Report No. 32727-GLB

Managing Agricultural Production Risk

Innovations in Developing Countries

June 2005

The World Bank
Agriculture and Rural Development Department

1818 H Street, NW

Washington, DC 20433

Telephone 202-473-1000

Internet www.worldbank.org/rural

E-mail ard@worldbank.org

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ACRONYMS AND ABBREVIATIONS

ACP	Africa-Caribbean-Pacific
APF	Agricultural Policy Framework of Canada
APH	Actual Production History
ARD	Agriculture and Rural Development Department of the World Bank Group
BASIX	Livelihood Promotion and Microfinance entity of Andhra Pradesh
BIP	Base Insurance Product
BSFL	Bhartiya Samruddhi Finance Limited (part of BASIX)
CAIS	Canadian Agricultural Income Stabilization
CAT	Catastrophe
COFIDE	Corporación Financiera de Desarollo S.A. (Development Finance Corporation located in Lima, Peru)
CRDB	Cooperative and Rural Development Bank Limited, a private commercial bank
CRMG	Commodity Risk Management Group (ARD, The World Bank)
DECRG	Development Economics Research Group of The World Bank
DOC	Disaster Option for CAT Risk
DPPC	Disaster Prevention and Preparedness Commission (Ethiopia)
DRP	Disaster Response Product
EC/ACP	European Commission/Africa-Caribbean-Pacific
EIC	Ethiopia Insurance Corporation
ENESA	Entidad Estatal de Seguros Agrarios, the National Agricultural Insurance Agency of Spain
ENSO	El Niño-Southern Oscillation (Sea surface temperatures)
ESSD	The World Bank Environmentally and Socially Sustainable Development Advisory Service
FAO	Food and Agriculture Organization of the United Nations
FCIP	Federal Crop Insurance Program
FSE	The Financial Sector Group of The World Bank
GDP	Gross Domestic Product
GIIF	Global Index Insurance Facility (proposed by CRMG)
GMO	Genetically Modified Organisms
IBLI	Index-Based Livestock Insurance
ICICI Lombard	Private general insurance company in India
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IFC	International Finance Corporation of the World Bank Group
IFFCO-Tokio	Private general insurance company in India — joint venture between Tokio-Marine and the Indian Fertilizer Association
IFPRI	International Food Policy Research Institute
IMF	International Monetary Fund
INISER	Instituto Nicaraguense de Seguros y Reaseguros Nicaraguan Institute for Insurance and Reinsurance
ISMEA	Istituto di Servizi per il Mercato Agricolo Alimentare (Italian Institute for Services to Agricultural Food Markets)

KBS LAB	Krishna Bhima Samruddhi Local Area Bank
LIL	Learning and Innovation Loan
MAMDA	Mutuelle Agricole Marocaine d'Assurance
MMPI	Malawi Maize Production Index
NASFAM	National Smallholders Association
NDVI	Normalized Difference Vegetation Index
NGO	Nongovernmental Organization
NMSA	National Meteorological Services Agency
OECD	Organization for Economic Cooperation and Development
OI	Opportunity International
PI	Production Insurance
RI	Reinsurance
SADC	Southern African Development Community
SECO	State Secretariat for Economic Affairs, Swiss Trade Commission
SENAMHI	Servicio Nacional de Meteorologia e Hidrologia del Peru (National Meteorology and Hydrology Service of Peru)
SRA	Standard Reinsurance Agreement (U.S. crop insurance)
TCDAI	Technical Committee for the Development of Agriculture Insurance (Peru)
UNCTAD	United Nations Conference on Trade and Development
WFP	World Food Program of the United Nations

PREFACE AND ACKNOWLEDGMENTS

This document is produced by Ulrich Hess, task manager, and Jerry Skees, Andrea Stoppa, Barry Barnett and, John Nash, with three background papers by 1) Robert Townsend, 2) Paul Siegel and 3) Jerry Skees, Barry Barnett, and Jason Hartell. These papers can be viewed at the Commodity Risk Management Group (CRMG) Web site, www.itf-commrisk.org. Panos Varangis led the work for this study during its conceptual stage.

This paper is motivated by the solid and growing literature on alternative risk management techniques, but it is ultimately driven by empirical results that would have been impossible to obtain without the support and demand for action from the development community.

From The World Bank, Karen Brooks and Richard Scobey, rural sector managers in the Africa Region, supported the conceptual work and instilled a sense of realism and purpose to the ideas expressed in this paper. Jock Anderson and Derek Byerlee in the Agriculture and Rural Development department continuously refreshed our ideas in the areas of agricultural risk management and food security risk management. Kevin Cleaver, Sector Director and Sushma Ganguly, Sector Manager in the Agriculture and Rural Development department, gave motivational advice and guidance. Ken Newcombe, ESDVP, encouraged this work and has become a champion of the Global Index Insurance Facility (GIIF). In his IFC days, Cesare Calari, FSE, was an early supporter of weather risk management concepts and continues to encourage this line of thinking in his various capacities. Rodney Lester, senior insurance expert in FSE, also contributed with advice and support. Xavier Gine, DECRG, helped to shape our thinking on smallholder access to financial services. Colleagues in the social development and social protection areas, Harold Alderman, Will Wiseman, and Elena Galliano helped with the crossover to the social risk management realm, providing a better understanding of the needs of vulnerable populations and the relevance of insurance techniques for safety nets.

Development partners have continuously prompted quality leaps ahead through their particular expertise. Richard Wilcox of the UN World Food Program (WFP) pushes the weather insurance idea to new limits and has shaped our thinking at that level. Alexander Sarris, FAO, and Lamon Rutten, UNCTAD, supported CRMG in the areas of commodity risk management.

The key concepts espoused in this paper have been developed in the academic community as well. Ronald Duncan and his group at the World Bank systematically explored index insurance ideas in the early 90s (Priovolos and Duncan, 1991). Peter Hazell, IFPRI, and Jerry Skees analyzed the shortcomings of traditional crop insurance and suggested the weather index insurance alternative in the early 1990s.

This ESW insists on market-based insurance techniques, the only sustainable way to transfer risk transfer out of agriculture. At the same time, market gaps exist and often markets fail the poor. This is where CRMG and its partners can bridge the market gap: by "crowding in" the private sector. All this would not have been possible without the visionary thinking of market leaders in the weather risk management markets. Ravi Nathan, ACE Insurance of North America, in particular has helped to globalize the market beyond OECD countries thanks to creative partnership and risk-sharing structures that include marketing partners from developing countries. His vision continues to inspire the market and our work. Crucial advisors of the CRMG work and its ideas in this ESW are Brian Tobben and William Dick of Partner RE, Juerg Trueb, Swiss RE, and Rick McConnell (formerly Agricultural Financial Services Corporation, Alberta). Bruce Tozer, Rabobank, and Roy Leighton, Carlyon, have wisely and passionately advised and encouraged CRMG and the International Task Force for Commodity Risk Management throughout its existence.

