INSURING AGAINST BAD WEATHER RECENT THINKING

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Introduction

Given the objective of protecting rural household incomes, a government typically has a range of policy options, depending on the kinds of risk involved. It is important to begin by assessing the real sources of risk, since some risks can be reduced directly. For example, production variability arising from unreliable fertilizer deliveries can often be resolved by consistent import policies and improved transport, distribution and storage systems. Likewise, some weather-related risk may be diminished through irrigation investments, which also contribute to increased production. Plant breeders might also be able to reduce some yield risks by selecting for lower sensitivity to environmental stress. But many risks cannot be prevented in this way and may require appropriate instruments that provide compensatation when sever losses occur. Insurance has an important role to play in this context.

Instability in agricultural production, income, and employment has been a persistent and challenging problem for India and her poor, as analyzed in many of the pioneering writings of Professor C. H. Hanumantha Rao (e.g., Rao, 1975; Rao et al., 1988; Rao, 1994). Professor Rao recognized long ago that there are many methods for removing risk in agriculture and that insurance was only one policy tool. For example, some risk can be removed with investments in technology and infrastructure (Rao, 1971), and which may even contribute to increased productivity as well reduced risk (e.g. irrigation). Where they exist, these options can be superior to investments in crop insurance by either government or individuals. This chapter clearly acknowledges this to be true. However, not all risks can be reduced at reasonable cost in this way, and there are certain correlated risks where the optimal blending of insurance and capital investments may be optimal as well. Thus, this chapter focuses on providing the basic motivation for and innovation in insurance against adverse weather events. Progress has been made in creating new schemes to share natural disaster risk where correlated losses are quite common.

Recently, there has been growing interest amongst researchers, international development agencies (e.g. the World Bank), policy makers and private insurers in investigating and testing innovations in risk sharing for developing countries. India is in the midst of such experimentation with rainfall index insurance (Hess, 2003). And while it is too early to reach definitive conclusions on these experiments, ongoing consideration of innovations in light of their potential and their limitations is useful. This chapter is motivated to that end. Institutional developments must accompany market developments that involve both the broader financial community as well as the global community to effectively supply needed products.

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What Role Can Insurance Play in Economic Development?

Droughts, floods, and other natural disasters lead to severe income losses for rural people, especially farmers and poor people. Given their limited ability to offset these losses, many rural people suffer extreme hardship, lose assets, and default on their debts in disaster years. The economic development literature increasingly links poverty and shocks (e.g., Dercon, 2005). Studies find that a large portion of the poor in developing countries are transitory — moving in and out of poverty as they encounter shocks to household income. These poverty traps justify some type of public intervention for equity and efficiency enhancement. As Dercon (2005) concludes, "social protection may well be good for growth."

The prevalence of natural disasters is not new, and farmers, rural institutions, and lenders have, over generations, developed ways of reducing and coping with risk (e.g., crop diversification, farm fragmentation, kin support networks, storage, and asset accumulation). Although the virtues of these traditional risk management instruments are widely recognized (see Walker and Jodha, 1986; Walker and Ryan, 1990), they also have their limitations. They can be costly in terms of the income opportunities that rural people forego (e.g., crop diversification is typically less profitable than specialization).[3] They can also discourage investments and technological changes that, while risky, enhance long-term productivity growth. Also, risk exposure can reduce access to credit because of greater risk of debt default in bad years. And finally, shocks that accompany extreme events also create the poverty traps described above. Traditional risk management methods have limited capacity to spread covariate risks, like droughts, that affect most people in a region at the same time. In theory, these limitations would not exist if capital and insurance markets were perfect and could pool risks over wider regions and over time, but the reality in many developing countries is quite the opposite: relevant capital and insurance markets are poorly developed and weakly linked across regions and with urban areas.

Seminal works by Arrow (1964) and Debreu (1959) have addressed the value of risk sharing markets for society. Failures in insurance markets provide a rationale for governmental intervention, but only if government can fix the problem at a lower cost than the social benefits derived. Many governments have intervened with a range of risk management programs for rural people (e.g., crop insurance, livestock feed subsidies, and debt forgiveness). Such programs have often been an expensive drain on the public purse, and there is little evidence to show that these interventions have generated any sizeable social benefits or that the benefits exceed their costs (Hazell, 1992; Hazell, Pomareda, and Valdes, 1986).

