Index Insurance for Climate Risk Management & Poverty Reduction

Topics for Discussion

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Meteorologist checking instruments at the Sundakkam Palayam meteorological station, Avinashi, Coimbatore district, Tamil Nadu, India. Photo by Holger Meinke, September 2000.

For more info visit: http://iri.columbia.edu/features/2008/index_insurance_and_poverty_reduction.html

By Haresh Bhojwani, Molly Hellmuth, Daniel Osgood, Anne Moorehead, James Hansen

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http://iri.columbia.edu/publications/search.php?id=556
Please refer to the parent document for background and additional information.

CLIMATE and POVERTY

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Climate contributes to poverty both directly, through actual losses from climate shocks, and indirectly, through responses to the threat of crisis. The direct impacts occur when, for example, a drought destroys a smallholder farmer's crops. Not only will he and his family go hungry, but if they own plough animals they will be forced to sell or consume them in order to survive. When the rains return they will be significantly worse off than before because they can no longer farm effectively. These impacts can last for years in the form of diminished productive capacity and weakened livelihoods.

The indirect impacts are no less serious. Under the threat of a possible climate shock, people are under pressure to be excessively risk-averse. They shun innovations that could increase productivity, since these innovations may also increase their vulnerability or exhaust the assets they would need to survive a crisis. Creditors will not be prepared to lend if drought might result in widespread defaults, even if loans can be paid back easily in most years. This critically restricts access to agricultural inputs and technologies, such as improved seeds and fertilizers. Even though a drought (or a flood, or a hurricane) may happen only one year in five, the threat of the disaster is enough to block economic vitality, growth and wealth generation during all years – good or bad.

Together, these events and responses are major contributors to the perpetuation of poverty, confining people in so-called poverty traps. And, with climate change and continued population growth, the situation could dramatically worsen. The evidence indicates that extreme climate events are likely to increase in both frequency and magnitude over the coming decades. Meanwhile the human population is expected to rise by 50% by mid century, increasing the pressures and demands on agricultural systems. Innovations in managing and transferring climate risk are needed in order to increase the resilience in agricultural systems.

Weather index insurance explained

Weather index insurance is insurance that is linked to a weather index such as rainfall, rather than a possible consequence of weather, such as crop failure. This subtle distinction resolves a number of fundamental problems that make traditional insurance unworkable in rural parts of developing countries.

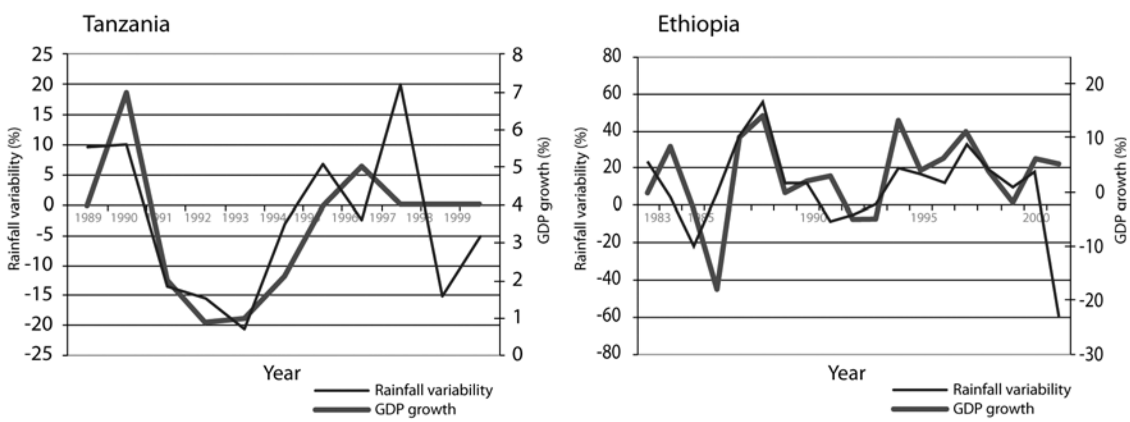
One key advantage is that the transaction costs are low. This makes it workable under real market conditions – both financially viable for private sector insurers and affordable to small farmers. Unlike traditional crop insurance against crop failure, the insurance company does not need to visit farmers' fields, to determine premiums or to assess damages. Instead the insurance is designed around rainfall data (for example). If the rainfall amount is below the earlier agreed threshold, the insurance pays out. Since there is no need for the insurance company to corroborate actual losses, payouts can be made quickly and distress sales of assets avoided. This process also removes the 'perverse incentives' of crop insurance, where farmers may actually prefer their crops to fail so that they receive a payout. With index insurance, the payout is not linked to the crop survival or failure, so the farmer has the incentive to make the best decisions for crop survival.