The demand for a systematic treatment of agricultural risk management techniques in developing countries ultimately came from people who deal with farmers and partly make their risks their own. The vision and inspiration of Nachiket Mor, ICICI Bank, India, and Vijay Mahajan, BASIX, India, are the real motivation of the astounding success of weather insurance techniques. The present paper and its proposals are unthinkable without ICICI Lombard and BASIX weather insurance pilots and the discovery that farmers understand and appreciate the transparency and timeliness of the product. Ramesh and Vasumathi in Mahahbubnagar, Ramana and Gunaranjan in Hyderabad, and in Mumbai, Virat Divyakirti, ICICI Lombard, and Bindu Ananth, ICICI, were the architects of a simple innovation that could change the rural landscape in India. Champions for other pilot projects are Rachid Guessous, MAMDA, Morocco, Ramon Serrano, INISER, Nicaragua, and Shadreck Mapfumo, OI, Malawi.

The authors wish to acknowledge the generous support of the Swiss State Secreteriat for Economic Affairs, SECO. SECO has provided support for the CRMG pilot programs in the area of innovative agricultural risk management, and these pilots provided major lessons for this report. The European Commission and in particular Henny Gerner is associated with the work of CRMG, and by extension this ESW, by providing constructive criticism and support for the idea of the Global Index Insurance Facility (GIIF).

Finally the authors express their sincere gratitude to World Bank reviewers, Jock Anderson and Stephen Mink, and to Celeste Sullivan and Anne Goes of GlobalAgRisk, Inc., for their editorial assistance.

EXECUTIVE SUMMARY

Progress is being made in creating risk transfer markets for weather events in developing and emerging economies. While this document introduces several sources of risk that create poverty traps for poor households and that impede the development process, the focus is on low-probability, high-consequence weather risk events as they relate to rural households. These types of risks are highly correlated and require special financing and access to global markets to pool the risk and make them more diversifiable, improving the pricing. Thus, a significant contribution of this document is the introduction of index insurance and highlighting how it can be used at the micro-, meso-, and macro-levels for risk transfer. In particular, using index insurance products, it is possible to organize systems to take advantage of global markets and transfer out of developing countries the correlated risks associated with low-probability, high-consequence events. This document presents both a conceptual backdrop for understanding how this can be done and also a progress report on several World Bank efforts to assist countries in using limited government resources to facilitate market-based agricultural risk transfer for natural disasters.

While global markets that provide reinsurance for natural disasters are both large and growing, they rarely have an interest in taking such risk from developing and emerging economies. In part this is because primary insurance markets are weak in developing countries. Before agreeing to provide reinsurance, global reinsurers engage in due diligence investigations of primary insurers and the risks the primary insurers wish to transfer. Compared to traditional insurance products, index insurance has far fewer hidden information and hidden action problems. This reduces the reinsurers due diligence and underwriting costs and makes it more likely that they will be interested in accepting natural disaster risk from new insurance providers in developing countries. Nonetheless, natural disaster losses can be significant, and carefully crafted ways to finance such losses are also critical preconditions for shifting the risk into global markets. Innovation in pooling these risks globally may also facilitate the transfer of natural disaster risk from developing countries.

One global innovation currently being prepared by the World Bank and European Commission involves a Global Index Insurance Facility (GIIF). The GIIF will have three functions that are targeted at helping developing country insurance providers build capacity: 1) supporting the technical assistance and infrastructure that are needed to develop index insurance using quality data; 2) aggregating and pooling risk from different developing countries to allow for improved pricing and risk transfer into the global reinsurance and capital markets; and 3) cofinancing certain insurance products on a bi-lateral basis from donor to developing country. Importantly, the third function will be separate from the commercial activity represented in functions 1 and 2. A global effort to facilitate these three functions could represent a major breakthrough for developing countries that are exposed to extreme natural disaster risk.

Another promising realm of innovation is in the development of improved technology to both measure weather and to link weather and farming systems together to forecast crop yields. Improved and less costly systems for measuring weather events in developing countries will play a significant role in the potential success of many of the ideas presented in this document. Secure and accurate measurement will influence both the pricing of index insurance and the demand from end users. Improvements in measuring the vegetative cover with satellite images and then forecasting the value of that vegetation either in terms of crop yields or grazing value could enhance the type of index insurance products that are made available in developing countries. Additionally, more sophisticated crop models that link weather, management systems, and soil can be used to provide insurance products that protect against the dominant random variable in production — the weather.

There are numerous reasons why risk transfer out of developing countries is important. Natural disasters impede the development process, push households into poverty, and drain fiscal resources of developing countries. Many of these natural disasters are directly tied to extreme weather events. Bad weather events have devastating impacts on agriculture. Of the 1.3 billion people in the world who are living on less than US$1 per day, nearly three-fourths depend on agriculture for their livelihood. In many countries around the world, agricultural development will still clear the way for overall economic development of the broader economy. There is a strong link between weather, the livelihoods of the poor, and development. Yet, there is a void in effective ex ante solutions for weather risks in developing countries. Instead, developing countries, the World Bank, and the donor community are currently heavily exposed to natural disaster risk via ex post responses such as financial bailouts, debt forgiveness, and emergency response.[1] None of these responses are optimal. They fail to provide an effective safety net for the poor; they can be inequitable, untimely, and create a dependency that has dire consequences.

If planning for, and financing of, extreme weather events occurs ex ante, access to both formal and informal lending should improve. As broader financial services become more accessible to the rural poor, newer technologies will be used and improvements in productivity and incomes should follow.

Farmers around the world utilize various risk coping and risk management strategies. However, many of these strategies are inefficient. The economic development literature is full of cases to illustrate how risk-averse, poor farmers often give up potentially higher incomes to reduce their exposure to risk. Both individual households and the larger society incur costs for smoothing consumption across income shocks. In many cases, the poor must resort to paying high interest rates for loans after a major income shock. Some argue that the poor cannot afford to purchase ex ante insurance protection against extreme weather events. However, the widespread use of ex post loans suggests otherwise.

The challenge remains of how to make insurance against extreme weather events both more effective and affordable. Two major challenges obstruct the development of risk transfer markets for agricultural losses caused by extreme weather events: 1) organizing ex ante financing for highly correlated losses that result in extremely large financial exposure; and, 2) high transaction costs due to asymmetric information problems such as moral hazard and adverse selection. The latter also makes it nearly impossible to provide traditional agricultural insurance for small farmers given large fixed transaction costs. This greatly increases the average cost, per monetary unit, of insurance protection for smallholder agriculture. Unfortunately, there are few successful examples to consider. Governments in developed countries have provided heavily subsidized crop insurance that is both costly and questionable in terms of net social welfare.

In addition to these challenges, traditional agricultural insurance markets often generate low levels of purchase because the potential insurance purchasers' willingness to pay for the insurance contract is less than the insurers' willingness to accept. Researchers frequently find that economic decision makers underestimate the likelihood and/or magnitude of low-probability, high-consequence loss events. This reduces their willingness to pay for insurance that protects against these events. At the same time, because they have little empirical information about the likelihood and/or magnitude of extreme events, insurers tend to add large extra costs to premium rates for insurance products that protect against low-probability, high-consequence loss events. This divergence between what potential purchasers are willing to pay, and what insurers are willing to accept, causes agricultural insurance markets to clear at less than socially optimal quantities of risk transfer.

New conceptual models are being developed to facilitate the transfer of extreme weather risk out of developing countries. This document reports on the progress of several ongoing efforts of the Commodity Risk Management Group (CRMG) at the World Bank that have been motivated by these models. All of these efforts are built on the premise that index-based insurance products can effectively address both the challenge of ex ante financing of highly correlated losses and the challenge of high transaction costs.

