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Innovative Financial Services for Rural India

Monsoon-Indexed Lending and Insurance for Smallholders

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Cover photo by Ulrich Hess. 2002. Storefront of service provider in India.

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Introduction

With the advent of an international market for managing weather-related risk, the use of insurance products based on a weather index is becoming a reality. In Alberta and Ontario, Canada various insurance programs based on weather and vegetative indexes have become mainstream insurance products for farmers. In emerging markets, such as Mexico and South Africa, risk insurance contracts based on weather are also beginning to be used. Following a World Bank Group feasibility study, an IFC-sponsored weather insurance project has developed weather insurance for cereals which will be sold to farmers in Morocco for the 2003/2004 crop season. (Hess, Richter, Stoppa, 2002) In another initiative, the Agricultural and Rural Development Family (ARD) of the World Bank, in collaboration with various private and public partners in India, is now supporting pilot studies to explore the feasibility of insurance for crop loans based on rainfall indexes.

This paper outlines an integrated crop loan insurance and risk management product for Indian rural finance and agriculture. This monsoon insurance for crop loans—combined with the risk management account proposed in this paper—could significantly improve farmers' access to crop loans and their capacity to manage risk. The paper is organized into the following sections:

1. the first section defines the problem of access to financial services, how monsoon risk affects that access and how the India government is currently addressing the problem;
2. the second section describes the concept of monsoon-indexed lending and risk management accounts for smallholders; and
3. the final section describes the findings of a modeling exercise applying the service in India.

1. The Problem of Limited Access to Financial Services and Stable Incomes in Rural India

For the rural poor in India, formal financial services would enable them to maximize returns on their surplus, smooth their consumption, and reduce their vulnerability to risk. However, their financial service needs—which include consumption credit and cash savings (Duggal, 2002)— are seldom met due to systemic problems in the financial sector and monsoon risk. In 1991, a comprehensive household survey addressing rural access to finance revealed that barely one-sixth of rural households had loans from formal rural finance institutions (RFIs). In fact, the survey found that only 35-37 percent of the credit needs of the rural poor were met through formal RFIs. This means that the share of household debt to informal sources is as high as 52-62 percent, at annual interest rates ranging from 36-120 percent. Another study by Price Waterhouse Coopers in 1997 indicated the dependence of low-income households on the informal sources for finance to be as high as 78 percent. A survey based on the Economic Census of 1998, showed that India's formal financial intermediaries—through their commercial lending programs—reportedly meet a mere 2.5 percent of the credit needs of the unorganized sector.[1]

Beyond credit, most of the rural poor also lack access to the banking system for savings. According to a leading microfinance practitioner in India (Mahajan, 2001), the transaction costs of savings in formal institutions were as high as 10 percent of the savings amount for the rural poor, due to the small average size of transactions and the proximity of rural villages to bank branches.

Farmers respond to the lack of formal financial services by turning to moneylenders; reducing inputs in farming; over capitalizing and internalizing risk; and/or by over diversifying their activities which leads to sub-optimal asset allocation.

The combined effect of these coping strategies is a poverty trap. Smallholders cannot risk investing in fixed capital or concentrating on the most profitable activities and crops, because they cannot leverage the start-up capital and they face systemic risks that could wipe out their livelihoods at any point in time. The challenge for banks is to innovate a low-cost way of reaching farmers and helping them better manage risk.

[1] The survey covered over 30 million small scale units across India.

How Monsoon Risk Limits Access to Financial Services

A 2003 survey of coffee farmers in Karnataka revealed that weather volatility is the single most important risk faced according to the respondents.[2] In fact, low rainfall is the primary factor affecting monsoon season (or kharif) crop production in India. In certain states, such as Andhra Pradesh (AP), several risks—such as, monsoon, flood, and cyclones—co-exist.

Table 1 Historical data on rainfall levels and kharif crop production in India

Deficient rainfall years	*Monsoon rainfall % departure from normal*	*Rainfall in July*	*Kharif food grain production % fall*
1972/73	-24%	-31%	-7%
1974/75	-12%	-4%	-13%
1979/80	-19%	-16%	-19%
1982/83	-14%	-23%	-12%
1986/87	-13%	-14%	-6%
1987/88	-19%	-29%	-7%
2002/2003	-19%	-49%	-19%

Source: GoI, Economic Survey 2002-2003,p. 157.

The magnitude of the decline in production during this season has varied depending upon the severity of the drought. During the 2002/2003 growing season, for instance, India saw a 49 percent drop in rainfall levels for the month of July, which is normally the rainiest month of the season and the most crucial month for kharif crops. As a result, kharif output fell 19 percent—the highest fall since the 1972/73 season. The severity of the drought caused a 3.1 percent decline in agricultural GDP and is likely to reduce overall GDP growth from 5.6 percent in 2002 to 4.4 percent in 2003.

Strategies for Coping with the Risk of Drought

Drought risk affects the poor especially. Quantitative and qualitative surveys show that the main asset people own is land. The very poorest are landless or possess only small parcels of land, and they also have less access to irrigation systems. Only 50 percent of poor households own livestock—sheep, goats, poultry—which tend to be smaller in drought-prone areas. The poor who lack even these productive assets depend on wages from farm employment and migration. Asset-poor households, especially those in drought prone areas, are not attractive to bankers so the poverty trap continues.

In the absence of risk management instruments, traditional risk management strategies are used to deal with drought risk, both before (*ex ante*) and after (*ex post*) the risky event occurs. (Siegel and Alwang, 1999) For instance, during a drought, larger farmers tend to cut down on wage labor first and resort to family labor. Examples of *ex ante* strategies include:

- the accumulation of buffer stocks as precautionary savings;
- the diversification of income-generating activities by working in farm and non-farm small businesses, and seasonal migration; or
- varying cropping practices (planting different crops, like drought-resistant variants, planting in different fields and staggered over time, intercropping, and relying on low risk inputs).

Similarly, companies may self-insure through high capitalization and diversification of business activities. Communities collectively mitigate weather risks with irrigation projects and conservation tillage that protects soil and moisture. Examples for ex-post strategies range from farmers seeking off-farm employment, to distress sales of livestock and other farm assets, to removing children from school to

[2] Survey of 500 farmers conducted by Indian Coffee board in cooperation with Commodity Risk Management Group of the World Bank.

work on the farm, and to borrowing funds from family, friends and neighbors. (Hanan and Skoufias, 1997; Hess, Richter and Stoppa, 2002).

Box 1 Drought risk and the poor in Andhra Pradesh

One-third of the population of Andhra Pradesh (AP) lives in drought prone areas classified as "semi-arid" or "low-rainfall region" (with a normal annual rainfall level of less than 750mm). Poor households in AP tend to have less than 2 acres of land of often-marginal quality while most of the poor in the scheduled castes are landless. The agricultural potential of the land, especially in drought prone areas, is limited by the lack of access to irrigation. A baseline study carried out for the AP poverty reduction project showed that less than 20 percent of poor households with land and depending on agriculture had access to irrigation. Poor household's access to "commons" such as pasture or water sources is often constrained by stronger claims of wealthier farmers.

An AP livelihood assessment survey revealed that of all the risky events identified by households 50 percent related to health and 28 percent related to nature, with the latter percentage going up for scheduled tribes and other castes. Thirty percent of respondents cited "loss of wages, income or work" as the major impact of a risk event. Forty-five percent cited that their response to the risk event was to borrow money, resulting in increased indebtedness.

Sources: Baseline Survey carried our for AP-DPIP in 6 selected districts (Adilabad, Anantapur, Chittore, Mahbubnagar, Srikakulum and Vizianagaram); Livelihoods participatory rural assessment (PRA) undertaken in Adilabad, Anantapur, Prakasham and Srikakulam; Report prepared for the the Society for Elimination of rural poverty (SERP), Applying the Social Risk Management Framework: Towards an Action Plan for the proposed AP Rural poverty reduction project (APRPRP), Dr. Siegel, P., Rani, S. and Dr. Alwang, J. The report recommends natural disaster insurance and natural hazards insurance, the latter based on rainfall indexes. Along with BASIX, the micro-finance institution in AP, the report also suggests revenue insurance based on price and weather indexes for groundnut, sunflower and cotton producers.

Risk Mitigation Through the Indian Crop Insurance Scheme

The government has reacted to drought risk with a crop insurance scheme based on an area-index that is offered through state-owned insurance companies. The National Agricultural Insurance Scheme (NAIS) covers credit default risk for most crops at premium rates of 1.5 to 3.5 percent of the loan amount, with small farmers receiving a 50 percent premium subsidy. The Agriculture Insurance Corporation (AIC) implemented this scheme and collected premiums of Rs 2.5 billion covering an area of 1.3 million hectares—a negligible fraction of cultivated land in India. Total claims were Rs. 4.7 billion, resulting in a claims ratio of almost 200 percent in a normal year.

> "The performance of the crop insurance scheme in India can only be judged as disappointing on all counts; financial, economic and administrative. …. from 1985-6 through 1999 the total premiums collected were Rs. 402 crores (US$80 million) and the total claims paid Rs. 2305.0 crores (US$461 million) with a sum insured of Rs. 24,921 crores (US$5 billion) The loss ratio excluding huge management expenses stands at 5.72. From an economic point of view average per annum claims paid were Rs. 233 crores which if compared to the sum-at-risk *i.e.* the agricultural output of the country worth Rs. 6,50,000 crores is hardly 0.035 percent and when compared to the total farm loans of Rs. 58,000 crores is only 0.40 percent."(Parchure 2002).

The following tables show that premiums and claims do not seem to be "equitably" distributed across crops and states.