Weather index insurance is one of a number of index-based financial risk transfer products that have the potential to help protect people and livelihoods against climate shocks and climate risk. Others include weather options, weather-linked bonds, weather derivatives, and bundled products such as insured credit. Indexes are not limited to rainfall but can also be constructed around other variables (streamflow, temperature, onset of rains, etc.). For simplicity, this paper presents the fundamental issues of index-based risk transfer products through the example of rainfall-based agricultural index insurance.

Index-based financial risk-transfer mechanisms (referred to as index insurance in the rest of the paper) are being tested for poverty reduction and climate-change adaptation. Case studies are showing that these mechanisms may be able to dramatically reduce both the direct and indirect impacts of climate shocks in some sectors, reducing vulnerability and enabling investment and growth. They are not suited to cover the entire range of risks faced by these sectors, and they do not supplant the need for good policy and practice. But index insurance could, if negotiated and managed properly to target key risks, provide a missing piece of the puzzle in the global effort to eradicate extreme poverty.

As with any tool, these mechanisms must be developed carefully if they are to fulfill their potential without unintended negative effects. Of the existing index insurance projects, few have reached the stage of actual financial transactions and most are small scale pilot projects or one-year test period projects at the national scale. While there is evidence that these projects can work at this limited scale, there are many challenges which need to be overcome if index insurance is to contribute to the eradication of poverty at large scales.

Relationship of rainfall variability and GDP growth in Tanzania and Ethiopia:
The impact that climate variability has on predominantly rain-fed agrarian economies is clearly demonstrated by Tanzania and Ethiopia, where gross domestic product (GDP) closely tracks variations in rainfall (see figure below).



About half of Tanzania's GDP comes from agricultural production (including livestock), the majority of which is rain-fed and highly vulnerable to droughts and floods. In Ethiopia, around 75% of the population are dependent on agriculture, which is almost entirely small-scale and rain-fed; a further 10% earn their living from livestock. Both farmers and pastoralists are highly dependent on the climate for their livelihoods; this is reflected in the remarkable way that GDP fluctuations follow those in rainfall.
Source: World Bank

1 WHAT KINDS of index insurance are necessary to span the range of poverty problems and assist development?

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There are three distinct but complementary ways that index insurance can contribute to poverty reduction. These can be visualized as a 'crisis safety net', a 'cargo net' and a 'productive safety net'. Each of these roles targets a different type of vulnerability to climate.

» The **'crisis safety net'** is used to avert humanitarian disaster by protecting very poor populations in the face of a severe climate shock.

» The **'cargo net'** seeks to help populations escape from a poverty trap by, for example, improving access to credit, increasing land or labor productivity, or enhancing technology adoption or market participation.

» The **'productive safety net'** is designed to protect the productive assets of those who are not poor, yet are vulnerable, to prevent them from falling into a poverty trap in the face of a climate shock.

While a safety net aims to catch someone who is falling into poverty or destitution, a cargo net is intended to lift someone who has already fallen into poverty. Index insurance bundled with credit or production inputs serves this role.

Index insurance would be implemented differently, insurance contracts would be purchased by different actors, and payoffs would be used for different purposes for each of these three roles. For example, in some cases it may be that the highest benefits to a farmer occur when the insurance is used to transfer risk from a player other than the farmer (such as a lender) so that a critical constraint to development can be overcome. The table below describes likely actors and impacts of index insurance in climatically good years and in bad years.