Index insurance products pay indemnities based on an independent measure that is highly correlated with realized losses. Unlike traditional crop insurance that attempts to measure individual farm yields, index insurance makes use of variables that are largely exogenous to the individual policyholder, such as area yield, or weather events, such as temperature or rainfall. This feature greatly reduces the need for deductibles and copayments since there is very little exposure to asymmetric information problems such as moral hazard and adverse selection. Because there is no need for farm-level loss adjustment, index insurance products also have lower transaction costs than traditional agricultural insurance products.

Purchasers of index insurance products are exposed to basis risk. Since index insurance indemnities are triggered not by farm-level losses but rather by the value of an independent measure (the index), it is possible for a policyholder to experience a loss and yet receive no indemnity. Conversely, it is possible for the policyholder to not experience a loss and yet, receive an indemnity. The effectiveness of index insurance as a risk management tool depends on how positively correlated farm-level losses are with the underlying index. Importantly, since farmers have incentives to continue to produce or try to save their crops and livestock, even during bad weather events, index insurance should provide for a more efficient allocation of resources.

Since they are standardized and transparent, index insurance products can also function as reinsurance instruments that transfer the risk of widespread correlated agricultural production losses. To the extent that institutions can be created to aggregate and pool the low-probability, high-consequence tail risk that results from writing insurance on these events, the divergence between insurers' willingness to accept and potential purchasers' willingness to pay should decrease, causing the market to clear at high quantities of risk transfer.

This document is written to inform a broad range of decision makers about progress that is being made in risk transfer for natural disaster risk. While the focus is on agriculture, obviously many of the same concepts can be used for other sectors that are exposed to natural disaster risk. Two basic innovations dominate the conceptual framework: 1) use of index-based insurance; and 2) layering risk to facilitate risk transfer. In many cases, individuals will self-insure against the layer of risk that is composed of high-probability, low-consequence losses. Some form of government intervention may be required to achieve higher levels of risk transfer in the layer of risk that is composed of low-probability, high-consequence losses. Between these two extremes is a layer of risk that, with appropriate risk transfer and pooling structures, can be transferred using market mechanisms.

Since catastrophe risks (CAT risks) are one of the impediments to market development, a framework for government action in the management of agricultural risk that includes models for government intermediation of catastrophic risk through Government Disaster Options for CAT Risk (DOC) has been developed, proposing that governments buy index-based catastrophic risk coverage in international markets and offer them at rates that are lower than global market rates to local insurers who would pass these savings on to end users in developing countries. This would mitigate large loss/infrequent risks that are usually difficult and expensive to reinsure in traditional reinsurance markets, and would ultimately allow local insurers to cover more people against the extreme risks in an ex ante fashion.

Several case studies are presented to illustrate how these concepts are being applied in countries around the world. While the specifics vary based on the needs of each country, all of the cases involve the use of index insurance and/or layering of risk to facilitate risk transfer. The final chapter of this document describes potential future roles for the World Bank in the area of agricultural risk management.

1. INTRODUCTION

This document presents innovations in agricultural risk management for natural disaster risk, with the focus on defining practical roles for governments of developing countries and the World Bank in developing risk management strategies.[2] Recent success stories demonstrate that the World Bank can play a role assisting countries with effective actions that use limited government resources to facilitate market-based agricultural risk transfer. This is important, as developing countries, the World Bank, and the donor community are currently heavily exposed to natural disaster risk without the benefit of ex ante structures to finance losses. Instead, at each big drought or other natural disaster, there is an appeal for financial support, leaving the vulnerable to the mercy of ad hoc responses from government, the international financial institutions, and donors. In most developing countries, livelihoods are not insured by international insurance/reinsurance providers, capital markets, or even government budgets. In addition, natural disasters and price risk in agriculture also impede development of both formal and informal banking. Without access to credit, risk-averse poor farmers are locked in poverty with old technology and an inefficient allocation of resources.

Advances in risk transfer in developed countries are leading the way to solving many social problems. Shiller (2003) documents progress, and charts a course for far more innovation as the democratization of finance and technology spur global risk pooling. Financial and reinsurance markets in developed countries are rapidly developing index-based instruments that allow for the transfer of systemic risks and even livelihood risks. Innovations in risk transfer for natural disasters have been well documented (Doherty, 1997; Skees, 1999b). The challenge is to make these innovations relevant in developing countries and facilitate knowledge and access.

Is the absence of formal risk transfer from natural disasters in developing countries inevitable? Clearly not; there are formal global markets for offsetting natural disaster risks and weather risks that are widely used in developed countries.[3] This document demonstrates how these markets can be used to insure natural disaster risk in developing countries. Agricultural sectors in developing countries are much more exposed to the vagaries of weather than are those of richer countries, so this protection would be even more valuable to them.

Is it a luxury to offer insurance to poor people who lack proper roads or even safe drinking water? Priorities must be set for any government. Careful consideration of the benefits and costs of different interventions is critical. Still, the poor are forced to make production decisions with the objective of minimizing risk, rather than maximizing profits, foregoing more remunerative activities that could provide an escape from poverty. An effective and timely insurance mechanism might allow people to engage in higher risk/higher return activities without putting their livelihoods at risk. Spurring development via improved financial markets is an important activity in developing countries.

Are there any effective precedents for agricultural insurance mechanisms in developing countries? While these innovations are just taking hold, progress has been made with weather insurance for farmers in India, Ukraine, Nicaragua, Malawi, Ethiopia, and Mexico. Several other experiments are also documented in this work. Weather-insured farmers in India say they either have a good crop — in which case it does not matter if they do not recoup the insurance premium — or they have a monsoon failure, in which case they receive an insurance payout. This will at least cover their cash outlays and perhaps some extra money that allows them to keep children in school and preserve assets that otherwise would have to be liquidated at greatly reduced prices. These farmers will be likely to invest a little more in the right seeds and fertilizer at the right time. Quantifying this impact is difficult right now, but a large impact assessment will soon provide more information. It is clear already that when offered the choice, many

farmers will pay for fully priced weather insurance in India. Even farmers who have access to the government-subsidized crop insurance product choose to buy the market-priced weather insurance product. They say they like the objective nature of the weather index; they can go and check the weather station measurements themselves. They also like the timely payout. Indeed, on this count, the new rainfall index insurance that pays on a timely basis compares favorably to the national crop insurance product that might pay after 18 months.

Is this only for large commercial farmers? One true advantage of weather insurance is that it can be targeted to small farmers as no monitoring is needed to verify farm-level losses. The Indian experience demonstrates that small farmers find value in weather insurance. BASIX (a microfinance entity in Andhra Pradesh) estimates that all of the 427 farmers who bought weather insurance policies in 2003 are small- and medium-sized farmers with 2-10 acres of land and an average yearly income of 15,000-30,000 Rupees, or between US$1 and US$2 per day. Currently, many of those buying weather insurance in India are repeat customers. Clearly, these farmers were not too poor to buy the product. Early survey results demonstrate that over one-half list managing risk as the number one reason for buying the insurance. Some farmers might have chosen this new insurance option over the prospect of having to turn to a high interest money lender when cash is needed after a harvest failure.