Given these failings, many governments turn to various forms of direct disaster assistance to relieve the problems of stricken areas. Such assistance is costly, and costs may escalate in the future as more people live in vulnerable areas and as global climate change increases the frequency and severity of many natural disasters. Moreover, once disaster assistance has been institutionalized and taken for granted, it can lead to many of the same perverse incentive problems as an insurance subsidy, inadvertently worsening future problems by encouraging people to increase their exposure to potential losses. For example, assured compensation for flood or hurricane damage to homes can lead to the building of more houses in flood and hurricane

[3] Using econometric methods and panel farm household data from South India, Gautam, Hazell and Alderman (1994) estimated that households paid an implicit risk premium of between 13 and 17 percent in terms of the average income they forewent to reduce risk. Similar findings have been reported by Binswanger and Sillers (1983) and Antle (1987).

prone areas than prudent investors would otherwise build.[4] Similarly, assured compensation for crop losses in drought prone areas may encourage farmers to grow more of the compensated crops even when they are more vulnerable to drought than alternative crops or land uses.

More effective risk management instruments are needed to enable rural people to better manage their own catastrophic risks. While some disaster assistance should never be ruled out, new developments in insurance raise the possibility of substantially reducing the financial burden on governments.

New Approaches to Insurance

Natural hazard risks are different than many types of risk that are insured. In the traditional insurance literature these types of risk are not insurable. Insurance works best when the losses from risk being insured are independent. For example, not everyone is expected to have an automobile accident at the same time. With natural hazards it is expected that many people will have losses at the same time. Mixing markets and government may be needed at some level to effectively create insurance markets that meet the following requirements:

- Affordable and accessible to all kinds of rural people, including the poor.
- Protects consumption and debt repayment capacity through compensation for catastrophic income losses.
- Practical to implement, given the limited kinds of data available in most developing countries.
- A core market-orientation with little or no government subsidies.
- Avoidance of the moral hazard and adverse selection problems that have bedeviled most agricultural insurance programs.

Area-based index contracts, such as regional rainfall insurance, could meet all these requirements.[5] The essential principle of area-based index insurance is that contracts are written against specific perils or events (e.g., yield loss, drought, or flood) defined and recorded at a regional level (e.g., at a county or district level in the case of yields, or at a local weather station in the case of insured weather events). In its simplest form, insurance is sold based on the value of protection desired. The insured should be able to select any value of insurance. The premium rate can be quoted as dollars per one hundred dollars of protection. Buyers in the same region would pay the same premium rate. Likewise, once an event has triggered a payment, all buyers in the region would receive the same rate of payment. That rate would be multiplied by the value insured.

Besides drought or area-index insurance, similar kinds of index-insurance contracts can be written against other natural disasters, including flood, excess rainfall, wind speed from hurricanes, earthquake events using the Richter scale, mortality rates for animals in Mongolia, etc.

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[4] See Dennis Mileti's 1999 book, *Disasters by Design*, for an excellent assessment of how U.S. public policy on disaster relief has compounded the suffering and loss due to disasters.
[5] In point of fact, the idea of area-based insurance is not new. Chakravati wrote about how this approach was the only appropriate approach for India as early as 1920.

Payouts for index insurance can be structure in a variety of ways:[6] 1) a simple zero/one contract (once the threshold is crossed, the payment rate is 100 percent); 2) a layered payment schedule (e.g., a 33.3 percent payment rate as different thresholds are crossed); or 3) a proportional payment schedule. The U.S. area-yield insurance, the Group Risk Plan (GRP), is an example of a proportional payment schedule. The payout function appears below:

$$Indemnity = \max\left(0,\ \frac{Index\ Trigger - Realized\ \ Index}{Index\ Trigger}\right) \times Liability$$

In the case of area-yield index insurance, the insurance is written against the average yield for a region (e.g., a county or district), and a payment is made whenever the realized (or estimated) yield for the region falls below some predefined yield (say, 90 percent of normal). The predefined yield is referred to as the *Index Trigger* in the equation above. Area-yield programs exist in the United States, India, Brazil, and Canadian province of Quebec (Miranda, 1991; Mishra, 1996; Skees, Black, and Barnett, 1997).

Area-based yield insurance requires long and reliable series of area-yield data, and this kind of data is not available in most developing countries. Hence alternative weather indices may be more attractive, such as area rainfall or temperature, for which there are available time-series data collected on a regular basis. Mexico has made some progress in using weather index insurance to reinsure the book of business on traditional crop insurance. The state agricultural insurance company (Agroasemex) also has experience with offering individual farmers weather index insurance (Skees et. al.,2005). India has made significant progress in offering rainfall index insurance (Hess, 2003).

Some Attractive Features of Area-Based Index Insurance

Less Adverse Selection

Because all buyers in a region pay the same premium and receive the same indemnity per unit of insurance, it avoids adverse selection problems. Moreover, the insured's management decisions after planting a crop will not be influenced by the index contract, greatly reducing moral hazard. A farmer with rainfall insurance, for example, possesses the same economic incentives to produce a profitable crop as the uninsured farmer.