	Crisis Safety Net	Cargo Net	Productive Safety Net
Purchased By	Government, relief agency, NGO or other institution with society-wide responsibilities	Farmer, farmers' association, credit institution, NGO or development organization	Farmer, farmers' associations, NGO, government, development organization
Impact of Insuance Scheme in Bad Year *(when a climate shock occurs)*	Payout available when climate shock occurs, allowing rapid response, minimizing long-term effects	Payout enables creditors to be paid back. Households are protected from the direct impacts and retain more of their assets	Payout allows for a quick recovery from shock. Productive assets are not compromised, protecting insured from backward slide into poverty
Impact of Insurance Scheme in Good Year *(when no climate shock occurs)*	Safety net diminishes uncertainty and enables better decisions by all groups	Risk distribution allows access to credit and improved livelihood strategies – allowing escape from the poverty trap imposed by climate	Greater confidence and certainty enable greater investment and economic growth

Index Insurance in Practice

Index insurance is at pilot project stage in various developing countries. As of mid-2007, there were nearly two dozen such projects under way, although few projects have reached the stage of actual financial transactions. Target users range from micro-level clients such as nomadic herders or small-scale rice or groundnut farmers, to meso-level institutional clients such as water user groups or financial institutions, to national governments and UN agencies. Drought has been by far the most common target of weather index insurance, and has triggered the most payouts, but there are also products addressing flooding, excess rain and livestock mortality. The following examples illustrate the use of index insurance for the roles presented in the table.

Ethiopia is prone to drought, and with around 75% of the population dependent on rain-fed agriculture, it has many people both caught in poverty traps and livelihood-threatened in extreme drought. The World Food Program (WFP) has been involved in disaster relief efforts in Ethiopia since the early 1960s. In 2006 the WFP took out insurance on behalf of the Ethiopian government for part of its emergency assistance exposure. A 'livelihood loss' index was developed, reflecting crop (and income) losses at different stages of the growing seasons under reduced rainfall. In 2008 WFP and partners seek to scale up the pilot to a livelihood risk financing package to $US 300 million to cover up to 6.7 million people through a safety net scale up, around $US 50 million of the package could be covered by insurance. This is an example of a 'crisis safety net' funded through index insurance.

Malawi is another least developed country with many people locked into poverty traps and facing chronic food insecurity. In 2005, a project was set up to provide index insurance directly to farmers to protect them against drought – the first of its kind in Africa. The insurance is linked to rainfall, with data gathered from local weather stations. The project targets groundnut and maize farmers, who must be farming within 20 km of a weather station so that the rainfall data are relevant to their actual situation. The insurance has initially been provided by a consortium of the country's insurance companies, but in time it is intended that they will operate individually in competition with one another. Micro-finance companies are also involved, providing loans under the security of the insurance scheme.

Although still in its early stages, indications are that the insurance–loan package is enabling farmers to take risks that offer higher returns, for example buying improved seeds and fertilizer. This is an example of the 'cargo net' role of index insurance.

In 2007 the Millennium Promise Alliance transacted an index contract in order to prevent development gains in Millennium Villages from being destroyed by climate shocks – illustrating the 'productive safety net' role. The strategy was to prevent climate shocks from dropping villages back into the poverty traps that the project had been lifting them out of. The project is in the process of developing a related index mechanism to enable other project interventions to be able to further lift people out of poverty traps in a self-financed and sustainable manner.

One of the longest running index insurance projects was first transacted in India in 2003. In this project, index insurance was sold to 1500 smallholder farmers in Andhra Pradesh and Uttar Pradesh along with other micro-finance products thanks to World Bank Group Technical Assistance. The project has scaled up rapidly, with more than 10,000 clients by 2007. In 2004 three insurers including the state agricultural insurer replicated the product and reached 25,000 farmers. In 2005 more than 250,000 farmers were reached by five insurers. Swiss Re reinsures part of the portfolio to the tune of $US 50 million per year. In 2008 in Rajasthan alone 675,000 policies were sold to farmers. The scale-up is continuing with growing momentum, with the Government of India playing a greatly increased role and financial partners offering related products. With the dramatic growth, issues such as the role of public vs private observing networks, subsidized premiums, reduction in basis risk, the appropriate level of oversight appropriate and validation of contract quality are coming to the fore.