Is this sustainable? Now that the pilot program in India is in its third year, other insurance companies have replicated and sold the product, and BASIX has mainstreamed the weather insurance product and automated delivery to an expected 8,000 clients for the 2005 season. Countries in Sub-Saharan Africa and Latin America are starting their own weather insurance projects at micro-and macro-levels. For example, weather insurance-based drought emergency responses are being piloted in Ethiopia. Furthermore, weather insurance seems to be a good business. The Indian weather insurance program has emerged without the support of government subsidies. The Commodity Risk Management Group (CRMG) of the World Bank has advised those who were ready, to try these new approaches to agricultural risk management.

How can this be operationalized in the World Bank and elsewhere? Task managers and practitioners may have a desire to follow this work with potential projects — but how does one get started? This document presents ideas on how to begin with a solid framework of action. There are important public goods that governments and the World Bank could provide: for example, weather stations and risk financing for catastrophic protection.

Governments in drought-prone countries, and donors and relief agencies, should also be aware of the potential for other kinds of projects using risk management markets to improve the response to weather-related shocks. This document explores how current ad hoc disaster relief mechanisms can be modified and complemented by a more systematic response to recurrent droughts.

In assessing proper roles for government, one must first consider the economic benefits that can be created by risk management tools, the characteristics of risks faced by farmers in a specific area, and the challenges associated with creating and maintaining risk management tools such as insurance. In general, there is no “one-size-fits-all” policy recommendation for the role of government in agricultural risk management. We assume that most governments consider at least four criteria when considering alternatives for addressing agricultural risk management needs: 1) fiscal constraint; 2) growth; 3) market-oriented risk-transfer; and 4) the social goal to reduce poverty and vulnerability in rural areas.

Chapter 2 of the document begins with an overview of risk and how decision makers currently cope with and manage risk in developing countries, and also carefully examines the impediments to developing effective risk transfer markets. High transaction costs, problems with correlated risk, and the classic problems of moral hazard and adverse selection clearly increase the cost of traditional insurance. Chapter 3 reviews in detail the experience of some developed countries. A clear message about the government cost and inefficiencies of these systems further supports the need for finding new solutions for developing

countries. The stark contrast between what is possible in a developed country versus a developing country motivates a search for new solutions. Chapter 4 gives insight into alternative solutions that might be possible by introducing the concept of weather index insurance that insures against weather events that create serious agricultural losses. This chapter highlights the advantages of such systems for a developing country. Chapter 5 brings together two core innovations: 1) the use of index insurance to insure against detrimental weather events with significantly lower monitoring costs; and 2) the use of layering insurance products to segment risk in a more efficient fashion allowing for risk transfer of correlated risk. These innovations provide a rich framework for introducing new approaches for risk sharing and risk transfer in developing countries, and outline an effective role for the World Bank and other donors in this important domain of natural hazard risk management. Chapter 6 provides an overview of a number of pilot programs and case studies for countries that are ongoing. Finally Chapter 7 makes recommendations for the role of the World Bank and country governments in facilitating the development of innovation in agricultural risk management.

2. RISK AND RISK MANAGEMENT IN AGRICULTURE

Agricultural risk is associated with negative outcomes that stem from imperfectly predictable biological, climatic, and price variables. These variables include natural adversities (for example, pests and diseases) and climatic factors not within the control of agricultural producers. They also include adverse changes in both input and output prices. To set the stage for the discussion on how to deal with risk in agriculture, we classify the different sources of risk that affect agriculture.[4]

Agriculture is often characterized by high variability of production outcomes or, production risk. Unlike most other entrepreneurs, agricultural producers are not able to predict with certainty the amount of output that the production process will yield due to external factors such as weather, pests, and diseases. Agricultural producers can also be hindered by adverse events during harvesting or collecting that may result in production losses.

Input and output price volatility are important sources of market risk in agriculture. Prices of agricultural commodities are extremely volatile. Output price variability originates from both endogenous and exogenous market shocks. Segmented agricultural markets will be influenced mainly by local supply and demand conditions, while more globally integrated markets will be significantly affected by international production dynamics. In local markets, price risk is sometimes mitigated by the "natural hedge" effect in which an increase (decrease) in annual production tends to decrease (increase) output price (though not necessarily farmers' revenues). In integrated markets, a reduction in prices is generally not correlated with local supply conditions and therefore price shocks may affect producers in a more significant way. Another kind of market risk arises in the process of delivering production to the marketplace. The inability to deliver perishable products to the right market at the right time can impair the efforts of producers. The lack of infrastructure and well-developed markets make this a significant source of risk in many developing countries.

The ways businesses finance their activities is a major concern for many economic enterprises. However, in this respect, agriculture also has its own peculiarities. Many agricultural production cycles stretch over long periods of time, and farmers must anticipate expenses that they will only be able to recuperate once the product is marketed. This leads to potential cash flow problems exacerbated by lack of access to credit and the high cost of borrowing. These problems can be classified as financial risk.

Another important source of uncertainty for agricultural producers is institutional risk, generated by unexpected changes in regulations that influence producers' activities. Changes in regulations can significantly alter the profitability of farming activities. This is particularly true for import/export regimes and for dedicated support schemes, but it is also important in the case of sanitary and phytosanitary regulations that can restrict the activity of producers and impose costs on households.

Like most other entrepreneurs, agricultural producers are responsible for all the consequences of their activities. However, the growing concern for the impact of agriculture on the environment, including the introduction of genetically modified organisms (GMO), may cause an increase in producer liability risk. Finally, agricultural households, along with other economic enterprises, are exposed to personal risks to the wellbeing of people who work on the farm, and asset risks, the possible damage or theft of production equipment and assets (see Box 2.1).

Box 2.1 Asset-Based Risk Management

Siegel (2005) broadens the risk discussion into an asset-based risk management framework. This approach is more comprehensive and considers the dynamics of risks within a given context. The asset-based approach uses a "livelihood focus" in recognition that rural households hold a portfolio of assets and allocate these assets among a range of welfare-generating activities, and the particular livelihood activities reflect an explicit (or implicit) multi-dimensional objective function including economic, social, cultural, and environmental outcomes (Chambers and Conway, 1992; Carney et al., 1999). The asset-based approach helps us understand why and how households manage assets and risks to "select" certain livelihood strategies to achieve welfare outcomes in the face of specific asset-context interface conditions.

This approach focuses on the long-term implications of short-term decisions about the allocation of assets. For example, coping strategies used by poor rural households can lead to the degradation or decapitalization of assets such as cutting down trees, or taking children out of school, and these actions can contribute to a cycle of poverty. Alternatively, livelihood strategies can lead to improved asset portfolios such as investments in improved technology, training programs, empowerment in social and political networks that can lead to a virtuous cycle of sustainable growth. Asset accumulation and changes in livelihood strategies are thus important for sustained improvements in household well-being.

Improved management of rural risk is critical for poverty reducing rural growth. However, it is critical to move beyond a narrow risk management focus to a more holistic rural development approach that focuses attention on building, enhancing, maintaining, and protecting household assets. The development of new rural risk management instruments offers the potential to improve household livelihood options, yet their ultimate success depends on the linkages between assets, context, behavior, and outcomes. Thus, the real question to be asked is: What optimal risk management instruments will allow households to maximize their objectives in terms of expected income and variability of income?