Table 2a Cropwise premiums and claims: origin and destination (1985/6-1999)

Crop	*Premium*		*Claims*		*Loss Ratio*
	Rs. Cr.	*%*	*Rs. Cr.*	*%*	
Paddy	217.52	54	576.26	25	2.65
Wheat	52.36	13	46.10	2	0.88
Groundnut	60.42	15	1221.68	53	20.22
Jowar	36.25	9	184.40	8	5.08
Bajra	24.16	6	184.40	8	7.63
Pulses	4.02	1	23.05	1	5.73
Others	8.04	2	69.15	3	8.60

Source: author

Table 2b Statewise premium & claims: origin & destination (1985/6-1999)

State	*Premium*		*Claims*		*Loss Ratio*
	Rs. Cr.	*%*	*Rs. Cr.*	*%*	
Gujarat	64.45	16	1336.93	58	20.74
Maharashtra	60.42	15	253.55	11	4.19
Andhra Pradesh	100.70	25	322.7	14	3.20
Others*	177.24	44	391.86	17	2.21

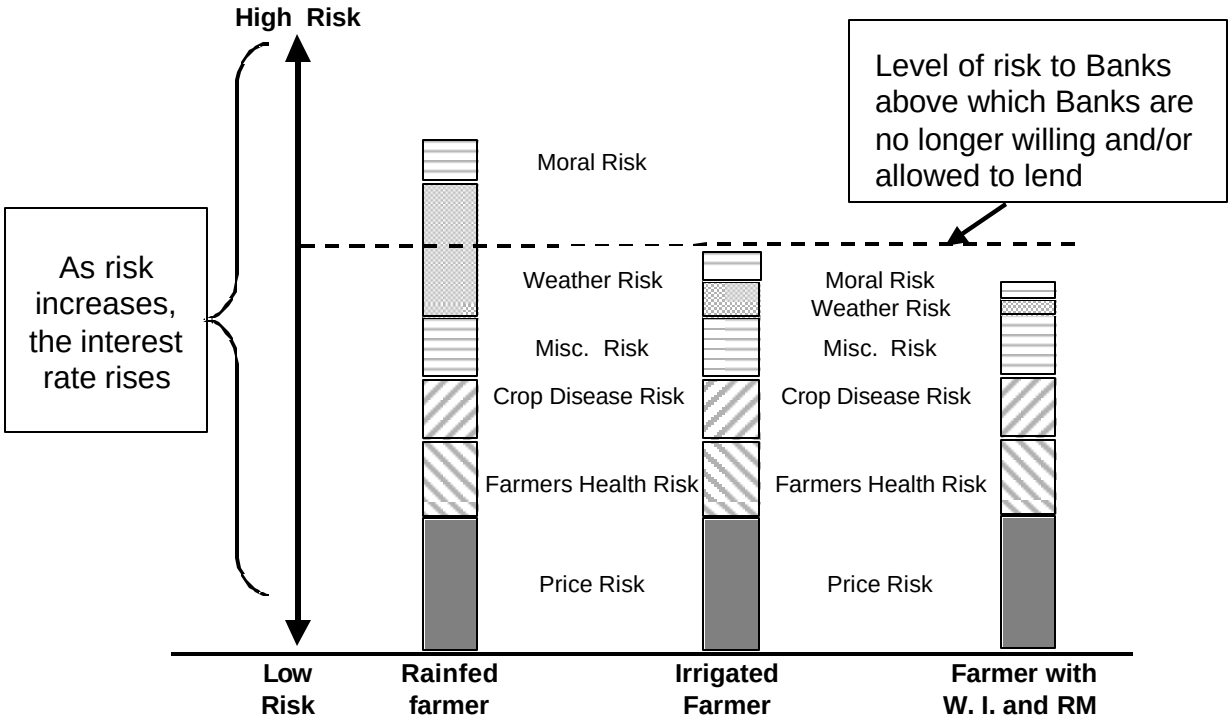
Note: include 22 states and UT's excluding Punjab, Haryana, and North-Eastern states.
Source: author

2. A Proposed Solution— Monsoon-Indexed Lending and Insurance for Smallholders

Indian banks seek to expand their crop lending to non-irrigated areas but are constrained by monsoon risk. One way to blend index insurance and rural finance is to integrate weather index insurance into loans taken by the farmers.

The objective of the pilot scheme proposed by the World Bank and its partners is to insure farmers against drought risk and allow for continued borrowing and savings throughout drought years. The savings portion of the scheme enables farmers to build collateral, which improves their access to credit and lower interest rates. Eventually the scheme seeks to improve the farmers' creditworthiness to a level where creditors would provide access to consumer credit. The incremental transaction costs are minimized by using smart cards and by packaging the crop loans and risk management with agricultural extension services and crop marketing. The weather index insurance is not a self-standing insurance product, but it is embedded in the loan agreement and then combined with a (forced) savings account.

Figure 1 Bank perception of crop loan risk



Legend: W.I. = Weather Insurance, RM = Risk Management
Source: CRMG, World Bank. "Commodity Price Risk Management for Producers, A Training Guide, modified

This scheme can significantly increase access to crop loans and savings mechanisms in rural areas, particularly in rainfed areas.[3] Farmers relying on rainfed agriculture in particular do not have access to formal crop finance, because banks perceive the risks as too high for the type of (capped and regulated) interest rate they can charge. Weather risk and moral hazard can tend to be higher for the rainfed farmer. In the case of monsoon-related crop failure, a culture of low payment morale sets in as the crop failure and resulting default on debts are seen as *force majeure*. In addition, political pressures for debt forgiveness tend to rise in drought years. This proposed scheme seeks to transfer systemic risk out of the farmer-bank relationship into insurance markets. It can lower the moral hazard problem by removing any excuse for non-repayment in case of monsoon-related crop failure. The design has four components:

1. monsoon index insurance;
2. a risk management account;
3. weather risk reinsurance; and
4. a smart card

Monsoon index insurance

The essential principle of monsoon index insurance is that contracts are written against specific rainfall outcomes (e.g. drought or flood) recorded at a local weather station. The rainfall outcomes tend to be defined at catastrophic levels and should be highly correlated with the value of regional agricultural production or income. For example, an insured event might be that rainfall during the most critical month of the growing season is 70 percent below normal. In years when the insured event occurs, all the people who purchased the insurance receive the same payment per unit of insurance.[4] In all other years, no payments are made. (Skees/Hazell 2002) In this Indian case the insurance event is defined as cumulative weighted rainfall dropping below a certain threshold of 75 percent up to 85 percent of the normal rainfall measured at the nearest weather station. Contract periods and payout dates depend on the particular crop cycle. Payouts are proportional to the measured rainfall deficit below the threshold and occur in the form of crop loan interest and principal relief.[5]

Risk management account

The purpose of this component is income stabilization, it is the risk management part based on farmer's individual decisions.[6] The farmer pays half of the overall insurance premium into a risk management account, effectively serving as self-insurance. This account can be dipped into by the insured party when the weather index insurance does not adequately compensate losses, thereby mitigating the basis risk of weather index insurance.[7] The account has a minimum balance. The farmer will be allowed to deposit part of his excess harvest earnings into the account through a deduction at the source, as his harvest sale

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[3] Appendix 1 provides a framework for the analysis of access to rural finance issues and lays out in detail how this scheme can push the "efficiency frontier" of rural finance.

[4] Half of the premium pays for insurance that pays out when average relevant rainfall for a certain crop falls below a certain threshold.

[5] The insurer can price the risk competitively by garnering the risk across districts and weather patterns in order to diversify his portfolio.

[6] The Ontario based AgriCorp government owned crop insurance provider for example offers the alternative "self-directed Risk Management" versus "Crop Insurance". The former is an income stabilization program where producers deposit money into their individual account and receive a contribution from the government.

[7] See also Appendix 4 for a discussion of farmers value at risk in relation to weather insurance basis risk

receipts are channeled through the bank or agricultural service provider. In addition the farmer could be allowed to deposit cash into the account at specialized low-cost rural branches of the lending bank.[8] The lending bank provides an incentive for accumulating savings with loan interest rebates and eventually access to a credit line.[9]

Weather risk reinsurance

The monsoon index insurance provider reinsures most of the risk in national and international weather risk markets through traditional excess of loss or quota share treaties. This allows for the global pooling of risk and thereby more competitive "portfolio-adjusted" pricing for the insurer and ultimately for the farmer. International weather risk market makers seek to diversify their portfolios out of US energy related risk. While the appetite for small end-user deals in "difficult" places is limited due to high structuring costs, the market makers certainly compete for reinsurance deals. Providers like ACE, SocGen, Swiss RE, Deutsche Bank, Credit Lyonnais, XL Weather Trading are all in the weather risk business and, in principle, are ready to transact in emerging markets as long as historical and settlement data are good. Deals in Mexico and South Africa are examples of this southward expansion of the weather market.

Smart card

The farmer can access his risk management account through a Smart Card. Initially the card serves as a debit card in agricultural service center hubs, certain points of sale, and at ATMs. Eventually it can be upgraded to a credit card. The main required investments are a VSAT (satellite connector) and swipe card readers. A potential partner is the Master Card provider in India (which did the Kissan Card). There are successful examples of such systems South Africa and Costa Rica. (box 2) Initially the card could be a low-tech passbook that allows the farmer to buy inputs at the participating agricultural service provider by drawing down funds from his risk management account. Alternatively, the farmer could draw down funds from the self-insurance account at the offering bank.

Box 2 International experience with smart cards and credit cards

South Africa's Standard Bank (SB) is using its ATM network, card technology, and stripped down branches to service poorer in a cost-efficient way. They offer a **card-based e-account** that combines transactions and savings functions with low fees. The E-Plan account, as it is called, can be opened with a minimum of 50 Rand and customers have access to the Bank's ATM network for performing transactions at low fees. At the end of 2001, Standard Bank had about 2.6 million account holders out of 11 million workers in total.

In Costa Rica, Financiera Trisan, a conglomerate that specializes in the import and wholesale distribution of agricultural and industrial chemicals, introduced **credit cards for agricultural inputs**. The *Agrimax card* is sold to retail distributors of chemical products and to individuals who desire to purchase inputs and services from merchants accepting the card. The *Maxicuenta card* is offered to individual clients with good repayment records and allows cardholders to make balloon repayments they have harvested and marketed their product. It effectively takes into account the seasonal nature of rural household cash flow. The cards were originally introduced as a substitute to factoring and traditional 30-day supplier credit.

Sources: South Africa information taken from "Access to Financial Services in South Africa", Alessandra Campanaro, Stijn Claessens, Karen Furst, Thomas Glaessner, Leora Klapper, Daniela Klingebiel, and Robert Schware, December 2002, abstract. Costa Rica information taken from "Agricultural Credit Card Innovation: The Case of Financiera Trisan", Wenner, Quiros, Inter-American Development Bank, Washington, D. C.