Mexico provides another example of the 'productive safety net'. It is estimated that 80% of Mexico's natural disasters are weather related, and they have a major impact on the viability of small-scale farming. In 2003 the Ministry of Agriculture and AGROASEMEX developed FARPRACC , a program designed and targeted to help protect the poorest farmers against climate-related risks. Index insurance is purchased as a financial hedging mechanism for government responsibility under the FARPRACC system. The beneficiary of the insurance is not the farmer, but the State Government, which then disburses to farmers conditional on rules, such as the declaration of disaster and a scientific assessment of losses.

2 CAN INDEX INSURANCE OVERCOME HURDLES in scale-up to cover the risks it must address?

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Basis risk is perhaps the largest hurdle to successfully scaling up index insurance. The index must target the correct risks and minimize basis risk, with all remaining risk clearly understood by the client. Contract design, and in particular selection of index, are crucially important here; while various external factors also play a part, such as data availability and quality, seasonal forecasts and climate change.

Successful implementation of index insurance depends upon the identification of an appropriate (context-specific) index, and the availability of adequate data to construct it. In doing so, prohibitively high transaction costs must be avoided. The index must be highly correlated to the loss (e.g. drought is clearly correlated with crop failure), and must be able to be measured reliably and consistently. In Africa in particular, the lack of sufficient weather stations in many rural areas, in combination with the policy of many governments to not provide climate information as a public good, limits the use of index insurance.

The client must be an active partner in the design process. Each different situation requires negotiation between the client and the provider to design a mutually useful contract (i.e. one that is responsive to the needs of the client while economically viable for the provider). Overly complex indices with reduced basis risk may be less valuable then simpler indices that can be more easily integrated into a farmer's risk management strategy. For example, a farmer may have risk management options for risks that occur at the beginning of the season that are more cost effective than purchasing insurance. Catastrophe can occur if the client does not know exactly what is not covered by the index, since the client may be unknowingly exposed to risks. There is danger of a disconnect between theory and reality if computer model driven-indices are not validated against clients' true risks.

Contracts will need to adapt each year with changing climate and changing client needs. In addition, contracts will have to be continually redesigned as robustness issues and opportunities for increased cost effectiveness become evident. This requires that a foundation be built to support local design, adaptation and scale-up. That is, capacity and tools will be needed at the local level, with support from the international research community.

Data over 30 years is generally considered adequate to construct a statistically significant index, however this may not be available for much of the developing world. Even with 30 years of data, one may not capture the very extreme events index insurance is designed to insure against. In addition, weather indices are designed based on the assumptions that the weather is unknown for the coming season, and that historical climate statistics provide a reasonable expectation of the future climate. However, seasonal forecasts and climate change, respectively, complicate these assumptions. Although there is substantial potential for benefits from seasonal forecasts, they may undermine the financial stability of the insurance. For example, if insurance is designed without accounting for forecasts, and clients use the forecast information to selectively buy insurance in years when drought conditions are predicted, then the insurance financing may collapse. Climate change, by changing the frequency and occurrence of risk over time, has an important implication for the long-term affordability and profitability of index-based financial products (and hence for the willingness of the industry to invest in new markets). Climate science can potentially help overcome some of these concerns. (see box on previous page)

What climate science can offer

Some of these challenges can be partially overcome through innovative climate science. A knowledge of underlying climate processes can be used strategically in product design or to know if relationships suggested by payout data are spurious or driven by known climate dynamics. Interpolation and remote sensing may help overcome a problems with stations with short data histories, more effectively utilize new stations for which there is no historical data, understand (and perhaps improve) the quality of coverage for clients who are more distantly located from the station. Because insurance is a tool that can directly address uncertainty, developing techniques to quantify the uncertainty in the climate and weather information allows that uncertainty to be built into robust products. Techniques that simulate rainfall distributions based on station data, are key in the design, evaluation, and pricing process but these techniques have limitations and must be further developed and evaluated for the context of index insurance to ensure that they are capable of addressing the issues that they are being challenged with.