Less Expensive to Administer

Index insurance contracts should be considerably less expensive to administer than traditional insurance: there are no individual contracts to write; no on-farm inspections; and no individual loss assessments. Index insurance uses only data on a single regional index, and this can be based on data that is available and generally reliable. It is also easy to market; insurance contracts could be sold rather like traveler's checks, and presentation of the certificate would be sufficient to claim a payment when one is due.

Potential for a Secondary Market

As long as the insurance is voluntary and unsubsidized, it will only be purchased when it is a less expensive or more effective alternative to existing risk management strategies. A secondary

[6] See Skees (2000); Stoppa and Hess (2003), or Skees, Hazell, and Miranda (1999) for a more complete description of alternative contract designs.

market for insurance certificates could also emerge enabling people to cash in the tradeable value of an insurance certificate at any time. This type of market would enable a more dynamic pricing of risk as conditions change.

Could be Sold to Non-Farmers (Others are at Risk)

Index insurance can be sold to anyone. Purchasers need not be farmers, nor even have to live or work in the region. The insurance should be attractive to anybody whose income is correlated with the insured event, including agricultural traders and processors, input suppliers, banks, shopkeepers, and laborers. Defining insurance contracts in small denominations would raise their appeal to the poor. Insurance could also be built into credit and into the purchase price of key inputs like fertilizer.

Can be Linked to Microfinance

Recent developments in microfinance also make area-based index insurance an increasingly viable proposition for helping poor people better manage risk (Skees, 2003; Mahul, 2002; Hess, 2003). The same borrowing groups established for microfinance could be used as a conduit for selling index insurance, either to the group as a whole, or to individuals who might wish to insure their loans. Banks and rural finance institutions could purchase such insurance to protect their portfolios against defaults caused by severe weather events. Rural finance entities aggregate and pool risk. With index insurance contracts one can take advantage of such entities to become the means of mitigating basis risk via loans to farmers who have a loss and do not receive a payment from the index insurance. In 2004 the microfinance group, BASIX, purchased rainfall insurance to hedge their portfolio of loans. This idea is also being pursued in Peru with COPEME — a group that represents a number of microfinance entities.[7]

Can Clear the Way for Innovation in Mutual Insurance

Index insurance contracts should be relatively easy for the private sector to run, and might even provide an entry point for private insurers to develop other kinds of insurance products for rural people. For example, once an area-based index removes much of the covariate risk in a region, an insurer can wrap individual coverage around such a policy to handle independent risk (e.g., individual losses not compensated by the area-based index). This would, of course, require special considerations and could most effectively be tried via mutual insurance groups such as the FONDOS of Mexico, where members know the farming practices of their neighbors and don't face the same degree of adverse selection and moral hazard as someone from the outside does. Black, Barnett, and Hu (1999) wrote about using agricultural cooperatives in the United States as the aggregator of farmers when purchasing index insurance and then acting as a mutual insurance company for independent risk.

Challenges for Index Insurance Contracts

While limited experience to date demonstrates that people will purchase index insurance contracts,[8] a key question is whether index insurance will prove attractive to enough individuals. An index product should be more affordable than individual insurance, particularly if government does not subsidize either. Moreover, by offering an index contract that removes most of the

[7] Personal communication between Skees and a BASIX manager in Rome, May 2004. Skees is involved in the work in Peru.
[8] Where the U.S. area-yield product was marketed, participation levels have been reasonable. Anecdotal evidence suggests that between 15,000 and 20,000 farmers in India have purchased the new rainfall insurance in 2004. Participation in the rainfall insurance contracts that were introduced in Ontario, Canada, in 2001 has also been strong.

systemic, correlated risk that an individual faces, independent risks may more easily be insured through conventional insurance or credit markets. Blending index insurance and credit will likely prove the most effective way to deal with both correlated and independent risk. Index insurance removes the big risk, and credit markets provide savings and loans when more isolated risk events create individual losses.

A problem with index contracts is that an individual can suffer a loss and not be paid because the major event triggering a payment has not occurred. For example, a farmer with rainfall insurance could lose a crop to drought at a micro-location, but not receive an indemnity if the rainfall at the regional weather station remains above the trigger point. With index contracts it is also possible for an individual to be paid when they suffer no losses. In futures markets, this type of risk is referred to as basis risk. Index contracts essentially trade off higher basis risks for lower transaction costs, and the insurance will not be attractive if the basis risk becomes too high.