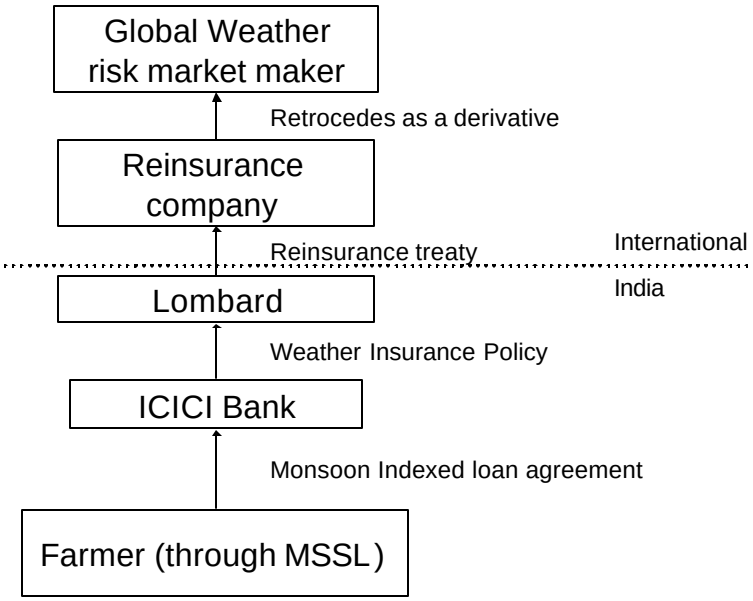
[8] In the USA the state incentivizes these "Farm and Ranch Risk Management" (FARRM) accounts through tax deferrals, thereby allowing the farmer to build cash reserves for risk management.

[9] The State could provide incentives for this type of income stabilization accounts. In Canada, the State matches farmers deposits into a "Net income stabilization account" (NISA) with matching contributions . See http://www.agr.gc.ca/nisa/

Institutional Models for Delivering Monsoon Indexed Crop Loan Insurance

The structure of the crop loan insurance pilot draws lessons from the IFC program in Morocco. That program is based on a European option where the option price is the cost of the coverage and the strike is the rainfall threshold below which an indemnity is triggered. (Hess etal. 2002)

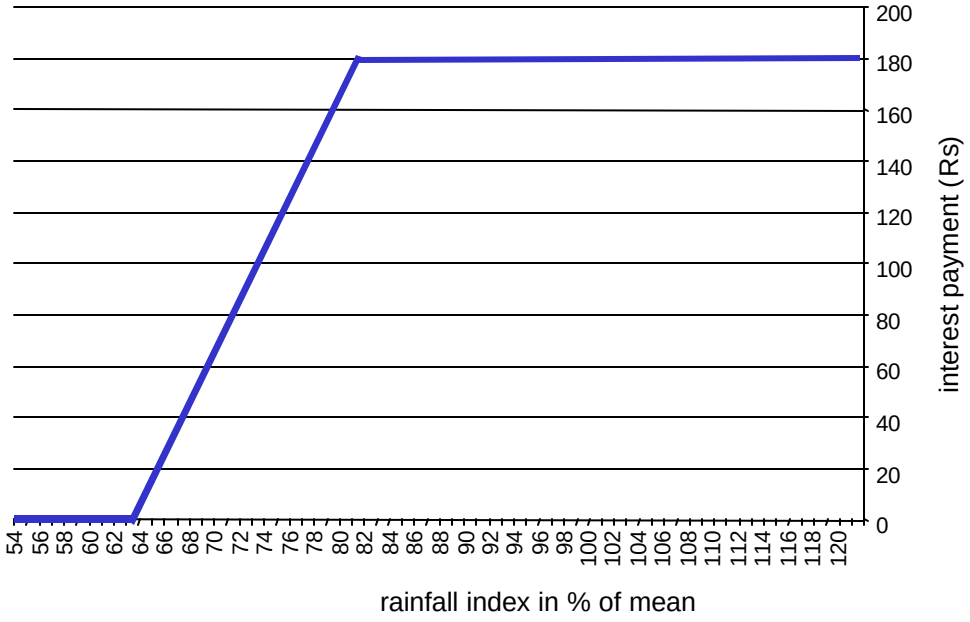
Figure 2 Risk transfer structure



Source: author

ICICI Bank is working in conjunction with ICICI Lombard, the ICICI Group's insurance company, to propose a few pilot cases of indexing interest payments to rainfall measures. (figure 2) The borrower pays a higher interest rate in normal years that comprises the weather index insurance premium, but in case of a severe rainfall deficit and in one case excessive rainfall in critical periods the borrower pays little or no interest on the loan. For example in Ujjain, Madhya Pradesh, a crop loans for soya farmer receiving a crop loans of Rs 2000 with embedded weather insurance would pay have an interest rate of 20.5 percent instead of 17.5 percent. The overall rate goes up due to the weather insurance premium, but ICICI Bank envisions being able to lower the base rate at a later date. The insurance kicks in when cumulative weighted rainfall during the critical growing periods falls below 80 percent of the mean. The farmer receives relief on his/her interest payments of Rs 10 per mm of rainfall index deficit. Where the yearly rainfall is 75 percent of the mean, the farmer would pay Rs 130 in interest instead of Rs 180. The relief on interest payments relief is an important break for farmers, whose budgets are strained after a failed harvest. (figure 3) The desired effect is to keep the farmer bankable even through drought years.

Figure 3 Crop loan interest payments



Source: author

Agricultural Agency Lending Model

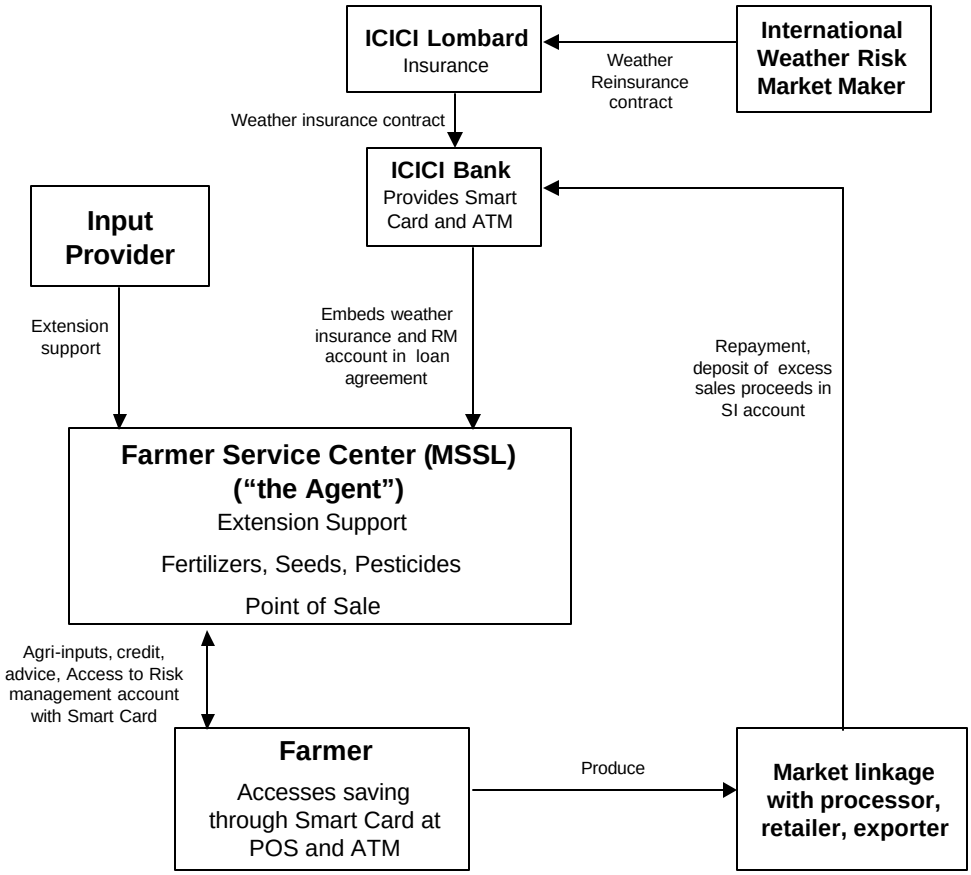
Mahindra Shubhlabh co-operation with ICICI Bank. ICICI bank innovated lending by effectively delegating a large part of the lending and collection process to *de facto* agents such as traders or agricultural service providers or local brokers that are close to the farmer by the nature of their business. In the ICICI Bank Farmer Service Center operating model with Mahindra Shubhlabh, (figure 4) ICICI identified an integrated agricultural services provider (IASP) that has a good relationship with the farmer and provides genuine and timely information through extension services. ICICI enters into a tripartite agreement with the IASP and the output buyer. ICICI provides credit to the farmers on the recommendation of the IASP, the farmer pledges its produce to the output buyer, and the IASP provides inputs to the farmer. Loan processing, disbursement and collection are effectively done by the IASP, while the credit decision remains nominally with ICICI Bank. At the end of the season, the farmers supply the crop to the output buyer and the output buyer deducts the loan amount from the sale proceeds and remits the loan to ICICI Bank in full settlement of the loan amount. The IASP receives a service fee for the loan processing and supervision services (1.5 percent on recovered loans). Currently 45 Shubhlabh offices operate on a franchise basis, financing around 4,000 farmers.

Loan default rates have been significantly lower with this integrated model that traps receivables and provides little actual cash to farmers. Transaction costs are reduced through more efficient loan processing by an agent close to the farmer and a de-facto wholesale credit approval process at ICICI. This agency model allows ICICI to lend to farmers without a significant branch network and with almost no due diligence costs. The Shubhlabh model uses “spokes” as agents itself, usually medium-sized but respected farmers that recommend borrowers. Sub-agents supervise borrowers through regular visits.

The crop loan insurance and risk management scheme would be a natural extension of the outlined MSSL – ICICI cooperation. MSSL acts effectively as ICICI agent with farmers and would simply expand current ICICI services offered to farmers through this scheme. MSSL is currently preparing a few of these pilot schemes in AP and MP. Roles and relationships in the scheme are illustrated in the following chart.ICICI

Bank provides crop loans through various agents in rural areas, one of them is Mahindra Shubhlabh (MSSL), an agricultural services and input provider—essentially a one-stop-shop for farmers. Part of the contract farming package deal that MSSL has with its farmers is a crop loan with ICICI Bank. MSSL effectively acts as an agent of ICICI Bank. Thanks to the close relationship between MSSL and farmers that includes backward linkages to output buyers, the default risk due to moral hazard is limited. Loan default rates are lower than those of comparable banks that lack these strong agency arrangements.