Different strategies might be developed to address the issue of seasonal forecasts, depending on the ability of clients to respond to the information in seasonal forecasts. If clients have no potential for improved activities in response to forecasts, the strategies include closing contract sales before forecasts are available, multiple year contracts, or selling options on the right to purchase the insurance. If the forecasts have information that could allow small-scale farmers to make better decisions, then other strategies might be appropriate. The insurance package could be built to take advantage of the forecast information, encouraging a farmer to take advantage of more profitable options when climate risks are lower, while using forecasts of bad years to provide incentives for more protective activities to prevent losses. When credit is connected to the insurance through an insurance–loan package (as for example in Malawi), the bundle could be designed to provide financial resources for the production package that are appropriate for the forecast, while still providing insurance protection in case the anticipated weather does not occur.

Because the market tools have not yet been assembled to easily provide products that could change year to year with forecasts, building such packages requires non-trivial innovations. The challenge will be to incorporate seasonal forecasts into index insurance packages so that the insurance protects against the uncertainty within the forecast in a way that is implementable by lenders and insurance providers.

Climate science also has a role to play in better understanding the potential impact of climate change. We know that for long term planning, we can no longer rely solely on the past observations due to climate change. Over relatively long timescales (i.e. 30 years or more) and large spatial scales (i.e. hemispheric, global), today's climate change models broadly agree, both with each other and with physical theory, about what is likely to happen in aggregate, at least with regard to anthropogenic climate change.

At shorter timescales and on local and regional scales, there is considerable disagreement among the models, making it difficult to reach conclusions. At the intersection between year-to-year climate variability and climate change lies decadal variability (over one or more decades, usually involving predictions over the next 10–30 years). This timescale has immediate relevance to strategic planning, and is consequently the subject of much ongoing research. By integrating climate science into its design, insurance products can be built to provide a robust tool to help society adapt to climate risk due to decadal and long term processes.

As insurance programs are scaled up, the spatial scale of climate processes will come into play. For example, drought in southern Africa is associated with ample rainfall in the Greater Horn of Africa. Can this be built into index insurance strategies? Applied research is needed, and the answer will also depend on the scale of the institutions involved, but there may be ways to design programs to take advantage of regional and global climate features and interdependencies – increasing the resilience and bringing down the costs of insurance programs.

3 WHAT ARE THE ROLES of governments , NGOs and donors in scaling up index insurance for poverty reduction?

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The government's role is crucial – it establishes the regulatory environment for index insurance, and national meteorological services and agriculture extension services provide vital knowledge for insurance design and implementation.

Private markets such as insurance are very different from many other aid related projects, in which donors can directly cover project expenses. A government, donor, or NGO cannot simply mandate scale up of market products that the poor and vulnerable purchase themselves, particularly if scale up is desired to progress faster than the typical consumer product. Governments, NGOs, and donors will have to ensure that they have a vision that includes capacity, mandate, and timing that is appropriate for the challenges associated with insurance scale up.

Policy makers must weigh the benefits of pursuing avenues that allow faster scaling of the number of policies sold in a product less directly connected to other interventions verses an insurance program that is more heavily anchored in complimentary development interventions that might necessitate slower scaling.

There is a heated debate on the role of subsidies in insurance. Given the extreme level of poverty of many being targeted in index insurance programs, many argue that subsidies are important. Others hold that subsidies are counter-productive. Subsidized insurance premiums can have many negative consequences. Subsidies can significantly distort the market and lead to unintended negative outcomes. They can lead to farmers taking risks they should not take, which increase their vulnerability. Subsidized premiums can make it difficult for an effective and sustainable private insurance sector to develop, and can lead to an index that targets the wrong risks. Allowing fair pricing of insurance can reveal what activities are too risky. If a premium is too high for farmers to consider paying it, perhaps the risks being insured are not worthwhile. It may be that there is another constraint (such as credit or liquidity) that prevents the insurance from being workable. In this case, instead of subsidizing the

Get covered: Insurance and Basis Risk

The index must be highly correlated with economic losses – it must be closely adjusted to work for the specific climatology and agronomy in question. It must also be transparent and objectively measured. Index insurance does not pay out for any factor that causes the farmer to lose her crop that is not reflected in the index. This problem is called 'basis risk', which is a central issue in index insurance design.

