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# RAFI notes

## Mitigating Weather Risk

### Issue 6

*A relatively new insurance product, index-based insurance, is a promising solution to mitigate highly-correlated weather risk. Index-based insurance mitigates weather risk to agricultural-based households and can also mitigate risk to private sector financial institutions; removing a primary constraint to finance in rural areas and to agricultural enterprises.*

#### INTRODUCTION

The livelihoods of many rural poor in low income countries remain predominantly dependent on agricultural activity, and agriculture activity is vulnerable to a wide range of risks, including those related to weather. Without mechanisms to protect themselves against risk, these rural households and enterprises are often unable or unwilling to take advantage of market opportunities. Instead, they follow low-risk/low-return livelihood strategies and may even retreat from profitable projects for which they have adequate liquidity, resulting in lower than necessary incomes and growth. Insurance, flexible savings, and other financial services that help households smooth consumption and protect themselves against shocks can help minimize potentially devastating asset losses and facilitate shifts toward adoption of livelihood strategies with potentially higher returns. In addition, instruments that mitigate risk to these households also remove a primary constraint to the supply of finance as private sector financial institutions are better able to reduce a major cause of default on loans in rural areas and to agricultural enterprises. Improved access to finance further reduces rural households' and agricultural enterprises' vulnerability by enabling them to improve technologies, expand assets, and take advantage of economic opportunities.

This note explores the relationship between agricultural sector development, weather risk and finance, and examines an insurance innovation that is designed to mitigate some of the risk.

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that rural households and agricultural enterprises experience as a result of extreme weather events. It also examines the potential impact of such an insurance product on financial institutions with significant agricultural loan portfolios.

## **WEATHER RISK**

Agricultural enterprises and rural communities depend on and are highly vulnerable to weather. Crop yields, economic activity, and livelihoods are shaped by particular weather patterns and other exogenous events. While weather is the key productive variable to an agrarian society, it can also be one of the most destructive. The impact of extreme weather events such as droughts and floods are particularly devastating to agricultural entities – farmers, producers, processors – and rural populations, where agriculture is the main source of revenue and livelihoods. Therefore, it is necessary for rural and agri-businesses to take advance action in order to have a more secure future, as well as to increase their attractiveness to potential partners and financial providers in the present.

General risk mitigation in rural communities in developing countries is most commonly done through autarkic informal savings activities, such as stockpiling goods and materials, or in-

vesting in livestock. However, such saving mechanisms may be as vulnerable to weather risk as principal farming activities. In other cases, households help each other in times of need, in what can be elaborate social insurance networks. But extreme weather events devastate an entire community at one time, unlike independent catastrophes (e.g. house fires or car wrecks) that affect an isolated number of people. A weather-related event is a correlated risk in that the damage caused is generally widespread across a particular geographic area.

### **Insuring Against Weather Risk**

In many developed countries, crop insurance protects producers from the impact of a wide range of possible risks, including variations in weather patterns that affect production and yields. This type of multi-peril insurance more closely resembles the traditional insurance products that are designed to protect against independent risks, such as car crashes or house fires. This type of insurance is only financially viable when the risks are infrequent and isolated, and the insurance premiums cover the costs of insurance payouts. Losses from correlated risks may cause an insurance company, especially a smaller company with smaller geographic range, to experience losses that exceed its financial reserves. In addition, the incentives for moral hazard under

traditional insurance policies can undermine the insurance provider's financial solvency. In developed countries where such insurance products are offered, the government provides significant subsidies for such insurance coverage as a support to the agricultural sector. The high costs and implied subsidies for such coverage make this type of product impractical for developing countries.

For an insurance product to be appropriate for a developing country context, the product would have to be lower cost and protect against potential losses from the type of extreme weather events that are a particular problem in a given area. The relatively new innovation in insurance products, index-based insurance, is a promising option to mitigate highly-correlated weather risk. Unlike traditional insurance, index-based insurance is designed to address correlated risk, has lower administrative costs, and reduces the exposure to moral hazard. While this type of insurance product is limited in its application, and not appropriate for all environments, it is increasingly being tested and expanded to new contexts.