Figure 4 Agricultural agency lending model – the example of Mahindra Shubhlabh

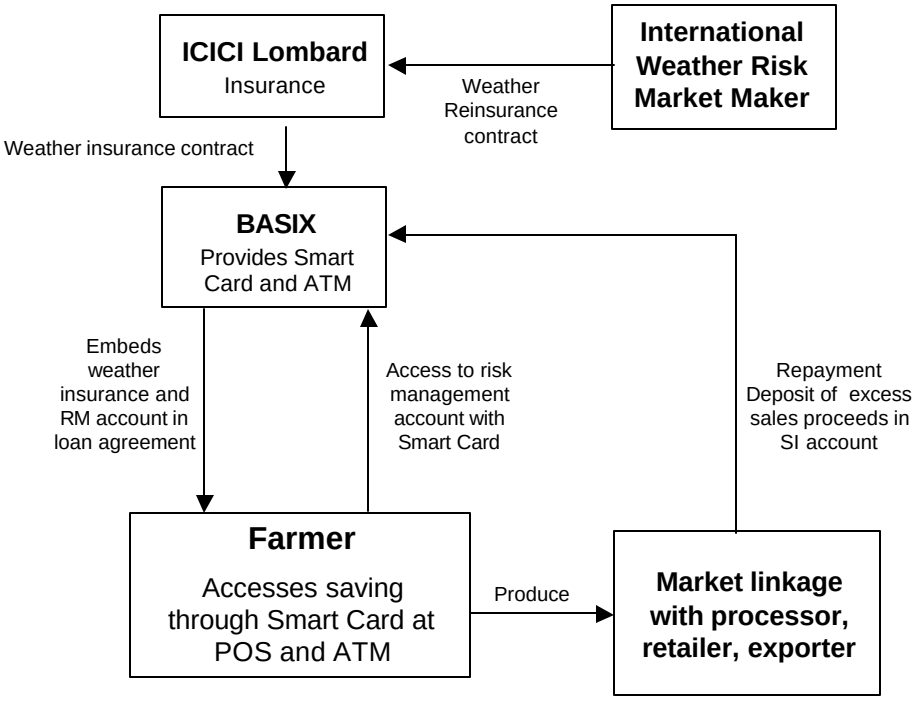


Source: author

The MFI – model – example of BASIX in Andhra Pradesh

BASIX has gained significant experience with innovative crop insurance schemes for dry-land agriculture. It has developed a concept for mitigating yield risk, based on self-insurance, mutual insurance and reinsurance with the insured playing a role in product administration. The concept has a built-in mechanism to minimize adverse selection, administration costs, and discourage settling false claims. BASIX also has considerable experience with Smart Cards. BASIX also does seasonal pre-harvest financing mainly to sunflower, cotton and groundnut farmers and would insure these loans and allow the farmers efficient access to a (forced) risk management account that it can offer through its branches. The scheme would be simpler compared to the MSSL scheme. (figure 5)

Figure 5 The MFI model – an example of BASIX in Andhra Pradesh



Source: author

How the scheme works – and its key benefits

The example of a maize farmer in Belgaum, Karnataka illustrates the simplicity of the scheme. The **key benefits** for the participants in the scheme are elaborated in table 3.

1. A farmer receives a crop loan from a bank.
2. The farmer pays the premium on weather index insurance and starts a risk management account (combined cost <6 percent of loan amount).
3. The risk management account (RMA) premiums are deposited in an interest bearing savings account. The minimum balance is 2 percent of the crop loan. The farmer can access his RMA funds with charge card at banks, agricultural and financial service providers and ATMs and through the charge card.
4. At the end of the season there are three possible outcomes:

a. In a normal year the farmer accumulates savings.

b. In a mild drought year, the farmer receives interest relief as the weather insurance kicks in. If the weather insurance payout is not triggered, the farmer can dip into his risk management account to meet his interest payments.[10]

[10] The farmer is not "forced" to dip into his savings, if he prefers to pay interest (and principal) relief without using his self-insurance savings, he should be free to do so.

c. In a severe drought year the farmer does not pay interest and pays only 10 percent of the principal. In addition, he or she can use accumulated savings funds for further principal payment relief.

5. The farmer saves money by (a) accumulating funds in a risk management account; and (b) depositing excess sales proceeds channeled through agricultural service centers. There is an incentive for the farmer to save on the risk management account through lower crop loan interest rates and reduced loan amounts.

6. Eventually the farmer will accumulate significant savings and can therefore obtain access to a credit line.

Table 3 Elaboration of benefits for program participants

Participant	*Key Benefits*
1. Farmer	✓ Insures debt service exposure against catastrophic events and maintains creditworthiness ✓ Smoothes income swings over time ✓ Builds up remunerated savings and collateral ✓ Can eventually optimize earnings through a credit line (in addition to crop loans)
2. Banks	✓ Secures lending and reduces default rates ✓ Improves collateral ✓ Can increase lending amounts AND savings in rural areas
3. Agricultural service and input provider	✓ Increases business thanks to larger lending amounts ✓ Increases farmers loyalty through multi year savings program
4. State	✓ Benefits from stabilized farmers incomes through reduced emergency assistance outlays ✓ Could subsidize the risk management account with fixed *ad valorem* grant and thereby efficiently and equitably enhance rural access to finance

Source: author

3. Simulating Monsoon Crop Insurance for Rainfed Maize Farmers in Belgaum, Karnataka

The idea underlying these types of contracts is that, once a sufficient degree of correlation between rainfall and yield has been established, agricultural producers can hedge their production risk by entering into a contract under which interest and principal relief would be granted if rainfall levels fall below the selected strike. In order to structure the contract, the issues to evaluate are therefore how to determine the strike and at what level to set it. The adopted procedure for developing rainfall insurance contracts was:

1. production and rainfall data were collected and organized;
2. the most appropriate rainfall period was selected estimating correlations between yields and different rainfall periods;
3. specific rainfall indexes were constructed assigning "weights" to different rainfall periods in order to maximize correlation between yields and rainfall; and
4. different interest and principal relief schedules were analyzed and evaluated.

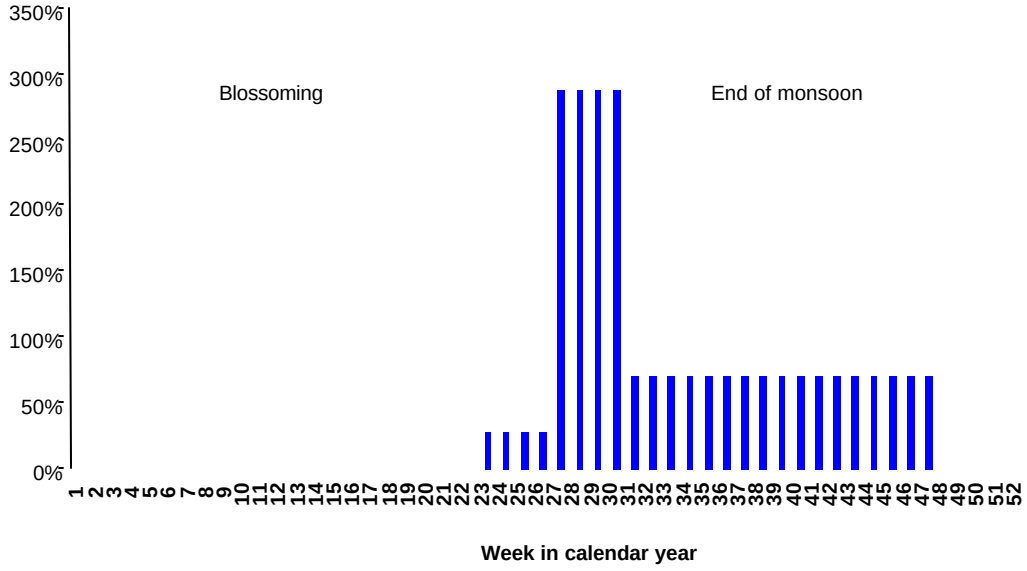
The choice of contract period depends mainly on climate and plant physiology, but also marketing issues. Subscription periods need to end at least two weeks before the start of the contract period. Once the appropriate period has been selected, the rainfall index needs to be structured. Despite the high level of yield-rainfall correlations measured for kharif crops in general, agronomic information in the contract structure enhances the measurement of the yield-rainfall relationship. Precipitation in different stages contributes in different measures to plant growth and, in addition, an excess of rain may be of no use for production. Hence, there is a weighting system that allows to differentiate the importance of rainfall in different growth periods and to introduce weekly caps that address the fact that excess rain does not contribute to plant growth. (figure 6)

In order to structure the index, trends in yield and rainfall series were examined, rainfall for each synoptic station aggregated in 7-day periods and weights assigned through a mathematical programming procedure that maximizes correlation between yields and the rainfall index. The vector of weights is then adjusted through an ad hoc procedure that slightly modifies the optimized vector in order to make it consistent with logic and agronomic intuition. This last step may somewhat reduce correlation between the two series, but allows homogenous rainfall periods to be established, that help to make the contract more understandable and more marketable.

The final value of the index (the value which, when compared with the threshold, indicates if the insured should be granted an indemnity or not) is calculated by summing the values obtained by multiplying rainfall levels in each period by the specific weight assigned to the period. Borrowers participating in the crop loan insurance program receive a payment if the level of the index falls below a predetermined threshold. The interest and principal relief is equivalent to the percentage of rainfall-index shortage multiplied by the level of coverage selected. Figure 7 provides a graphical description of the performance of the rainfall index insurance in the case of a maize producer for a specific synoptic station of Karnataka.