The relationship between assets and productivity explains the poverty cycle and the difficulty the poor have in improving their livelihoods. A household's portfolio of assets influences their risk attitude and their ability to respond to risk. Assets also determine the types of activities that can be undertaken. More productive activities are typically associated with greater risk, so how assets are utilized will impact productivity as a function of both expected income and variability of income. At the household level, agricultural risk management instruments reduce the variability of household incomes. The expectation is that by reducing risk and uncertainty, households will be able to accumulate assets and undertake more productive investments.

In the design of risk management instruments it is important to account for the unique "context" presented in different situations. Risk management instruments must be tailored to specific constraints and objectives within the country, community, and household context.

In considering the potential applications of index insurance in developing countries, it is not intended to suggest that index insurance is necessarily applicable or replicable for every situation. Nor should it be inferred that index insurance is a substitute for other risk management strategies. Where index insurance is being pursued it provides a starting point, and ideally a springboard, for the development of a variety of risk management mechanisms.

Notes: A more detailed discussion of these issues can be found in "Looking at Rural Risk Management Using an Asset-Based Approach," a background paper for this report by Paul Siegel. In particular, the reader is directed to Figure 1 which depicts the relationship between assets, context, behavior, and outcomes.

Source: Siegel 2005

RISK IN AGRICULTURE: STRATEGIES AND MECHANISMS

In discussing how to design appropriate risk management policies, it is useful to understand strategies and mechanisms used by producers to deal with risk, and for the purpose of this discussion to distinguish between informal and formal risk management mechanisms and between ex ante and ex post strategies.[5] As highlighted in the 2000/2001 World Development Report (World Bank 2001), informal strategies are identified as "arrangements that involve individuals or households or such groups as communities or villages," while formal arrangements are "market-based activities and publicly provided mechanisms." The ex ante or ex post classification focuses on the point in time in which the reaction to risk takes place: prior to the occurrence of the potential harming event (ex ante) or after the event has occurred (ex post). Among the ex ante reactions, it can also be useful to highlight the differences between on-farm strategies and risk-sharing strategies (Anderson 2001). Table 2.1 summarizes these classifications.

Table 2.1 Risk Management Strategies in Agriculture

		Informal Mechanisms	*Formal Mechanisms*	
			Market based	*Publicly provided*
EX ANTE STRATEGIES	***On-farm***	Avoiding exposure to risk Crop diversification and intercropping Plot diversification Diversification of income source Buffer stock accumulation of crops or liquid assets Adoption of advanced cropping techniques (fertilization, irrigation, resistant varieties)		Agricultural extension Pest management systems Infrastructures (roads, dams, irrigation systems)
	Sharing risk with others	Crop sharing Informal risk pool	Contract marketing and futures contracts Insurance	
EX POST STRATEGIES	***Coping with shocks***	Sale of assets Reallocation of labor Mutual aid	Credit	Social assistance Social funds Cash transfer

Source: Anderson 2001; Townsend 2005; World Bank 2001

Informal mechanisms[6]

Ex ante informal strategies are characterized by diversification of income sources and choice of agricultural production strategy. One strategy producers can employ is simply to avoid risk. In many cases, extreme poverty makes people very risk averse, often avoiding activities that entail risk but that could also bring larger income gains. This inability to manage risk and accumulate and retain wealth is sometimes referred to as the "the poverty trap" (World Bank 2001).

Once producers have decided to engage in farming activities, the production strategy selected is an important means of mitigating the risk of crop failure. Traditional cropping systems in many places rely on crop diversification and plot diversification. Crop diversification and intercropping systems are means to reduce the risk of crop failure due to adverse weather events, crop pest or insect attacks. Morduch (1995) presents evidence that households whose consumption levels are close to subsistence (and are therefore highly vulnerable to income shocks) devote a larger share of land to safer, traditional varieties of rice and castor than to riskier, high-yielding varieties. Morduch also finds that near-subsistence households spatially diversify their plots to reduce the impact of weather shocks that vary by location.

Apart from altering agricultural production strategies, households also smooth income by diversifying income sources and thus minimizing the effect of a negative shock to any one of them. According to

Walker and Ryan (1990), most rural households in villages of semi-arid India surveyed by the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) generate income from at least two different sources; typically crop income and some livestock or dairy income. Off-farm seasonal labor, trade and sale of handicrafts are also common income sources. The importance of income source diversification as part of risk management is emphasized by the Rosenzweig and Stark (1989), finding that households with more farm profit volatility are more likely to have a household member engaged in steady wage employment.

Buffer stock accumulation of crops or liquid assets, and the use of credit present obvious means for households to smooth consumption. Lim and Townsend (1998) show that currency and crop inventories function as buffers or precautionary savings.

Crop-sharing arrangements in land renting and labor hiring can also provide an effective way of sharing risks between individuals, thus reducing producer risk exposure (Hazell 1992). Other risk sharing mechanisms, such as community-level risk pooling, occur in specific communities or extended households where members of the group transfer resources among themselves in order to rebalance marginal utilities (World Bank 2001). These kinds of arrangements are effective for counterbalancing consequences of events that affect some members of the community, but do not work well in cases of covariate income shocks (Hazell 1992).

Ex post informal income-smoothing mechanisms are typically the sale of assets, such as land or livestock (Rosenzweig and Wolpin 1993), or reallocation of labor resources to off-farm labor activities. It is argued by Gadgil et al. (2002) that southern Indian farmers are able to quickly shift from 100 per cent on-farm labor activities to largely off-farm activities if the monsoon rains are expected to be poor. The importance of having labor flexibility built into the production strategy is emphasized by Fafchamps (1993) in his analysis of rain fed agriculture among West African farmers.

As reported by Townsend (2005), in analyzing the cost of risk on ex ante agricultural production strategies, Rosenzweig and Binswanger (1993), Morduch (1995), and Kurosaki and Fafchamps (2002), all find considerable efficiency losses associated with risk mitigation, typically due to lack of specialization — in other words, farmers trade off income variability with profitability.

The need to smooth consumption not only against idiosyncratic shocks, but also against correlated shocks comes at a serious cost in terms of production efficiency and reduced profits, thus lowering the overall level of consumption of the household. A major consideration for innovation would be to shift correlated risk from rural households (Skees 2003). An obvious solution is for rural households to engage in risk sharing with households or institutions from areas largely uncorrelated with the local risk conditions. Examples of such extra-regional risk sharing systems are found in the literature, for example, through credit and transfers with distant relatives (Rosenzweig 1988; Miller and Paulson 2000); through migration and marriages (Rosenzweig and Stark 1989); or through ethnic networks (Deaton and Grimard 1992). Although these studies find some degree of risk sharing and thus of insurance against weather, none of the systems are so widespread that they cover all households, nor are they even close to providing a fully efficient insurance mechanism. Most households are therefore still left with no insurance against correlated risks, the main source of which is weather.

Formal mechanisms

Formal risk management mechanisms can be classified as publicly provided or market based (Table 2.1). Government action plays an important role in agricultural risk management both ex ante and ex post. Ex ante education and services provided by agricultural extension help familiarize producers with the consequences of risk and help them adopt strategies to deal with risk. Governments also reduce the impacts of risk by developing relevant infrastructure and by adopting social schemes and cash transfers for relief after shocks have occurred.[7]

As mentioned in the section on informal mechanisms, production and market risks probably have the largest impact on agricultural producers. Various market-based risk management solutions have been developed in order to address these sources of risk.