Additionally, rainfall events impact crop yields quite differently depending on the soil moisture holding capacity. In some cases, a good deal of time has been spent attempting to create more complex rainfall insurance contracts that have various weights associated with different timing during the growing season. Since farmers know their own soils and operations best, it may be critical to allow farmers to determine the optimal rainfall insurance contract.[9]

For a rainfall index, the degree of correlation between net receipts from the index and farm income will play a large role in the effectiveness of the risk protection offered to a farmer. With higher correlation there will be less basis risk. It is possible that offering a set of rainfall indexes may fit better for different farming systems than any one index. For example, farm income risks for certain crops may be most sensitive to rainfall shortfalls at specific times of the growing season (e.g., planting and flowering), and offering insurance contracts against rainfall during those specific periods could help reduce the basis risk. Basis risk is also likely to be much less of a problem if the insurance is written only against catastrophic events (e.g., a severe regional drought) rather than against a wider range of downside risks.

Issues to be Addressed in Creating Sustainable Area-Based Index Insurance

Despite the promise of area-based index insurance, there are significant issues that must be resolved before it could be widely adopted. These include a) the need for secure weather event measurements; b) the actuarial challenges that are present due to oscillations in sea surface temperatures;[10] c) the covariate risk problem for the insurer; and d) the high frequency of some catastrophic events.

Secure Rainfall Measures

The proposed insurance depends on independent and secure methods for obtaining reliable information about weather events. While ground-level stations are at the core of such systems, they are not the only means for achieving this goal. Increasingly, Doppler radar is being installed in developing countries. Also, satellite images can be used as a means of cross-checking

[9] Skees encountered this when presenting work in Mexico a few years ago. A technical advisory one of the FONDOS confronted him in a relatively aggressive fashion asking “What makes you think you know more about the weather events that concern us then do we?”
[10] For example, El Niño Southern Oscillation (ENSO) gives strong and early signals about the coming cropping season in many parts of the world.

information from ground stations. Nonetheless, ground stations will continue to be used in the near term if rainfall index insurance is to be widely adopted.

Ground weather stations are rarely very secure and could easily be tampered with once significant sums of money are dependent upon their readings. Enhanced security is one option, which might require relocating some stations to more secure sites. New hardware systems that eliminate any direct human involvement in the recording process could also help. One company in the United States offers a rain gauge operated by a battery with a five-year life. Tiny buckets trip the measuring device so that rainfall at .01 of an inch can be recorded, but no rain is actually collected and stored. By using a data jack with computer software, a worker simply plugs into the rainfall-measuring device and downloads the data. Since the rain is not collected, there is no need to download the information on a daily basis. Another kind of measuring device uses a laser beam to record rainfall and again no water is captured and stored. The cost of these types of gauges is quite reasonable (just a few hundred dollars each) so there is opportunity to densely populate a region with rain gauges. Such coverage would permit readings from several adjacent gauges to be averaged, for a region. It would also reduce the danger of distorted readings should an individual tamper with a single gauge. Again, the optimal system will likely use a variety of verifications systems including remote sensing data taken from satellite images, Doppler radar, or soil moisture readings to verify low rainfall.

Sea Temperature Oscillation

The actuarial soundness of the insurance could be undermined by the ability to use sea surface temperature oscillations to predict the insured events. The most common measures are associated with El Niño-Southern Oscillation (ENSO).[11] It may be necessary to adjust the cost of the insurance when an oscillation event is confirmed, although this would require sufficient lead-time between knowledge of the pending event and the time of selling insurance. The most troublesome aspect of ENSO events in some parts of the world is that they extend across several crop seasons, raising the prospect that the demand for insurance would follow the same cycle and be highest (lowest) in those years when payouts were most (least) likely. Clearly, the insurance could not remain financially viable on this basis. One solution is to sell multi-year insurance contracts a few years into the future before anyone has knowledge of an oscillation anomaly. For some regions of the world, writing an index insurance contract on ENSO measures may be a reasonable alternative.[12]

Finding Efficient and Affordable Mechanisms to Share Covariate Risk

The insurer faces high risk because of the covariate nature of the insured risk. When a payment is due, then all those who have purchased insurance against the same weather station must be paid at the same time. Moreover, if insured risks at different rainfall stations are highly correlated, then the insurer faces the possibility of having to make huge payments in the same year. To hedge against this, the insurer can either diversify regionally by selecting weather stations and risks that are not highly and positively correlated, or sell part of the risk in the reinsurance and financial markets.

[11] A variable widely accepted as a measurement of ENSO is Sea Surface Temperature (SST). Sea surface temperatures are recorded in four regions of the pacific basin. Regions 1 and 2 are located off the coast of Peru and Ecuador. Regions 3 and 4 are located at the level of the equator from South Asia to the borders of ENSO regions 1 and 2.
[12] While working in Peru, Skees and others find that changes in the ENSO 1 and 2 are good predictors of extreme rainfall events. ENSO 1 and 2 are also strongly correlated with bad crop yields.