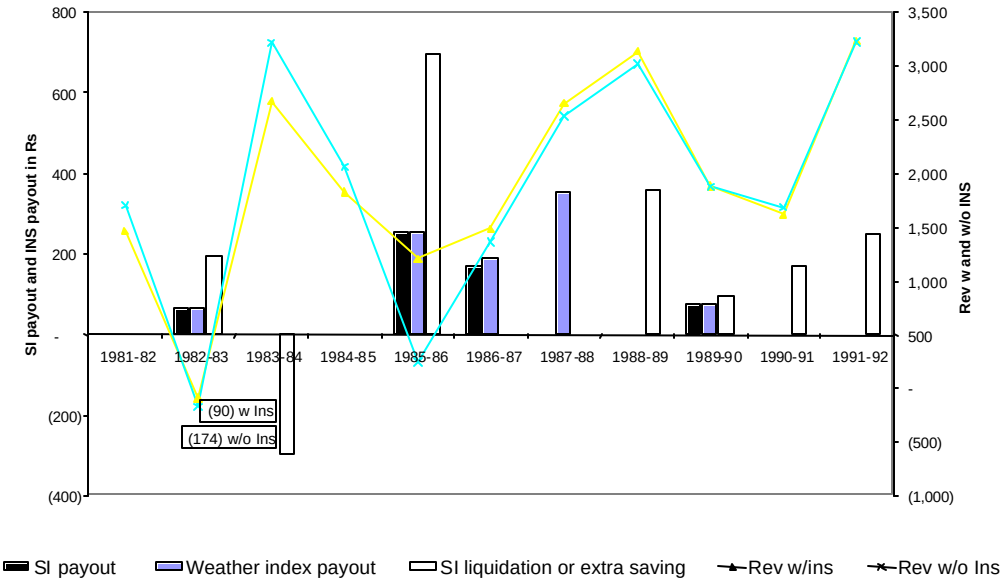
The figure represents the different levels of maize revenue with or without crop loan insurance. The coefficient of variation (C.V.)[11] without insurance is 59 percent, with insurance 50 percent.

Figure 6 Weather insurance contract critical periods and weights



Source: author

Figure 7 Self Insurance and Insurance payouts and revenues w and w/o insurance

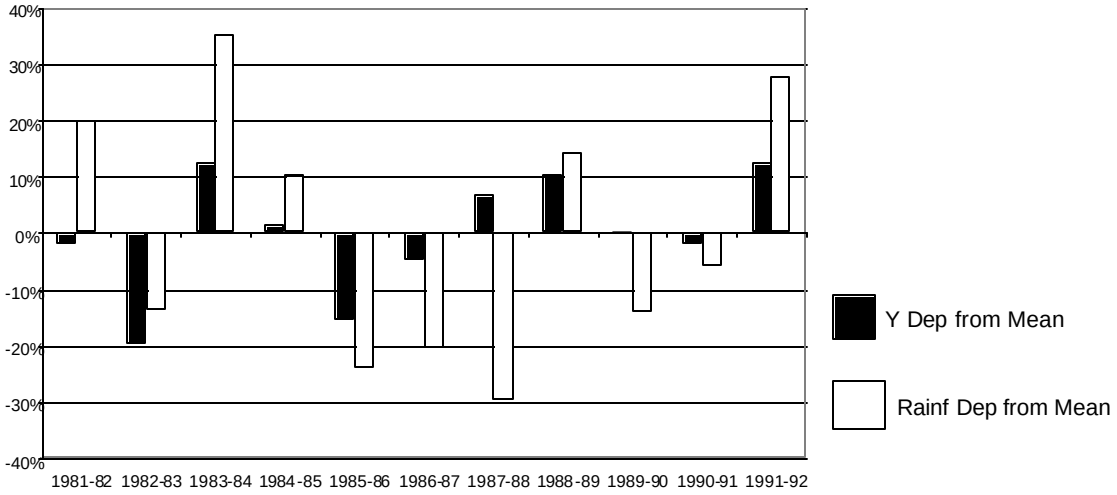


Source: author

[11] As such, levels of expected yields and revenue reveal little about the relative risk. On the basis of a yield time series a profile of these risks can be developed as well. Since expected yields vary among crops and provinces, risks measures are normalized by using the coefficient of variation (CV): CV = Standard deviation / Mean. (Varangis/Skees 2001)

Another useful way to describe the performance of the rainfall index insurance is to analyze the dynamics of revenue loss and the payments triggered by the program in each of the crop years. Figure 8 shows that the program triggers a payment in each of the years for which a revenue loss is recorded, although it does generate a "false positive", i.e., a payment is made although the (officially recorded) area yield is above the mean.

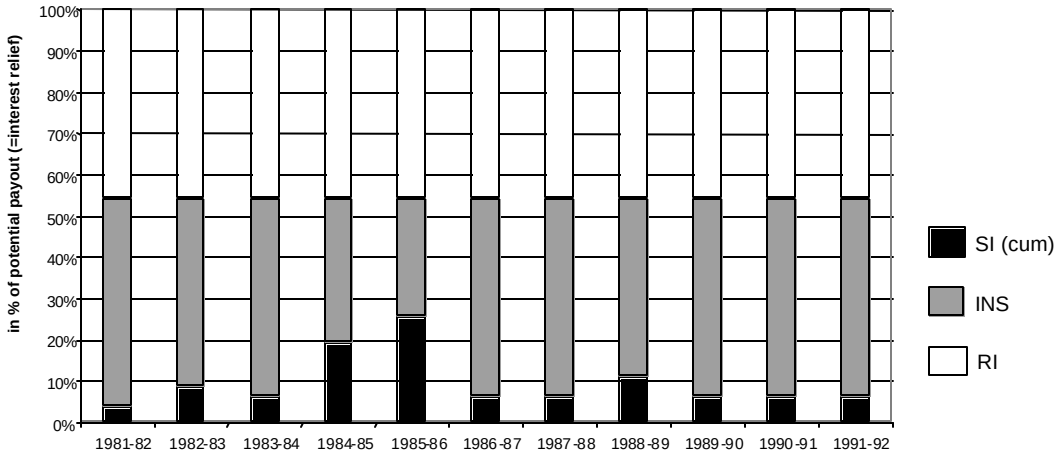
Figure 8 Rainfall and yield departures from mean 1981-92 Belgaum, KA



Source: author

The weather insurance payouts and draw-downs from the self-insurance account result in interest and principal relief. Payouts from the self-insurance or risk management account partly compensate for the weather index insurance "basis risk" and partly serve as an income management tool where the farmer can decide to liquidate part of the accumulated savings after a number of good years. Figure 9 illustrates how the risk is distributed between self-insurance, weather index insurance and reinsurance for the insuring party.

Figure 9 Risk sharing among self insurance, insurance and reinsurance



Source: author

4. Conclusions

This crop loan insurance and risk management scheme can help banks significantly increase their lending volumes, especially in rainfed areas. At the same time, the scheme can help bring down default rates as well as transaction costs. It could help farmers stabilize their incomes and even allow farmers access to a greater credit line thanks to enhanced collateral.

Appendix 1. Access to rural finance – analytical framework

In developing countries, rural finance markets are limited and inefficient. In rural areas financial service providers perceive the costs of entry and costs of doing business to be high. In addition, default rates in agricultural lending are particularly high due to the nature of the risks involved in farming. In order to better understand the market-driven constraints to broader access of financial services in rural areas, we propose the banker's profit function as an analytical framework.

Target profit rate = interest + fees – transaction costs – supervision costs – cost of defaults

Financial service providers need to adequately remunerate their equity capital and have a certain cost of funds. These two basic variables combined with the provider's start-up and running costs of new business determine a minimum *target profit rate*. Banks need to achieve this target profit rate in order to stay in business; otherwise equity holders will not be remunerated adequately and will shift funds into more profitable businesses.

Interest Rates and Fees

Banks in industrial countries often make most of their profits from fee income; however, in emerging markets the interest rates, loan handling fees, and, the internal rate of return are often capped. This is especially true for smaller amounts or credit provided to smallholders, which make it difficult for banks to fully recover their costs.[12] (Miller, etal. 1993) This constraint effectively leads to credit rationing by banks and tends to prevent access of clients with smaller loan sizes, as transaction costs tend to be fixed on a per loan basis. Often smallholders resort to moneylenders and other informal lending sources and pay much higher rates than formal lenders would charge. Rural sector lending quotas put on banks do not solve this problem but instead create incentives for banks to lend to large clients with a rural sector base.

Transaction and Supervision Costs

In rural areas, loan sizes are typically small and their borrowers are highly heterogeneous, which makes the cost of due diligence per loan very high. Other conditions that drive up transaction costs include:

- *Information assymetries*. There are few credit bureaus or other providers of credit information, thus making due diligence much more expensive.
- *Human resource constraints.* Banks often have difficulty finding qualified loan officers for rural markets. When they do their work is slowed by lack of good credit information on clients.
- *Limited or no price discovery.* Assessing credit risk is more difficult and the margin of error is high under conditions where there are only local price benchmarks instead of national grades and prices, where there is very limited dissemination of prices, and where brokers have an information monopoly.
- *Institutional inefficiencies*. The lending and disbursement process is rarely automated. This combined with the geographic spread of clients slows down the entire lending process. It also drives up borrower supervision costs for the banks and compliance costs for customers .

[12] In their article, Miller, Lynn, Ellinger, Barry, Lajili report on a bank survey in Iowa, USA where 70 percent of all respondents cited *differential* and 57 percent *risk adjusted* loan pricing on agricultural production loans as their response to farmers credit risk.

These conditions usually result in delayed disbursements, delayed enforcements and compounded transaction costs.

