can help insurers fulfil the minimum regulatory caps on investing in rural/social sectors without building a rural network.

Rainfall Options

Deficient and excess rainfall need not always be packaged together as there may be farmers who are primarily worried about only deficient or only excess rainfalls. In that case they should pay the premium corresponding to only one part (half that of the straddle) which brings to the fore the necessity of disentangling the strangle giving rise to rainfall put loans and rainfall call loans which can be transacted separately. The put option protects the farmer from only deficient rainfall and the call option from only excess rainfall. The maturity for the contracts will be the cropping season. Apart from the primary underwriters, the insurers, farmers themselves can write these options. For instance a farmer worried only about deficient rainfall may buy a put option and sell a call option to a farmer who is worried only about excess rainfall. Thus the insurers themselves can perform the roles of market-makers bringing liquidity to the market. The farmer should buy a number of options equal to (amount of exposure/payoff of the option).

Specific Contingencies

Agricultural production critically depends on the right weather conditions as temperature, rainfall, sunshine etc. over each intermediate stage like sowing, flowering, maturation, harvesting etc. for an optimal yield. The shortfall in rainfall may be more devastating in some particular stage than others. Rainfall options have the potential to meet these specific agricultural contingencies by being designed as short length options with maturity periods of a month or even a fortnight. Their prices would then depend on the probability distribution of rainfall over those specific time intervals.

Some attractive features of rainfall options to secondary market players are the ability to meet regulatory requirement, portfolio diversification through immunity to market interest risk, making cross hedges to protect stock portfolio etc.

Challenges in weather based crop insurance

The main challenges regarding scale up of weather insurance are as follows

Awareness and capacity building: Need to build the customer confidence on workability

as well as transparency of the scheme among the farmers in a newer product is of utmost importance. In addition it is also needed to adequately educate other stakeholders from public as well as private sectors who will be involved in the management of the scheme.

Availability of reliable data: Real challenge lies in collection of data on weather parameters for sufficiently longer period at GP or even Block level.

Additional weather stations: Government expenditure for installation of additional weather stations to collect farm-specific real time data.

Weather Insurance in India

Weather derivative as a financial instrument to hedge weather risks emerged first in U.S.A in 1997 and is the fastest growing derivative market today according to Chicago Mercantile Exchange (see Brockett, Wang & Yang, 2005). In India the concept is still nascent. On a pilot basis ICICI Lombard launched a rainfall insurance scheme with support from World Bank, for groundnut in Mahabubnagar, Andhra Pradesh in 2003. The insurance policy sold a non-linear put option on a rainfall index correlated with crop yield. Due to delayed monsoon that year the rainfall index fell by 21 percent resulting in a payment to the farmers (Sinha, 2004). ICICI Lombard also launched a pilot scheme for insurance against excess rainfall for rice farmers in Aligarh, Uttar Pradesh. As documented by Manuamorn (2005), ICICI Lombard views a substantial profitability potential in weather insurance and expects that 'the weather insurance business, if underwritten properly, is at least as attractive a business proposition as other lines of general insurance'. Similarly in 2004, IFFCO-TOKIO targeted four Indian states-Gujarat, Maharashtra, Andhra Pradesh and Karnataka for a deficit rainfall insurance scheme during monsoon months.

The Agriculture Insurance Company of India Limited (AIC) introduced Varsha Bima–2005 in about 125 India Meteorological Department (IMD) station areas spread across 10 states. Under each IMD rain gauge station area, two or three blocks adjoining the station were chosen to implement major crops in that area. The product is also available to non-loanee farmers and provides for at least two options: one covering the limited sowing period and the other covering the complete season. The farmers can choose any one coverage option–either "sowing failure" or the full season option ("seasonal rainfall" or "rainfall index"). AIC on has also launched crop-specific and location-specific weather based crop insurance scheme, as Rainfall Insurance Scheme for Coffee, Apple Insurance, Rubber Plantation Insurance, etc. AIC Annual Report, 2007-08 mentions that while the major share of premium still comes from NAIS (82%), the other commercial products' portfolio is on increasing trend.

Conclusion

Limited success in traditional crop insurance schemes is attributed to the financial non-viability due to non – actuarial based premium as well as the serious problem of moral hazard, adverse selection and complex administrative procedures. In contrast the weather indexed insurance schemes would result in financial viability for the insurer by effectively transferring his risk to the investors in the secondary capital market and eliminating adverse selection and moral hazard problems while reducing administrative costs by using an objectively calculated index. The scheme would also ensure quick settlement of claims attributed to the independently monitored weather indices besides protecting farmers for overall income rather than crop specific yield.

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