The possibility for diversifying risks across regions is feasible within larger and agro-climatically diverse countries, but is unlikely to be sufficient for most developing countries. The dominance of the agricultural sector in many developing countries also limits possibilities for pooling climate risks within the broader national economy. Financial instruments for pooling climate risks across countries would therefore be of some importance.

International reinsurance is already available for some kinds of natural disaster risk. The simplest form of reinsurance is a stop loss contract where the primary insurer pays a premium to get protection if their losses exceed certain levels. Other forms of reinsurance are also common. Quota-share arrangements involve simply sharing both premiums and indemnities. Despite significant growth in the international reinsurance markets in recent years, reinsurance markets are still thin with few large international firms and limited capacity. Moreover, reinsurers often display short memories and after a major catastrophe, reinsurance premiums have been known to increase sharply or the insurer simply pulls out of the market.

As an alternative to formal reinsurance, recent developments in global financial markets are making it increasingly feasible to use new financial instruments to spread covariate risks, like regional rainfall, more widely (Skees, 1999; Doherty, 1997). While a good deal of experimentation has occurred with instruments such as catastrophe bonds and by trading state yields on the Chicago Board of Trade, these ideas have not yet proven viable for agricultural risks. The transaction costs associated with these arrangements have likely been a major impediment in their use for developing countries and for agricultural risk. Governments can play a role in aggregating risk within the country to the greatest extent possible before going to the global markets. Special pooling of risks that are reasonably standard and use reliable measures can then be more efficiently priced in the global markets.

Skees and Barnett (1999) and Lewis and Murdock (1996) go further by proposing that governments could offer some very low-level index contracts to reinsurers to assure that adequate capital is forthcoming. Since the insurer will likely load for events that have not yet happened, this may be a highly useful way to make these contracts more affordable while maintaining market principles. One way to facilitate this is for government to offer options on rainfall that is at the lowest level experienced in recent decades. Primary insurers and reinsurers would determine how many and what mix of such contracts to purchase from the government. These contracts could be simply rated at the historical breakeven rate, or they could be auctioned to the highest bidder. International development banks, such as the World Bank or others in the capital markets, could back up these contracts with a contingency loan so that the government would have sufficient capital to pay all losses if the bad year came before an adequate reserve had been built up. In effect, the capital markets would be offering a stop loss-type contract to the government.

High Frequency Events and the Vulnerable Poor

Another difficulty with area-based index insurance is that some catastrophic weather events occur with such sufficient frequency that insurance may not be affordable (e.g., if one attempted to write a zero/one index-insurance contract against droughts that occur one year in five, it would require a 20 percent premium just to cover the expected indemnity payments). This is often a problem for many of the poorest regions where insurance is most needed. It is also a problem for many of the poorest and most vulnerable people who simply cannot afford to pay the full cost of insurance even when it is available. These are the kinds of situations where governments (often with donor support) find it most necessary to provide free but targeted relief and safety net programs.

However, even in these situations, area-based index insurance may provide a more cost effective and less distorting way of assisting the vulnerable, but it would have to be sold on a subsidized basis (Goes and Skees, 2003). Unlike public relief, insurance provides an automatic right to compensation when an insured event occurs, and payments need not be delayed while policy makers try to determine if an emergency has arisen, or until relief agencies have launched their field operations. Moreover, if the insurance is routinely sold to the most vulnerable, then, unlike relief programs, there is no need to target payments in times of crisis when things are most difficult.

Subsidizing regional index insurance for poor, high risk regions and households may also distort incentives less than publicly provided relief that is not charged at all. As mentioned earlier, perverse incentive problems can arise once people take relief like food aid or disaster payments for granted. There is reduced incentive for farmers to pursue prudent risk management options and increased incentive to adopt farming practices that while more profitable on average, are also more vulnerable to drought. Such induced behavioral changes can lead to greater losses in drought years and increased dependence on emergency relief for managing losses in the future. If insurance is heavily subsidized then these same incentive problems arise. But incentive problems can be reduced by insisting that the insured pay a reasonable share of the insurance premium out of pocket (a co-insurance requirement) and by targeting subsidies wherever possible to the poorest and most vulnerable groups.

Examples and Experience with Index Insurance Contracts

Area-Yield and Revenue Insurance in the United States

The U.S. government has supported crop insurance in some fashion since 1938. Farms in the United States are very different than those in India, both in terms of size and the technologies used for production. Less then two percent of the U.S. population now live on farms. Average farm size in the United States is over 100 times greater than those farms in India. The United States is also a rich country that has a history of subsidizing farmers. The U.S. farmer pays less than 25 percent of the cost of crop insurance programs (Skees, 2001).

In the United States, multiple-peril crop insurance (MPCI) is designed to protect against losses from a wide array of natural occurrences, including drought, excess moisture, hail, plant disease, insects, and wind. The intent is to insure only acts of nature and not bad management. Policyholders must follow “generally accepted farming practices.” While this provision is in place to reduce the impact of moral hazard, it is difficult to enforce.