### **Index-Based Insurance**

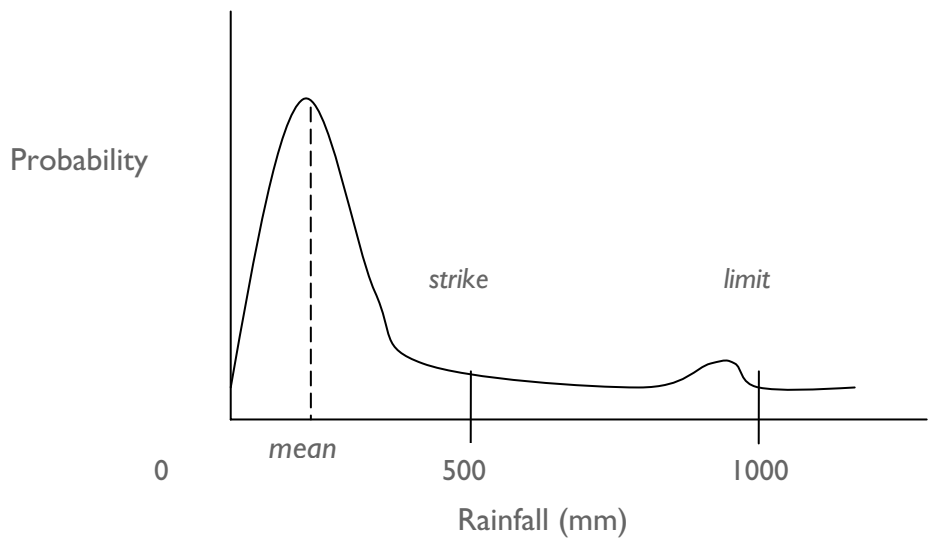
Index-based insurance is derived from objectively measurable events (e.g. extremes in rainfall, wind speed, temperature) that strongly correlate to a variable of interest (e.g., crop yields, loan default rates). While many different types of data can be used to develop this type of insurance product, index contracts based on weather variables are more common and are generally easier to implement as weather

data are easier to measure, more objective, and more readily available than, for example, yield estimates. Most developing countries have historic weather data that can be used to support the risk analysis necessary for developing the particular insurance contracts.

Development of an index-based insurance product relies on a reliable and trusted system for obtaining the data that will be indexed, and on having sufficient data to establish the expected value of the index relative to the expected losses—in crop yields and revenues or loan default. There is no need for any farm-level information. An index-based insurance contract uses data on the selected objective event as the basis for decision on whether and when payments will be made. Whether or not actual losses (e.g., on any particular farm) are incurred is incidental to the payments.

An index contract has a defined range within which indemnity payments will be made, with payment levels increasing at scheduled intervals across the range. The trigger, or strike, sets the lower end of the range, at which payments begin. The limit sets the point at which the maximum indemnity payment level is reached.

**FIGURE 1: EXAMPLE OF INDEX INSURANCE USED TO MANAGE THE RISK OF EXTREME RAINFALL.**



For example, an index contract that insures against excess rainfall would begin making indemnity payments once rainfall exceeds the strike level within a defined time period (e.g. a month, a season, etc.). Indemnity payments would be scaled to increase as the rainfall exceeds the strike level. The maximum indemnity payment would be made if rainfall is equal to, or above, the limit (see Figure 1).

Index contracts offer numerous advantages over traditional forms of farm-level multiple-peril crop insurance, including:

1. Lower/no moral hazard. Does not encourage insured parties to alter their behavior so as to increase the potential likelihood or magnitude of a loss.
2. Lower adverse selection. Limits ability to exploit information asymmetries as an index is based on widely available information.
3. Lower administrative costs. Removes the need for on-farm inspections or claims adjustments and the need to track individual farm yields or financial losses.
4. Standard and transparent structure. Provides easily understood contract terms for purchasers.
5. Availability and negotiability. The contracts could be made available to a wide variety of parties, including farmers and farm laborers, commercial agricultural lenders and rural MFIs, traders, processors, input suppliers, shopkeepers, and consumers. Moreover, policies are easily tradable in secondary markets.

6. Reinsurance function. Because the policies are tradable in secondary markets, transfer of the correlated risks in local insurance portfolios is possible.

### **Potential Application of Index-Based Insurance for Rural and Agricultural Finance**

Correlated risk and sectoral uncertainty limit the entry of financial institutions into rural markets. Correlated risk can wreak havoc on an agricultural loan portfolio. Financial institutions, particularly small MFIs, do not operate broadly enough to pool and manage the correlated risk of agricultural production. As a result, if they are willing to lend to agricultural enterprises at all, lenders require large amounts of collateral to secure loans and charge higher interest rates. The result is the under-provision of loans to the rural and agricultural sector and to lower-wealth rural borrowers who may lack assets or be unwilling to risk them as collateral.

Index-based insurance products, like traditional insurance products, can be used to cover the risk of loss to the farmer, but can also be used to provide the lender protection on its portfolio. If these indexed-based insurance products were available, financial institutions could purchase policies to protect

themselves against the risk of losses within their portfolio as a result of extreme weather events. By protecting themselves against catastrophic losses due to weather, they are better able to consider lending to agricultural enterprises and/or lending on improved terms. Alternatively, financial institutions could require agricultural enterprises to purchase index based insurance contracts as a prerequisite to a lending relationship. In either case, the addition of index-based insurance reduces the risk profile of the agribusiness clientele and, in turn, might increase the willingness of financial institutions consider loans to such clients. Creating instruments that protect financial institutions from some of the risk can stimulate lending to rural financial markets, especially for agriculture. Such policies will have a multiplier effect as they encourage entry of new and more affordably priced loans and help liberate rural households from risk constraints that suppress their own entrepreneurial activity.