The Cost of Default

Agriculture and agro-processing—and by extension rural areas, in general—are more exposed to correlated risk—systemic events that affect large areas at the same time. The major systemic risks are weather, output prices and government. In contrast to idiosyncratic risk such as accident or most health crises, systemic risk cannot be insured in a traditional manner, as it does not follow the law of large numbers which makes insurance viable: car insurers can predict loss ratios within reasonable confidence intervals, crop insurers insuring weather events could easily have loss ratios of 200-300 percent. Smallholders who borrow money tend to be more vulnerable to systemic risk due to their low asset bases. This covariant risk makes it difficult for banks to operate in the rural sector because a weather event, could bring about a large number of simultaneous defaults. Due to this systemic risk problem, insuring weather risk in farming is usually not viable due to costs of this type of insurance induced by moral hazard and adverse selection. Loss adjustment and monitoring costs are high and inversely related to loss ratios. A number of other factors contribute to high costs of default in rural areas. Borrowers in rural areas tend to default more easily on commercial banks loans if they do not have a personal relationship with the bank and the bank does not have a local presence. A history of government bailouts of failed state banks coupled with directed lending have also contributed to low payment among rural borrowers. Most rural inhabitants have no fixed collateral or only small plots of land that often can not be mortgaged. A farmer's title to a piece of land is often unclear and tenuous, and identifying alternative collateral is costly and cumbersome. There are also insufficient collateral registration and enforcement mechanisms. Finally, the more highly leveraged the farm becomes, the greater the risk and the greater the expected return.[13] (Oury, 1970)

Minimizing Default and Supervision Costs

In a transparent and competitive market banks and other rural financial service providers seek to maximize profits by minimizing transaction, supervision and loan default costs. There is, however, a trade-off minimizing default rates and minimizing supervision costs. A rural lender that invests in personal contact and borrower supervision will have lower default rates, but higher transaction and supervision costs. (figure A1.1) Thus banks continuously optimize the relationship between these two goals, the key variable being information about borrowers and their credit histories.[14]

The hypothesis of this paper is that the proposed loan insurance and risk management scheme can lower the costs of both default and supervision. This will move the curve closer to the axis intersection. (figure A1.2) The first shift takes place when the loan insurance directly impacts default rates as it mitigates drought risk.

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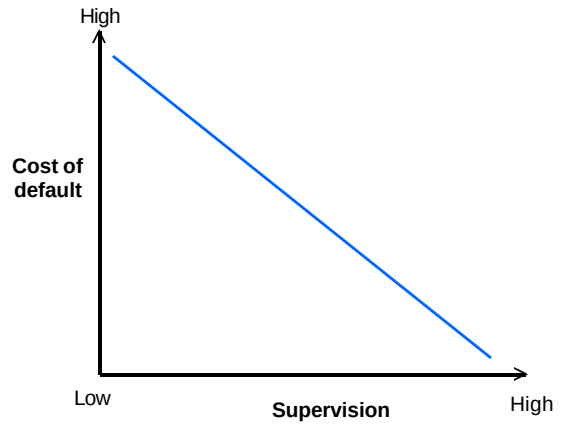
[13] With more capital invested in higher risk and higher return farming operations, expected returns increase, as does the standard deviation of returns to equity. This is illustrated by studies at the International Rice Research Institute which indicate that whereas the total cash cost of production for the average Filipino rice farmer using traditional methods and varieties is about US$20 per hectare, the cost rises to US$220 when the new high yielding IR-8 is grown. The yield is expected to increase threefold leading to a net return four times greater than with traditional varieties, the farer must have access to substantially greater credit to finance his operations and leverage his business. The needs of developing countries to adopt new technology lead to substantial credit absorption burdens.

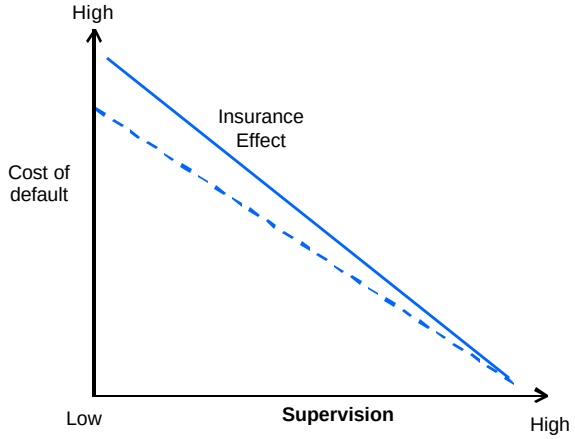
[14] Credit risk modeling and credit scoring techniques based on empirical evidence about defaults could indeed allow for the construction of a linear optimization model that optimizes the portfolio supervision – interest rate mix.

Figure A1.1 The cost of default and supervision



Source: Author

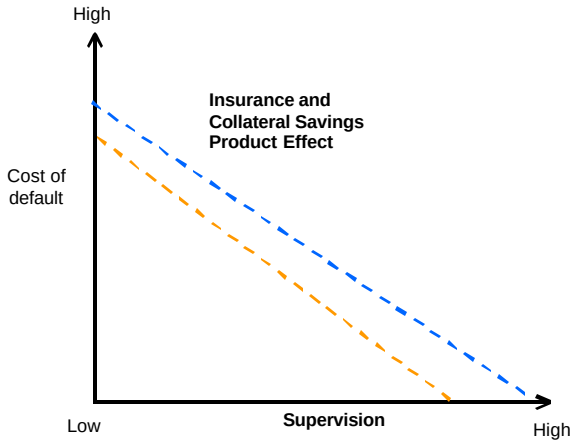
Figure A1.2 Insurance effect on the cost of default and supervision



Source: Author

While the insurance can help lower the costs of default, the risk management product will increase client loyalty thanks to the savings account and the income smoothing affect for the farmer. As discussed in section 2, rural borrowers normally have few incentives to pay on a loan or to pay a trader contract. If political intervention does not bring about debt forgiveness, the inefficient court system will delay the seizure of assets if that is done at all. If the farmer's own savings is at stake, there is an incentive not to default. (figure A1.3) This combined with incentives to accumulate savings, such as lower interest rates in the future, creates a product that has benefits for farmers and lenders alike. This affects supervision costs, as the loan collection and field control efforts are less stringent thanks to the cushion effect of insurance and savings.

Figure A1.3 Insurance and collateral savings products effect on the cost of default and supervision



Source: Author

Appendix 2. Description of First Weather Insurance Pilot in India, July 2003 and Profile of the Companies Piloting Monsoon-based Weather Insurance

Mahindra Shubhlabh is an IFC investee company. MSSL, headquartered in Mumbai, plans to develop 180 Agricultural Service Centers (ASCs) in India's major agro-climatic areas. Up to ten internet-based kiosks will be set up around each center. One hundred and fifteen centers will be located in the northern states and sixty-five in the southern states. Currently, there are two farm centers operating in four districts of Tamil Nadu state; one operating in one district in Andhra Pradesh state; two in three districts in Rajasthan state; and two districts in Karnataka state. In addition to this, four more centers spread across Tamil Nadu, Karnataka, and Rajasthan will be operational soon. All of the centers are and will be located in rural areas in small towns and villages. The sites are on rural roads - in general on agricultural or commercial land.

ICICI Bank is India's second-largest bank with total assets of about Rs. 1 trillion (US$20 billion), a network of about 540 branches and offices, and over 1,000 ATMs. ICICI Bank offers banking products and financial services to corporate and retail customers through its specialized subsidiaries and affiliates in the areas of investment banking, life and non-life insurance, venture capital, asset management and information technology. ICICI Bank's equity shares are listed in India on stock exchanges at Chennai, Delhi, Kolkata and Vadodara, the Stock Exchange, Mumbai and the National Stock Exchange of India, Limited and its American Depositary Receipts (ADRs) are listed on the New York Stock Exchange (NYSE).

ICICI Lombard General Insurance Company Limited ("ICICI Lombard") is a joint venture between ICICI Bank Limited and Lombard Canada Limited, one of the oldest property and casualty insurance companies in Canada. ICICI Lombard leverages the ICICI Bank Group's brand equity, extensive distribution networks and technological infrastructure.

BASIX, another IFC investee, is actually a group of financial services and technical assistance companies set up in 1996 as a microfinance—or rural livelihood promotion—institution. The mission of BASIX is to promote a large number of sustainable livelihoods, including for the rural poor and women, by providing financial services and technical assistance in an integrated manner.

- Bhartiya Samruddhi Finance Limited (Samruddhi), registered with the Reserve Bank of India as a *non banking finance company*, is the main operating entity through which credit is delivered.
- Indian Grameen Services (IGS) is an NGO, registered as a Section 25 not-for-profit company, provides technical assistance and support services to Samruddhi borrowers and other rural producers and institutions.

The two companies are held together by BASIX, Ltd.—holding company through which initial equity investments were made in Samruddhi. In February 2001, BASIX also got a license from the Reserve Bank of India to open a Local Area Bank. The Krishna Bhima Samruddhi Local Area Bank promoted by BASIX commenced operations in March 2001 in the districts of Mahaboobnagar in Andhra Pradesh and Raichur and Gulbarga in Karnataka.[15] (BASIX 2003)

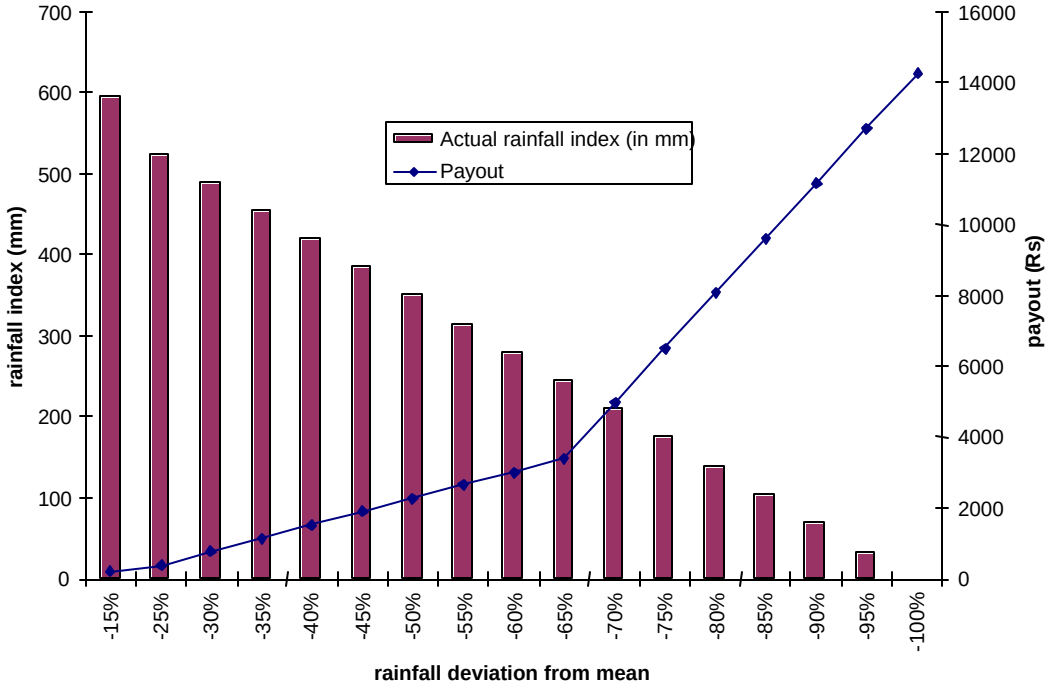
[15] Basix website. http://www.basixindia.com

BASIX launched its first weather insurance program in July 2003 through its local area bank KSB in Maboobnagar. Local area banks are limited to operations in three adjacent districts and therefore face limited natural portfolio diversification, which helped to convince KSB that weather insurance contracts for its borrowers could mitigate the natural default risk inherent in lending in drought prone areas such as Maboobnagar, at the extreme Eastern end of AP, bordering Karnataka. The district has experienced three consecutive droughts during the last years.