Indemnifiable losses include quality adjusted yield shortfalls, prevented planting, and in some cases, replanting costs. Contracts for annual crops must be purchased no later than approximately six weeks prior to planting. Contracts for perennial crops must be purchased in the fall of the year before the crop is harvested. These dates are set to reduce the possibility that farmers will purchase insurance only when the likelihood and/or magnitude of a potential loss is greater than normal — a phenomenon known as intertemporal adverse selection.

Beyond the base MPCI product that insures against individual farm yield losses, the United States now offers a wide array of products. Revenue insurance products for the individual farm yields have been the fastest growing in the set of new products. Interestingly, the United States also has an area-based product that pays based on losses at the county-yield level (Skees, Black, and Barnett, 1997). The Group Risk Plan (GRP) is remarkably similar to the Indian crop insurance product, with important differences in the manner in which the expected county yield is determined and premium rates are established. County premium rates are designed to be actuarially sound and the procedures have been approved by both the U.S. government and the international reinsurance community.

The United States also offers a number of revenue insurance products, including a product that is based on county yields and the national average movement in prices. The Gross Revenue Insurance Product (GRIP) is offered only for commodities where a futures exchange market can be used as the base for establishing the expected price. This is important as revenue insurance requires a reliable source for determining the expected price for the current season. Expected county revenue shortfalls with triggers as high as 90 percent of the expected level and liability up to 150 percent of the expected county revenue are available under GRIP.

The combined business of GRP and GRIP represent only about 5 percent of the total acres insured for corn and soybeans in the United States. This is not surprising given that the United States. has heavily subsidized individualized insurance programs that compete with area-yield index insurance products. Nonetheless, for corn and soybeans, these programs still comprised over US$100 million of gross premium on 5.8 million acres in 2004. The loss experience for the combined GRP and GRIP for corn and soybeans from 1995-2003 is 0.86[13]. Thus, the U.S. area-yield insurance programs have been actuarially sound.

The Indian Crop Insurance Program

Indian agriculture accounts for 24 percent of the gross domestic product and provides work for almost 60 percent of the population. The performance of current crop insurance programs can be considered disappointing (Kalavakonda and Mahul, 2003; Mishra, 1996; Parchure, 2002). Over the period from 1985 to 2002 the Indian crop insurance program experienced an average loss ratio of over 5. This implies that the government contributed over 80 percent of the total costs of the program while farmers contributed only 20 percent. This problem emerged not because of a direct intent to subsidize farmers, but because premium rates charged to farmers were not based upon actuarial principles. There is very little price discrimination among rates to reflect the large differences in relative risk that occur among the different Indian states. These differences and the poor rate-making procedures also mean that the preponderance of payments from the Indian crop insurance program have been made to only one state — Gujarat.

The basic concept of using area yields to indemnify farmers in India is sound given the small size of farms. However, the fundamental flaw associated with premium rates must be addressed if the Indian program is to become sustainable. Largely due to rate-making problems, the average annual cost of the crop insurance program to the Indian government is already in excess of US$0.5 billion and seems destined to grow quite rapidly. This cost is present even though the current participation rate is only about 10 percent for India.

Another significant problem with the Indian crop insurance program is timely payment. In many cases, farmers must wait as long as one year after a loss to receive a payment. These long delays are created by the bureaucratic process associated with making the final estimates for area yields. Since the Indian crop insurance program is delivered via Indian banks, long delays in payments add to interest payments for farmers with loans. For the poorest farm households such delays increase the likelihood that they will need to borrow in the expensive informal credit markets when there is a crop failure. A fundamental issue that should also be addressed is to what extent

[13] The U.S. crop insurance program performance is calculated using the "Summary of Business" database available from the United States Department of Agriculture (USDA) online.

more subsidies on crop insurance will prevent farmers from making needed adjustments in what they grow or how they use their other resources. At some point, crop insurance subsidies will slow adjustments and cause farmers to continue to produce high risk crops that are almost certain to have problems given bad weather. Finally, since crop insurance subsidies are positively associated with the size of the farm, careful consideration is needed to prevent these programs from benefiting only the larger farms. Many of the rural poor in India have little or no plantings of crops and, thus, will not benefit from subsidizing the existing crop insurance program in India.