### **Opportunities and Challenges of Offering Index-Based Insurance**

While there is significant potential for index-based insurance to mitigate risk and expand access to rural and agricultural finance, there are also several drawbacks. Index-based insurance, unlike multi-peril insurance, only protects against the single peril that the contract was designed to ad-

dress. For instance, an insurance product designed to cover losses correlated with excess rainfall would not protect against drought and other calamities that might affect crop yield or productive capacity. Furthermore, there can also be large and costly constraints to its implementation. There are a range of issues that limit the availability of sustainable weather-related insurance products in developing countries. These include policy and institutional issues, availability of weather data that correlate strongly with agricultural production and income; and people's understanding of the value and use of weather insurance. There may be a need to address hesitation on the part of individual insurers to offer a weather-based insurance product, at least initially, due to the high exposure to risk if they were to try to develop the product by themselves.

Index-based insurance products are not available in most developing economies at this time. However, some promising research and pilots are being conducted to test the potential for its use. Indexed-based insurance has been used in Mexico to reinsure the government's crop insurance portfolio, using the global reinsurance market. In Uganda, Centenary Rural Development Bank offers weather insurance to bank customers in six provinces to hedge against correlated risk from natural disasters. In Malawi, a product has been piloted to protect local groundnut farmers from drought. In Mongolia, a World Bank pilot project is underway to insure against losses of livestock as indexed against livestock mortality rates as shown by an annual livestock census. In Peru, a pilot activ-

ity is being launched to offer an index-based risk transfer product that would be based on sea surface temperature (El Niño), which is highly correlated with extreme flooding in the Northern Coastal regions of Peru. This product would be sold to MFIs who could, in turn, offer better financial services to farmers even in the face of losses from extreme flooding. It is important to note that index based insurance is not a panacea to all weather related risks. For instance, it is not appropriate in areas where risks are not periodic. Places in Northern Africa, for example, that are plagued by the continual, and worsening, lack of rainfall, index based insurance to mitigate the impacts of drought would not be financially feasible.

The introduction of index-based insurance in developing countries will be a challenge. Despite the promise of index-based insurance options for developing countries, the costs of designing and testing index-based insurance programs and the required infrastructure for data collection are also great. Timeframes and costs of implementing an index-based insurance option will vary by country based on the existing infrastructure and the sophistication of the financial

market. Donors considering programs to support index-based insurance should review the experiences of the pilot activities listed above to determine if the program costs are feasible and their context is appropriate. Donors should explore opportunities to collaborate and share the costs of a pilot program with each other, and with private sector partners. The general factors that donors and governments should consider to stimulate the development and practical application of index-based insurance in developing countries are:

1. Identifying/creating relevant data set. The viability of index insurance depends critically on the underlying

index being objectively and accurately measured. The index measurements must then be made widely and should be available in a timely manner. In many cases, the availability or existence of reliable data is the largest challenge to developing an index-based insurance product. Without a reliable and comprehensive dataset, index-based insurance is not feasible.

2. Ensuring secure data collection. Where data collection needs to be improved, support can be provided to enable effective and objective collection through, for example, improvements to weather collection stations. The credibility of index or data sets used to derive the insurance product is critical. Therefore, stations that collect the weather

### Recommended

“Managing Agricultural Production Risk: Innovations in Developing Countries.” Agricultural and Rural Development Department World Bank 2005.

[http://siteresources.worldbank.org/INTARD/Resources/Managing\\_Ag\\_Risk\\_FINAL.pdf](http://siteresources.worldbank.org/INTARD/Resources/Managing_Ag_Risk_FINAL.pdf)

Kimball, Richard. “Note from Malawi: Weather Insurance Mitigates Risk.”

[http://www.microlinks.org/ev\\_en.php?ID=10539\\_201&ID2=DO\\_TOPIC](http://www.microlinks.org/ev_en.php?ID=10539_201&ID2=DO_TOPIC)

Skees, J.R.. “Risk Management Challenges in Rural Financial Markets: Blending Risk Management Innovations with Rural Finance.” Thematic Paper presented at USAID’s Paving the Way Forward for Rural Finance June 2-4, 2003 Washington, DC.

International Task Force on Commodity Risk Case Studies, <http://www.itf-commrisk.org/>

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information must be secure from tampering.

3. Educating rural people and institutions about the value and use of weather insurance. Index insurance policies are typically much simpler than traditional farm-level insurance policies. However, since the policies are significantly different than traditional insurance policies, education is required to help potential users assess whether or not index insurance instruments can provide them with effective risk management.
4. Legal and regulatory framework. Establishing an appropriate legal and regulatory framework for weather insurance is necessary to discourage abuses and encourage market usage.
5. Underwriting. Until a sufficient volume of business has been established, the insurance may need to be underwritten, perhaps through contingent loans from donors, until international re-insurers or banks are willing to assume the underwriting role. The World Bank took on this role in Mongolia, for a project to protect against extreme livestock losses.