Price Risk Management

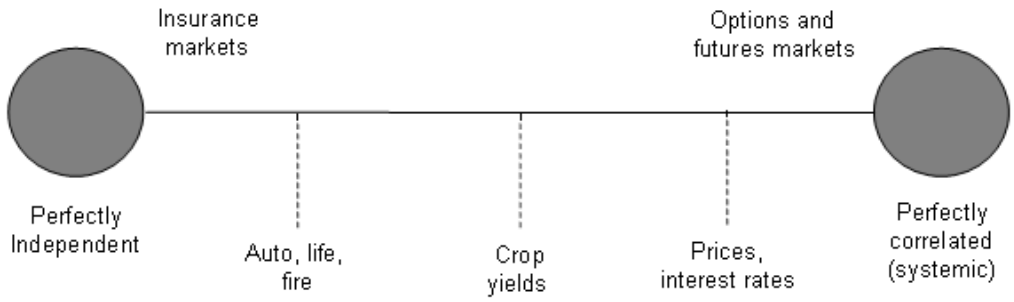
One way producers have traditionally managed price variability is by entering into preharvest agreements that set a specific price for future delivery. These arrangements are known as forward contracts and allow producers to lock in a certain price, thus reducing risk, but also foregoing the possibility of benefiting from positive price deviations. In specific markets, and for specific products, these kinds of arrangements have evolved into futures contracts, traded on regulated exchanges on the basis of specific trading rules and for specific standardized products. This reduces some of the risks associated with forward contracting (for example, default). A further evolution in hedging opportunities for agricultural producers has been the development of price options that represent a price guarantee that allows producers to benefit from a floor price but also from the possibility of taking advantage of positive price changes. With price options, agents pay a premium to purchase a contract that gives them the right (but not the obligation) to sell futures contracts at a specified price. Price options for commodities are regularly traded on exchanges but can also be traded in over-the-counter markets. Futures and options contacts can be effective price risk management tools. They are also important price discovery devices and market trend indicators.

For agricultural producers in developing countries, access to futures and options contracts is probably the exception rather than the rule. However, futures and options markets in developed countries represent important price discovery references for international commodity markets and indirect access to these exchange-traded instruments may be granted through the intermediation of collective action by producer groups such as farmer cooperatives or national authorities.[8] While futures and options are an important reality for some commodities, they are not available for all agricultural products.

Production/Weather Risk Management

Insurance is another formal mechanism used in many countries to share production risks. However, insurance is not as efficient in managing production risk as derivative markets are for price risks. Price risk is highly spatially correlated and, as illustrated by Figure 2.1, futures and options are appropriate instruments to deal with spatially correlated risks. In contrast, insurance is an appropriate risk management solution for independent risks. Agricultural production risks typically lack sufficient spatial correlation to be effectively hedged using only exchange-traded futures or options instruments. At the same time, agricultural production risks are generally not perfectly spatially independent and therefore insurance markets do not work at their best. Skees and Barnett (1999) refer to these risks as "in-between" risks. According to Ahsan et al. (1982), "good or bad weather may have similar effects on all farmers in adjoining areas" and, consequently, "the law of large numbers, on which premium and indemnity calculations are based, breaks down." In fact, positive spatial correlation in losses limits the risk reduction that can be obtained by pooling risks from different geographical areas. This increases the variance in indemnities paid by insurers. In general, the more the losses are positively correlated, the less efficient traditional insurance is as a risk-transfer mechanism. For many ideas presented in this document, a precondition for success is a high degree of positive correlation of losses.

Figure 2.1 Independent versus correlated risk



Source: Miranda and Glauber 1997

The lack of statistical independence is not the only problem with insurance in agriculture. Another set of problems is related to asymmetric information — a situation that exists when the insured has more knowledge about his/her own risk profile than does the insurer. Asymmetric information causes two problems: adverse selection and moral hazard. In the case of adverse selection, farmers have better knowledge than the insurer about the probability distribution of losses. Thus, the farmers have the privileged situation of being able to discern whether or not the insurance premium accurately reflects the risk they face. Consequently, only farmers that bear greater risks will purchase the coverage, generating an imbalance between indemnities paid and premiums collected. Moral hazard is another problem that lies within the incentive structure of the relationship between the insurer and the insured. After entering the contract, the farmer's incentives to take proper care of the crop diminish, while the insurer has limited effective means to monitor the eventual hazardous behavior of the farmer. This might also result in greater losses for the insurer.

Agricultural insurance is often characterized by high administrative costs. These costs are high, in part, due to the risk classification and monitoring systems that must be put in place to address asymmetric information problems. Other costs are associated with acquiring the data needed to establish accurate premium rates and conducting claims adjustment. As a percentage of premium, administrative costs are typically larger, the smaller the policy.

Spatially correlated risk, moral hazard, adverse selection, and high administrative costs are all important reasons why agricultural insurance markets may fail. Cognitive failure among potential insurance purchasers and ambiguity loading on the part of insurance suppliers are other possible causes of agricultural insurance market failure.[9]

If consumers experience cognitive failure in recognizing and planning for low-frequency, high-consequence events, the likelihood for an insurance market to emerge diminishes. When making an insurance purchase decision, the consumer can have a problem determining the value of the contract or, more specifically, the probability and magnitude of loss relative to the premium (Kunreuther and Pauly 2001). Many decision makers tend to underestimate their exposure to low-frequency, high-consequence losses. Thus, they are unwilling to pay the full costs of an insurance product that would protect against these losses. Low-frequency events, even when severe, are frequently discounted, or ignored altogether, by producers trying to determine the value of an insurance contract. This happens because evaluating probability assessments over future events is complex and often entails high search costs. Many people resort to a variety of simplifying heuristics, but probability estimates based on these heuristics may differ

greatly from the true probability distribution (Schade et al. 2002; Morgan and Henrion 1990). There is evidence that agricultural producers forget extreme low-yield events. The general finding regarding subjective crop-yield distributions is that agricultural producers tend to overestimate the mean yield and underestimate the variance (Buzby et al. 1994; Pease 1993; Dismukes et al. 1989).

On the other side, insurers will typically load premium rates heavily for low-frequency, high-consequence events when there is considerable ambiguity surrounding the actual likelihood of the event (Schade et al. 2002; Kunreuther et al. 1995). Ambiguity is especially serious when considering highly skewed probability distributions with long tails as is typical of crop yields. Uncertainty is further compounded when the historical data used to estimate probability distributions are incomplete or of poor quality. This is a very common problem in developing countries. Small sample size creates large measurement error, especially when the underlying probability distribution is heavily skewed. Kunreuther et al. (1993) demonstrate via experimental economics that when risk estimates are ambiguous, loads on insurance premiums can be 1.8 times higher than when insuring events where the probability and loss estimates are well specified.

Together, these effects create a wedge between the prices that farmers are willing to pay for catastrophic agricultural insurance and the prices that insurers are willing to accept. Thus, functioning private-sector markets fail to materialize or, if they do materialize, cover only a small portion of the overall risk exposure (Pomareda, 1986).