The Indian government response to crop insurance challenges might consider using limited government funds to achieve the most impact. Given this constraint, it is likely that the government of India would also do well to consider how this can be done by facilitating emerging markets. There are several things that can be done to facilitate improved crop insurance in India. First, actuarial procedures can be applied to improve rate making for the existing area-yield insurance program. Second, the Indian government can continue to encourage the development of weather index insurance products that is ongoing in India. One way to facilitate this development would be to allow private insurance companies the right to have farmers assign indemnity payments from the government area-yield program to the insurance provider in exchange for an improved private product. Rainfall insurance products should be able to make significantly more timely payments than the Indian area-yield insurance product. Combining products in this fashion would basically turn area-yield insurance into a form of reinsurance for private providers. Third, the Indian government could follow the lead of the Mexican insurance program in the short run to provide some basic reinsurance for large losses from their insurance program.

Rainfall Index Insurance in India

Monsoons in India can bring damaging cyclones and flooding to the coastal plains. Drought has also been a significant problem in India. Parchure (2002) estimates that about 90 percent of the variation of crop production in India is due either to inadequate rainfall or to excess rainfall. To address this problem, Parchure recommends what he calls, Varsha Bonds and Options. These instruments would pay for extreme rainfall events.

By 2003, significant developments were emerging in India to offer rainfall insurance contracts. ICICI Lombard General Insurance Company began a pilot insurance program that will pay farmers when there are rain shortfalls in one area, and pay others in case of excess rain. In the first year, ICICI Lombard offered drought policies via a small microfinance bank in southern India (BASIX) and the excess rain covers through the ICICI Bank. As discussed above, these contracts also should solve the delayed payment problem associated with the existing crop insurance program in India.

BASIX used ICICI Lombard and technical assistance from the Commodity Risk Management Group of the World Bank to develop and launch the new rainfall insurance products. BASIX is a microfinance institution offering a wide array of financial services to rural customers. BASIX began operations in March 2001, in the districts of Mahbubnagar in Andhra Pradesh and Raichur and Gulbarga in Karnataka. In 2003, the new rainfall insurance was targeted at individual farmers for three categories of groundnut and castor farmers: small, medium, and large. A weighted and capped rainfall index insurance policy was developed in the first year (Hess, 2003). Since 2003, rainfall insurance is being offered in several states across India with continued expansion from ICICI Lombard, IFCCO-Tokyo of India, and the state insurance program, Agricultural Insurance

Company of India. Unconfirmed reports suggest that around 18,000 policies have been sold in 2004[14].

In 2004 BASIX insured its crop lending portfolio with a "Weather based loan portfolio insurance". ICICI Lombard would compensate BSFL for deviations in rainfall below the threshold level, which is fixed at a percent of the average rainfall in the area.[15] ICICI Lombard in turn reinsured this risk with one of the top international reinsurers. The insurance is designed to cover drought induced default costs in drought prone areas and therefore allows BASIX to continue lending in these riskier areas.

Mongolian Pilot Program to Index Livestock Mortality Rates[16]

The government of Mongolia is on the verge of launching a pilot program to test index-based livestock insurance in three states in Mongolia. From 2000 to 2002, over 11 million adult animals died in Mongolia due to harsh winter disasters (*dzud).* The total population of animals was reduced from over 33 million to less than 26 million – over 48 percent of the cattle and yak died. Skees and Enkh-Amgalan (2002) recommended an index insurance product that would indemnify herders based on the death rate of adult animals in a *sum* (the name for local areas in Mongolia). These contracts would be offered by species for cattle and yak, sheep, goats, and horses. In the past year, considerable effort has been undertaken to design a sustainable insurance program that has both commercial and social dimensions. Mongolia may be the only country in the world that has suffered from widespread deaths of livestock. This likely makes the application of indexbased livestock insurance unique to Mongolia. While there may only be a few countries in the world where a similar project on livestock mortality could be tried, there are a number of new aspects of what is being designed that should have wider application to natural hazard risk in developing countries.

Extreme death rates of adult animals in a *sum* are not uncommon. In 2001 a number of areas lost in excess of half of the animals. Still, these are rare events and represent an extreme risk for a commercial insurance provider. Thus, a social program called a Disaster Response Plan (DRP) was designed to allow the government to pay for losses beyond a certain extreme threshold (25 or 30 percent of the animal deaths). Herders will automatically qualify for the DRP if they purchase the Base Insurance Product (BIP). The BIP pays for losses between 7 percent mortality up to the DRP threshold. Herders choosing not to purchase the BIP can obtain the DRP by paying a small administrative fee.

The combination of BIP and DRP offers more protection for herders who chose to purchase BIP at a lower price as the commercial insurer does not have to pay for losses in the DRP range. Furthermore, extreme losses are less likely to be in the calculus of herder decisions meaning that they are not likely to create perverse behavior like a heavy subsidy would for BIP. BIP is priced in a commercial fashion by loading for extreme losses that occur when many herders lose animals at the same time. Still BIP exposure is significant. Unique financial arrangements facilitate

[14] Personal communication between Jerry Skees and Ulrich Hess, November 2004. According to industry sources cited by Ulrich Hess and Joanna Syroka, ICICI Lombard sold 3000 policies to orange farmers in Rajasthan, 600 policies to groundnut/castor farmers in AP. IFCCO Tokyo AIC are reputed to have sold respectively 3,000 and 13,000 policies.