KSB bought a bulk insurance policy from ICICI Lombard and sold around 300 individual farmer policies for three categories of groundnut and castor farmers, small, medium and large. Small farmers are defined as households farming less than 2 acres of land, medium farm between 2 and 5 acres and large farmers have more than 5 acres. Premium rates are 456 Rs for the small farmers with a liability of 14,250 Rs, medium farmers pay 600 Rs with a maximum liability of 20,000 Rs and large farmers pay 900 Rs for a liability of 20,000. At this pilot stage KSB therefore decided to limit liability per farmer rather than imposing per acre limits, in order to manage overall liability. KSB sought to sell policies to up to 300 farmers for each of the two targeted crops during this pilot stage. Farmers uptake has been immediate, with around 100 farmers signing up at the first day.

The payout structure for the small farmer is as follows.

Figure A 2.1 Maboobnagar weather insurance - small farmer payout structure



Source: author

KSB and ICICI Lombard opted for a weighted and capped rainfall index, which means that the maximum rainfall counted per sub-period is limited to 200m and more critical periods for the plant growth are more heavily weighted than others.

Informal interviews with around 15 the farmers who bought the policies revealed that farmers are very well aware of the rainfall based index nature of the contracts and the associated basis risk. They also understand the two-step payout structure of the policy and the fact that the liability limit is a theoretical

number and historical maximum payouts are around 3025 and would have occurred in 2002 and 1997. Thus the premium rate at that level is around 15%. Nevertheless the farmers seem to value the quick payout of the weather policy, which distinguishes it from the federal crop insurance policy in India. Interviewed farmers also understand and appreciate the weighted and capped structure of the contract as it directly reflects their experience that the distribution of rain throughout the season matters a lot for the yield.

KSB decided that only borrowing farmers can buy weather insurance policies. Eventually KSB contemplates to lower the interest rate for these farmers due to the reduced default risk.

BASIX/KSB also designed policies for Soya farmers in MP, Ujjain and UP, Aligarh. One of the top 5 reinsurers in the world has agreed to reinsure this entire weather insurance portfolio.

Appendix 3. Designing a Weather Insurance Contract – the Example of a Rainfall Contract for Wheat Farmers in Morocco

The Morocco, the World Bank study recommended a rainfall insurance program based on a European model where the option price is the cost of the coverage and the strike is the rainfall threshold below which an indemnity is triggered. The Moroccan insurance company MAMDA then started developing the concept in conjunction with IFC. The underlying concept is that once a sufficient degree of correlation between rainfall and yield is established, an agricultural producer can hedge his/her production risk through a contract that would pay out if rainfall levels fall below the selected strike. In order to structure the contract, one must consider how to determine the strike and at what level to set it. In the case of cereal and sunflower production in Morocco, the following procedure for developing rainfall insurance contracts was adopted:

1. collect and organize production and rainfall data;
2. select the most appropriate rainfall period, estimating correlations between yields and different rainfall periods;
3. construct specific rainfall indexes, assigning "weights" to different rainfall periods in order to maximize the correlation between yields and rainfall; and
4. analyze and evaluate different payment schemes.

After having collected and validated the data, one must first define the rainfall time period that should be considered for coverage purposes. The choice depends mainly on climate and plant physiology, but marketing issues are also relevant. To avoid the possibility of producers making an informed decision on whether to enter into the contract or not, that is, if they benefit from weather forecasts, it is clearly not advisable to include rainfall periods that precede contract signing time. Typical time between contract signing and rainfall period commencement is two weeks.

Once the appropriate period has been selected, it is time to structure the rainfall index. In Morocco, authorities found that despite the high correlation between yield and rainfall that were measured for crop production (close to 0.8 in the case of wheat), it is nevertheless advantageous to include agronomic information in the contract to enhance the measurement of the yield-to-rainfall relationship. In fact, precipitation in different stages contributes in different measures to plant growth. Additionally, too much rain can be of no use for production. Therefore, it is useful to develop a weighting system that differentiates the importance of rainfall at different stages and shapes the model account for the fact that excess rain may be wasted without contributing to plant growth.

Table A3.1 Structure of rainfall-index insurance for wheat in Morocco

Month	*10-day period*	*Weight*
November	1	2.0
	2	2.0
	3	2.0
December	1	0.5
	2	1.0
	3	1.0
January	1	10.0
	2	0.5
	3	0.5
February	1	1.0
	2	1.0
	3	1.5
March	1	1.0
	2	0.5
	3	1.0

Source: IFC, Morocco Weather Index Insurance Project

To structure the index, one needs to examine the trends within the yield and rainfall series, aggregate the data for each synoptic station into 10-day periods; and assign weights to maximize the correlation between yields and the rainfall index.[16] The weights are then adjusted through an ad hoc procedure that slightly modifies these weights in order to make it consistent with logic and agronomic intuition. This last step may reduce correlation between the two series somewhat, but it allows one to establish homogenous rainfall periods, which helps make the contract more understandable and marketable. Table A3.1 provides an example of one the indices developed for wheat in Morocco.

The final value of the index is the sum of the values obtained by multiplying rainfall levels in each period by the specific weight assigned to each period. This value is compared to the threshold to indicate if the insured should be granted an indemnity or not. Customers participating in the rainfall-index program receive a payment if the level of the index falls below a predetermined threshold. The payment is equivalent to the percentage of rainfall-index shortage multiplied by the level of coverage selected. Customers applying to the program should be allowed to select different levels of coverage, which allow them to insure different levels of potential revenue. Figure 2 provides a graphical description of the performance of the rainfall index insurance in the case of wheat production for a specific synoptic station of Morocco. The figure represents the different level of wheat revenue with or without rainfall insurance. It should be noted that the insurance program prevents revenues from falling below a threshold of approximately Dh3,000 (approximately US$300 equivalent).

One other useful way to describe the performance of the rainfall index insurance is to analyze the dynamics of revenue loss and the payments triggered by the program in each of the crop years. Figure 3 shows that the program triggers a payment in each of the years for which a revenue loss is recorded and also that it does not generate "false positives", i.e., payments where there is no revenue loss. Figure 3 also illustrates the issue of selecting the threshold level. Quite logically, the higher the threshold set for a contract the better the coverage provided; however the trade-off is that a higher threshold results in a higher cost for the insurance coverage. In Figure A3.1, in Menkes where the coverage level is set at 375 mm, the indemnities for the years 1982 and 1987 are probably too high, which wastes resources that are accounted for in the premium of the policy. Figure A3.2 shows a case for a different threshold level (275 mm) for which the coverage is probably not as good, but for which the actuarial premium is more than halved.

The proposed proportional rainfall-index payment scheme is only one of the possible solutions for structuring a weather-related crop insurance program. The IFC research team evaluated several different alternatives, all of which aim to make the coverage as extended and as comprehensive as possible. In terms of payment structure, non-proportional contracts—i.e., where the unit payments increase as rain shortfall increases—were tested and other weather variables, like temperature, were added to the structure of the contract. Overall, however, the simplicity of the rainfall index and the comparatively lower cost of the coverage led to the selection of the simple proportional rainfall index as the preferred model for implementation.

An interesting marketing feature of the rainfall insurance program that should be launched for the 2002–3 crop year is that, following the successful experience of the drought program, the contracts will most probably be marketed by linking the insurance policies to farmers' requests for credit. The credit institution can apply part of a farmer's loan to financing the insurance coverage. This marketing procedure will certainly help the development of the program in its infancy. At the same time it will cover the producer's revenues and reduce the default risk for credit institutions.