3. DEVELOPED COUNTRY APPROACHES TO AGRICULTURAL RISK

To better understand agricultural risk management markets and government policies to facilitate access to risk management instruments, it is worthwhile to critically analyze the experiences of some developed countries. The experiences of the United States, Canada, and Spain are described for reference purposes, but it is important to understand why these systems may not be replicable or suitable in most developing countries. Nonetheless, it is important to recognize that many developed countries have more involved market support and income transfer programs that extend well beyond crop insurance. To the extent that these more complex programs are based on farm income, they also involve levels of protection for severe crop failures. The European community has extensive policies that focus on income protection.

CROP INSURANCE PROGRAMS IN DEVELOPED COUNTRIES

This section presents overviews of agricultural risk management programs in three developed countries: the United States, Canada, and Spain. These countries have been able to implement substantial programs to reduce yield and revenue risk for agricultural producers. While these programs offer a variety of risk management products for farmers, the programs also require significant government support that is not feasible for most countries.

The United States

In the United States, multiple-peril yield and revenue insurance products are offered through the Federal Crop Insurance Program (FCIP), which is a public/private partnership between the federal government and various private-sector insurance companies.[10] The program seeks to address both social welfare and economic efficiency objectives. With regard to social welfare, the private companies that sell federal crop insurance policies may not refuse to sell insurance to any eligible farmer — regardless of past loss history. At the same time, the program aims to be actuarially sound.

Policies are available for over 100 commodities but in 2004 just four crops — corn, soybeans, wheat, and cotton — accounted for approximately 79 percent of the US$4 billion in total premiums. Excluding pasture, rangeland, and forage, approximately 72 percent of the national crop acreage is currently insured under the FCIP. About 73 percent of total premiums are for revenue insurance policies, while 25 percent are for yield insurance policies.[11]

Most FCIP policies trigger indemnities at the farm (or even sub-farm) level.[12] Yield insurance offers are based on a rolling 4-10–year average yield known as the Actual Production History (APH) yield. The federal government provides farmers with a base catastrophic yield insurance policy, free of any premium costs.[13] Farmers may then choose to purchase, at federally subsidized prices, additional insurance coverage beyond the catastrophic level. This additional coverage, often called “buy-up” coverage, may be either yield or revenue insurance. Farm-level revenue insurance offers are based on the product of the APH yield and a price index that reflects national price movements for the particular commodity.

Area-yield and/or area-revenue buy-up insurance policies are offered through the FCIP for some crops and regions. The areas for these policies are defined along county boundaries. On a per acre insured basis, area-level insurance products tend to be less expensive than farm-level insurance products. Thus, in 2004, area-yield and area-revenue policies accounted for 7.4 percent of total acreage insured but less than 3 percent of total premiums.

The federal government also provides a reinsurance mechanism that allows insurance companies to determine (within certain bounds) which policies they will retain and which they will cede to the

government. This arrangement is referred to as the standard reinsurance agreement (SRA). The SRA is quite complex with both quota-share reinsurance and stop losses by state and insurance pool, however, in essence, it allows the private insurance companies to adversely select against the government. This is considered necessary since the companies do not establish premium rates or underwriting guidelines but are required to sell policies to all eligible farmers.

There are four components of federal costs associated with the U.S. program:

1. Federal premium subsidies range from 100 percent of total premium for catastrophic (CAT) policies to 38 percent of premium for buy-up policies at the highest coverage levels. Across all FCIP products and coverage levels, the average premium subsidy in 2004 was 59 percent of total premiums.

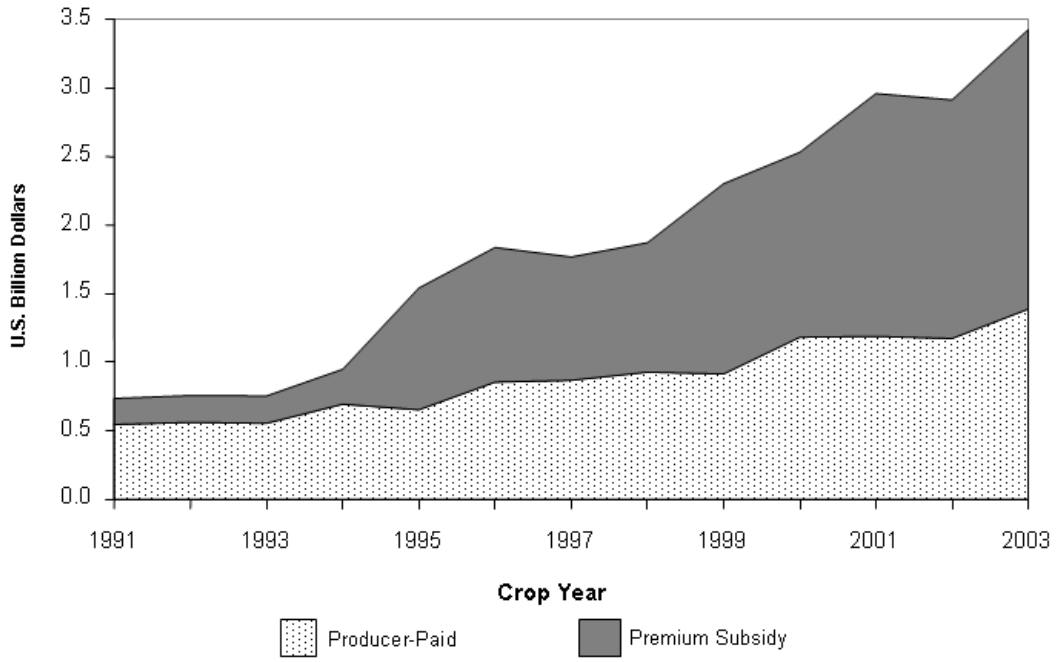
2. The federal government reimburses administrative and operating expenses for the private insurance companies that sell and service FCIP policies. This reimbursement is approximately 22 percent of total premiums.

3. The SRA has an embedded federal subsidy with an expected value of about 14 percent of total premiums.

4. The program, by law, is allowed to be called actuarially sound at a loss ratio of 1.075. This implies an additional federal subsidy of 7.5 percent of total premiums.

On average, the federal government pays approximately 70 percent of the total cost for the FCIP. Farmer-paid premiums account for only about 30 percent of the total cost. While the direct-farmer subsidy varies by coverage level, the U.S. has consistently passed legislation to increase the subsidy level to farmers for crop and revenue insurance products. The rate of subsidy is one component that has influenced the growth in overall premium. Figure 3.1 clearly shows that the growth in premium subsidy is greater than the growth in farmer paid premiums. The rate of subsidy was increased in 1995 and 2001.

Figure 3.1. Crop insurance premiums and indemnities in the United States



Source: Babcock et al. 2004

Canada[14]

In 2003 Canada revised its agricultural risk management programs. The "Business Risk Management" element of the new Agricultural Policy Framework (APF) is composed of two main schemes: Production Insurance and Income Stabilization.

The Production Insurance (PI) scheme offers producers a variety of multiple-peril production or production value loss products that are similar to many of those sold in the United States. One major distinction, however, is that the Canadian program is marketed, delivered, and serviced entirely and jointly by federal and provincial government entities, although it is the provincial authorities who are ultimately responsible for insurance provision. This allows provinces some leeway in tailoring products to fit their regions and to offer additional products.