[15] Economic Times India, July 20, 2004: ICICI Lombard to design weather insurance

[16] Skees and GlobalAgRisk, Inc. had a *First Initiative* contract and a PHRD grant to assist in designing and making recommendations to the Mongolian government regarding livestock mortality insurance and social programs. Olivier Mahul of the World Bank has been assisting in this work and his contributions are gratefully acknowledged.

sharing these risks with the government of Mongolia only after the insurance providers have pooled all sales into a common pooling arrangement. The government of Mongolia plans to offer a stop loss for the pooled risk at a fair premium for the insurance companies. Reinsurance premiums will allow the government to build a reserve to pay for these losses at some level. However, extreme losses beyond the reserve are quite possible, especially in the early years. Thus, the World Bank is willing to offer contingent loans to pay for these losses should they occur. The unique financing and structure of the contracts could be transferred to rainfall insurance contracts for developing countries.

Conclusions

Unlike traditional agricultural insurance, properly designed area-yield or weather-index insurance contracts require less monitoring to control adverse selection and moral hazard. In addition, administrative costs should be low. A variety of rural people could purchase area-index insurance contracts in addition to small-scale farmers. They could also be sold in small units that might appeal to poor people. Finally, creative forces within financial markets should be able to use index insurance contracts to handle covariate risk. Wrap-around products that cover some additional risk are possible. Microfinance entities could use the contracts to handle major risk, hedging their portfolio of loans and offering better terms of credit. Many possibilities exist for using this type of insurance to further develop markets for sharing risk.

Despite the promise of index insurance contracts, some key issues must be addressed. All parties must be confident that the measurement of what triggers payment is secure and accurate. There must also be confidence and transparency in the procedures used to develop premium rates. Great care must be used in designing contracts that match what is at risk for most people, and more active involvement of the contract end-user is needed to assure that this is the case. Marketing plans must be developed that address how, when, and where index contracts are to be sold. Also, the government and other involved institutions must consider whether to facilitate and regulate secondary markets of exchange for the contracts. Finally, reinsurance or effective and efficient use of other financial markets will be critical for sharing the covariate risk represented in index contracts. These risks must be spread around the world to obtain the best pricing.

Once properly constructed index contracts are in place, it should be possible to obtain efficient pricing in the international markets. Governments can build the infrastructure for measuring the index and monitoring the information to add credibility. Governments may also become involved in selling very low options on the index to improve the pricing. These options could be secured by contingency loans with an international bank (e.g., the Inter-American Development Bank or the World Bank). While some government support is needed for infrastructure development and to facilitate better pricing of low-frequency/high-consequence events, it will remain important not to launch insurance on a heavily subsidized basis. Doing so would distort incentives for private insurers, farmers, and other decision makers. The government role should be targeted at exploiting the many possible market evolutions and uses of an effective index insurance contract. It is critical that governments not engage in attempting to protect individual farmers from independent risk, rather this effort should be left to the market via index insurance that removes the big risk and other effective financial markets that can help farmers and others cope with the independent risk.

Given the apparent attractiveness of area-based index insurance, one might expect the private sector would already have initiated its development in many countries. But this has not happened on any widespread scale. One reason for this is that there are several setup problems that might require public intervention to jumpstart activity, particularly in developing countries. Setting up basic infrastructure to get started may be an important role for government. The Mongolian Index-Based Livestock Insurance pilot program offers an excellent example of how government can help in starting index-based insurance products. Start-up activities for weather index insurance products may include a) funding the research costs of identifying key catastrophic weather events that correlate strongly with agricultural production and income in different types of agricultural regions; b) educating rural people about the value of weather insurance; c) ensuring secure rainfall stations; d) establishing an appropriate legal and regulatory framework for weather insurance; and e) underwriting the insurance in some way (perhaps through contingency loans) until a sufficient volume of business has been established, so that international reinsurers are willing to assume the underwriting role.

A market-based, risk-sharing insurance alternative for natural disasters has many potential advantages. By making insurance available, government may not have to provide free disaster aid except for the poorest and most vulnerable groups. Farmers may be more flexible in taking advantage of the benefits of specialization, and other efficiency gains should be expected, as well. As market-based insurance can serve the risk management needs of the rural poor, it can also help redress important food security problems. Finally, to the extent that indemnity payments can keep a household from slipping back into the ranks of the poor just when they are making progress, these instruments can also be used to motivate economic growth.

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