Basis risk can occur for many reasons. It can occur when the rainfall information as measured at the station (or remotely sensed proxy) differs from the rainfall at the farmer's plot. It can occur when the formula for the index does not fully reflect the drought risk and timing of vulnerability of the crop or if the index is not targeted to cover a useful risk. It can occur if the crop is destroyed in a non-drought year by another factor, such as disease. With enough basis risk, it is possible for an index insurance contract to actually increase the risk that a farmer faces—even if the insurance is subsidized.

Some level of uninsured risk is probably unavoidable even for traditional insurance products. Since insurance typically only pays out once every 4-7 years and may not be a cost effective solution to address all losses, there are many years for which there will be no payments or insufficient payments to fully cover losses. The trade-offs involved in addressing the appropriate risks to insure and managing basis risk that is critically important in successfully scaling up index insurance. It is not only important to reduce basis risk, but it is also important that the existing basis risk is understood by all involved, so that people are not unknowingly exposed to the risks that the insurance does not cover.

insurance, the subsidy may be better directed to a different component of the system. It may also be that the index under consideration is not sufficiently effective, or is attempting to provide unrealistically complete risk coverage instead of targeting the parts of the risk that are cost effective to address.

In some situations it is worthwhile for a government or donor to directly pay index insurance premiums or to provide subsidies. For example, a donor may use index insurance to protect components of its projects that are vulnerable to climate, or to more cost-effectively manage its relief funds by indexing an early warning system. The government can be a purchaser of insurance, covering its expenses during emergency relief and recovery efforts. The government effectively distributes its emergency relief budget over several years as insurance premiums, and has rapid access to resources when these are most needed.

National meteorological services are an important governmental contribution to the up-scaling of weather index insurance. In many developing countries climate data is not freely available, either as a result of restrictive use policies and fees being charged, or poor data coverage and quality. Donors, private sector companies and NGOs can play a significant role in encouraging governments to support their meteorological services, ensuring that these meet the information needs of their society, and enabling access to data for the construction of indices. However, data quality and access remain an important unresolved challenge in the implementation of weather index insurance at larger scale.

A natural role that governments, NGOs and donors might play is to support the foundation of the index scaling process, supporting the data infrastructure, capacity building, applied research and education that are necessary for index insurance to be robust, self-scaling, adaptable and sustainable.

ORGANIZATIONS

Global Humanitarian Forum is an international arena aimed at fostering dialogue and brokering partnerships that strengthen the international community's ability to more effectively address current and emerging humanitarian challenges. The forum has been founded by former United Nations Secretary-General Kofi Annan and is supported by Swiss government in efforts to generate increased investment in preparedness and prevention.

Founded in Zurich, Switzerland, in 1863, Swiss Re operates in more than 25 countries and provides its expertise and services to clients throughout the world. Swiss Re's traditional reinsurance products and related services for property and casualty as well as for life and health business are complemented by insurance-based corporate finance solutions and supplementary services for comprehensive risk management.

IRI employs researchers and specialists in climate, forecasting, environmental monitoring, water resources, public health, agriculture, food security, economics, institutions and policy, education among other areas. Research undertaken within all these fields is brought together in support of place and problem-based scalable projects with direct collaboration of relevant stakeholder groups, with a focus on developing countries. IRI has been working with many partners in various regions to help develop financial instruments targeted at poverty reduction and climate resilience. The IRI is a member of the Earth Institute at Columbia University.

The National Oceanographic and Atmospheric Administration focuses on developing a broader user community for climate products and services. NOAA's Climate mission is to understand and describe climate variability and change to enhance society's ability to plan and respond. Its long-term climate efforts are designed to develop a predictive understanding of variability and change in the global climate system, and to advance the application of this information in climate-sensitive sectors through a suite of process research, observations and modeling, and application and assessment activities. The IRI was established as a cooperative agreement between Columbia University and the NOAA's Climate Program Office.