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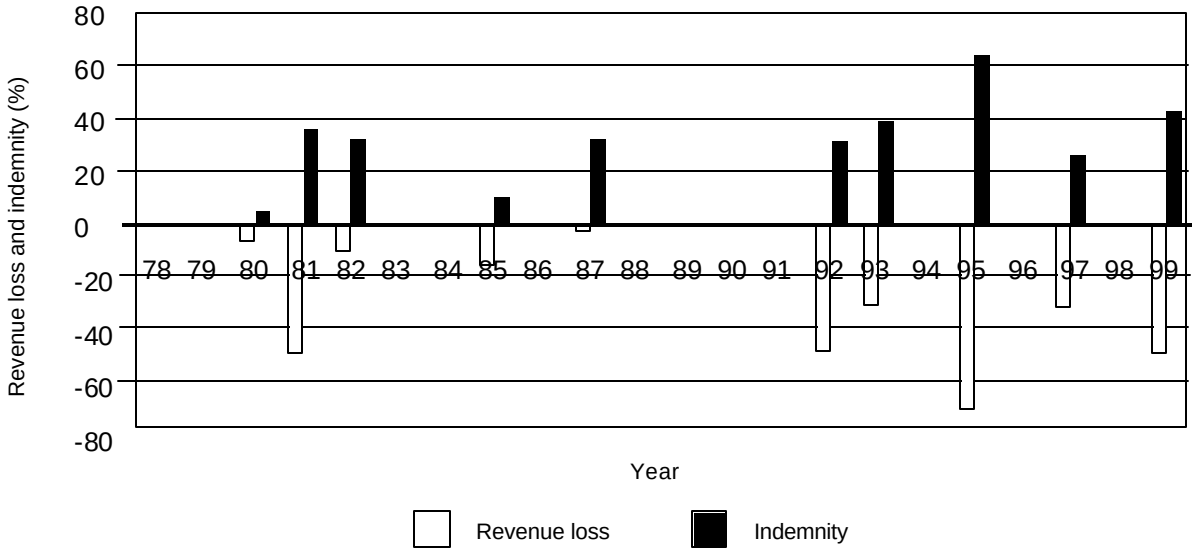
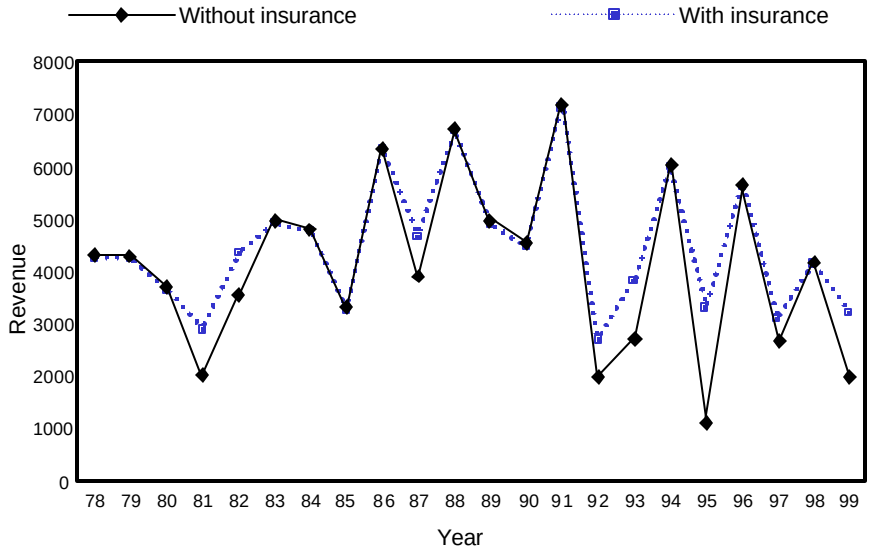
[16] A mathematical programming procedure is used to assign the weights.

Figure A3.1 Performance of rainfall-index insurance for wheat in Meknes (threshold 325 mm)



Source: IFC, Morocco Weather Index Insurance Project.

Figure A3.2 Wheat revenues with and without rainfall insurance (index threshold 275 mm)



Source: IFC, Morocco Weather Index Insurance Project.

Appendix 4. Basis Risk and Farmers Value-at-Risk*

A major concern with insurance based on weather or other indexes is basis risk— the potential mismatch between insurance payouts and farmers' losses. Jerry Skees writes that *"[t]he effectiveness of index insurance as a risk management tool depends on how positively correlated farm-yield losses are with the underlying area yield or weather index."*[17] This concern relates to the question of whether insurance based on a weather index can substitute for traditional crop insurance and *indemnify* the farmer for his losses. The usual answer is that basis risk can be managed if:

1. the correlation between index and yields is high and the index is measured well; and
2. efficiency gains with index insurance allow for lower deductibles, which partially compensate for the basis risk.

The experience of the commodity risk management group at the World Bank shows that the relevant question is whether the payout from insurance based on a weather index effectively reduces the insured's *value-at-risk (VAR)* rather than compensating for a single crop loss only. Value-at-risk is a measure of potential dollar loss from an adverse change in prices occurring in a normal market environment. The farmer's value-at-risk is an effective measure of his overall vulnerability, his exposure to income shocks—such as a wedding, a disease, or a big drought. The farmer is interested in maximizing his overall income while minimizing his value-at-risk. Income comes from multiple sources—such as, off-farm labor, livestock, as well as field and perennial crops. As stated earlier, diversifying income sources is clearly a way of managing risks and minimizing VAR by sacrificing some of the benefits that could come with specialization and economies of scale.

Once we understand the farmer's value-at-risk and his objective function, which allocates investments among VAR minimization and income maximization according to the farmers risk aversion, we can redefine the basis risk issue and the weather index insurance discussion. The message is that certain systemic shocks, particularly weather, affect not only one crop but *all* farmer activities. In a severe drought, all rural economic portfolios suffer, the herder who has some land, the dentist who is also a wheat farmer. The farmer cares about the insurance effect on his income over VAR.[18]

Anecdotal evidence indicates that rural entrepreneurs understand the portfolio coverage effect of weather index insurance. In Morocco, for instance, a dentist expressed his willingness to pay for weather index insurance, because a drought reduces both his number of patients and the yields of his secondary farming activity. Similarly, a Sunflower Association asked to have a highly customized wither insurance contract simplified, presumably to have better insurance coverage for the overall farmers' portfolios. In India a World Bank/Indian Coffee Board survey reveals that out of surveyed 500 coffee farmers 420 intercrop coffee with pepper, 229 with paddy. All of these crops are subject to monsoon risk.[19] Transferable

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* This annex was originally prepared as a commentary on the paper "Risk Management Challenges in Rural Financial Markets: Blending Risk Management Innovations with Rural Insurance" by Jerry Skees, Prepared for presentation at: *Paving the Way Forward for Rural Finance: An International Conference on Best Practices* June 2 – 4, 2003 Washington DC.

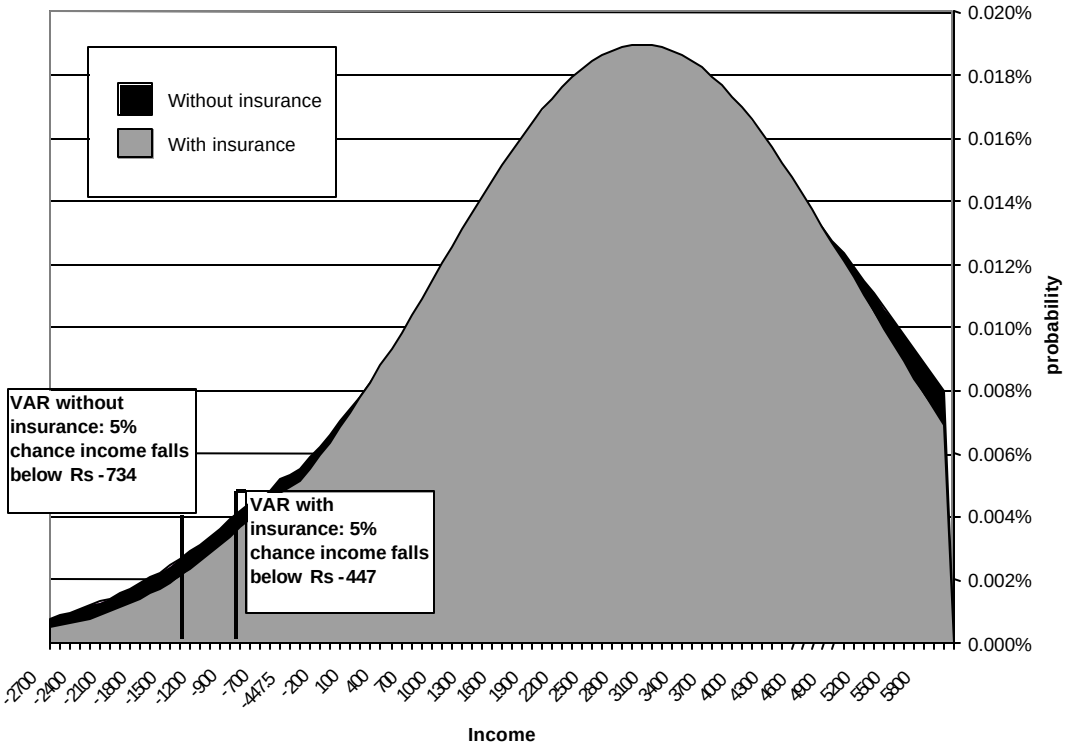
[17] J.Skees paper, idem.

[18] Anecdotal evidence suggests that it tends to be the woman and mother in the household who is more concerned with VAR, that is, how much is at stake in the worst case, and the man in the household might be more preoccupied with the maximization of income and risk taking business ideas.

[19] Survey of 500 coffee farmers conducted in 2003, ARD Commodity Risk Management Group

standardized area contracts are clearly more easily tradable than highly customized single-crop models, which again put the traditional basis risk question in question – the farmer might highly value the tradability and therefore the high secondary market price of the instrument. Banks would more readily accept the instrument as liquid collateral for loans – again reducing the "basis risk" of the instrument.

Figure A4.1 Probability mass function with and without insurance for soya in Ujjain, Madhya Pradesh, India



Source: author

The Value-at-Risk Model at the heart of the insurance discussion allows for a better choice of instruments and indexes. The combination of price and weather indexes into a revenue index might be the right choice for a coffee farming area where the lack of cash income from coffee affects the area's overall economy. Clearly, weather index insurance seems to be a powerful hedge for a farmer that intercrops coffee with pepper and also farms paddy—as it significantly reduces his overall VAR. In weather exposed staple food growing areas with highly diversified and specialized activities the right insurance trigger might be a basket of weather stations.

Appendix 5. Sample term sheet from Belgaum, Karnataka, India

The termsheet lays out the key terms of the loan and insurance products.

State, District	Karnataka, Belgaum
Commodity targeted	Maize
LOAN	
Interest rate	17.5%
Maturity	6 months
RAINFALL INSURANCE	
Calculation period	6/18/03 to 8/19/03
Reference Weather Station	Belgaum Weather Station (Karnataka)
Period Rainfall Index	Total cumulative amount of precipitation measured at the Reference Weather Station subject to a cap of 700 mm
Total Rainfall Index	Total of the Weighted Period Rainfall Index in all Sub-Periods
Threshold	90% of mean
Payment	17 Rs per % point below threshold
Maximum Payout	1,530 Rs equivalent to 100% interest relief and in terms of debt relief 30% principal relief (but accumulated RM account balance could cover total principal payments)
Premium:	2.0% of loan amount
Load factor (insurance premiums in excess of claims)	15%
RISK MANAGEMENT ACCOUNT	
Premium	4.0% of maximum payout
Minimum account balance	2% of maximum payout in savings account
Deposit rate	6%
SIMULATION RESULTS	
Farm Revenue Coefficient of Variation without insurance (per ha)	59%
Farm Revenue Coefficient of Variation with Insurance (per ha)	51%

Notes: The simulation period is 1981-1992, areas mostly rainfed. Today total maize area is only 4500 ha, of which 14% is rainfed.

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