Production insurance plans are offered for over 100 different crops, and provisions have been made to include plans for livestock losses as well. Crop insurance plans are available, based on individual yields (or production value in the case of certain items, such as stone-fruits) or area-based yields. Unlike the U.S. program, Canadian producers are not allowed to separately insure different parcels, but rather must insure together all parcels of a given crop type. This means that low yields on one parcel may be offset by high yields on another parcel when determining whether or not an overall production loss has occurred. Insurance can also be purchased for loss of quality, unseeded acreage, replanting, spot loss, and emergency works. The latter coverage is a loss mitigation benefit meant to encourage producers to take actions that reduce the magnitude of crop damage caused by an insured peril.

Cost sharing between the federal government and each province for the entire insurance program is to be fixed at 60:40, respectively, by 2006. However, federal subsidies as a percentage of premium costs vary from 60 percent for catastrophic loss policies to 20 percent for low deductible production coverage. Combined, federal and provincial governments cover approximately 66 percent of program costs, including administrative costs. This is roughly equivalent to the percentage of total program costs borne by the federal government in the United States program. Provincial authorities are responsible for the solvency of their insurance portfolio. In Canada, the federal government competes with private reinsurance firms by offering deficit financing agreements to provincial authorities.

Beginning in 2004, the Canadian Agricultural Income Stabilization (CAIS) scheme replaced and integrated former income stabilization programs. CAIS is based on the producer production margin, where a margin is "allowable farm income," that includes proceeds from production insurance, minus "allowable (direct production) expenses." The program generates a payment when a producer's current year production margin falls below that producer's reference margin, which is based on an average of the program's previous five-year margins, less the highest and lowest. One important feature of CAIS is that producers must participate in the program with their own resources. In particular, a producer is required to open a CAIS account at a participating financial institution and deposit an amount based on the level of protection chosen (coverage levels go from 70 percent to 100 percent of the "reference margin"). Once producers file their income tax returns, the CAIS program administration uses the tax information to calculate the producer's program year production margin. If the program year margin has declined below the reference margin, some of the funds from producers' CAIS account will be available for withdrawal. Governments match the producers' withdrawals in different proportions for different coverage levels.

The total investment by federal and provincial governments for the "business risk management" programs is CAN$1.8 billion per year. In 2004 around CAN$600 million were provided by governments as insurance premium subsidies.

Spain

The Spanish agricultural insurance system is structured around an established public/private partnership. On the public side is the National Agricultural Insurance Agency (ENESA) that coordinates the system and manages resources for subsidizing insurance premiums, and the Insurance Compensation Agency (*Consorcio de Compensación de Seguros*) that, together with private reinsurers, provides reinsurance for the agricultural insurance market. Local governments are involved only to the extent that they are allowed to augment premium subsidies offered at the national level. On the private side, insurance contracts are sold by Agroseguro, a coinsurance pool of companies that aggregates all insurance companies active in agriculture. Farmers, insurers, and institutional representatives are all part of a general commission hosted by ENESA that functions as the managing board of the Spanish agricultural insurance system.

Similar to the United States and Canada, insurance policies offered cover multiple perils in a combined program. Policies are available for crops, livestock, and aquaculture activities, with these risks being pooled across the country by Agroseguro. Unlike the United States and Canada, farmer associations are more actively involved in implementation and development of agricultural insurance. Government has reserves to cover extreme losses, and as a final resort, the government treasury is used to cover losses that may occur beyond these reserves.

Total premiums for agriculture insurance policies purchased reached around US$550 million (€490 million) in 2003, of which approximately US$225 million (€200 million) have been provided by the government (Burgaz 2004). The rationale for subsidizing agricultural insurance is that it will serve as a disincentive for the government to also provide free ad hoc disaster assistance. To reinforce the point, Spanish producers are not eligible for disaster payments for perils for which insurance is offered. For

noncovered perils, ad hoc disaster payments are available, but only if the producer had already purchased agricultural insurance for covered perils.

WHY THE EXPERIENCE OF DEVELOPED COUNTRIES IS NOT A GOOD MODEL FOR DEVELOPING COUNTRIES

There are various reasons for developing countries to avoid adopting approaches to risk management similar to the ones adopted in developed countries. Clearly, developing countries have more limited fiscal resources than developed countries. Even more importantly, the opportunity cost of those limited fiscal resources may be significantly greater than those of a developed country. Thus, it is critical for a developing country to consider carefully how much support is appropriate and how to leverage limited government dollars to spur insurance markets. In developed countries, government risk management programs are as much about income transfers as they are about risk management. Developing countries cannot afford to facilitate similar income transfers to large segments of the population who may be engaged in farming. Nonetheless, since a larger percentage of the population in developing countries is typically involved in agricultural production or related industries, catastrophic agricultural losses will have a much greater impact on GDP than in developed countries.

Policy makers should also carefully consider the structural characteristics of agriculture for different countries. In general, farms in developing countries are significantly smaller than farms in countries like the United States and Canada. For traditional crop insurance products, smaller farms typically imply higher administrative costs as a percentage of total premiums. A portion of these costs are related to marketing and servicing (loss adjustment) insurance policies. Another portion is related to the lack of farm-level data and cost effective mechanisms for controlling moral hazard.

Developing countries also have far less access to global crop reinsurance markets than do developed countries. Reinsurance contracts typically involve high transaction costs related to due-diligence. Reinsurers must understand every aspect of the specific insurance products being reinsured (for example, underwriting, contract design, ratemaking, and adverse selection and moral hazard controls). Some minimum volume of business, or the prospect for strong future business, must be present to rationalize incurring these largely fixed transaction costs. The enabling environment to gain confidence in contract enforcement and the institutional regulatory environment are critical to create trust that must be present for a global reinsurer to become involved. These components are largely missing in developing countries. In fact, a prerequisite for effective and efficient insurance markets is an enabling environment. Setting rules assuring that premiums will be collected and that indemnities will be paid is not a trivial undertaking. In this respect, the alternative risk management products discussed in Chapter 5 are structured to overcome many of these problems.

4. INNOVATION IN MANAGING PRODUCTION RISK: INDEX INSURANCE[15]

INDEX INSURANCE ALTERNATIVES[16]

Given the problems with some traditional crop insurance programs in developed countries, it has been critical to search for new solutions that would mitigate several aspects of the problems outlined above. Index insurance products offer some potential to this end (Skees et al. 1999). Index insurance products are contingent claims contracts that are less susceptible to some of the problems that plague multiple-peril farm-level crop insurance products. With index insurance products, payments are based on an independent measure that is highly correlated with farm-level yield or revenue outcomes. Unlike traditional crop insurance that attempts to measure individual farm yields or revenues, index insurance makes use of variables that are exogenous to the individual policyholder — such as area-level yield, or some objective weather event such as temperature or rainfall — but have a strong correlation to farm-level losses.

For most insurance products a precondition for insurability is that the loss for each exposure unit be uncorrelated (Rejda, 2001). For index insurance, a precondition is that risk be spatially correlated. When yield losses are spatially correlated, index insurance contracts can be an effective alternative to traditional farm-level crop insurance.

Index products also facilitate risk transfer into financial markets where investors acquire index contracts as another investment in a diversified portfolio. In fact, index contracts may offer significant diversification benefits, since the returns should be generally uncorrelated with returns from traditional debt and equity markets.

BASIC CHARACTERISTICS OF AN INDEX

The underlying index used for an index insurance product must be correlated with yield or revenue outcomes for farms across a large geographic area. In addition, the index must satisfy a number of additional properties that affect the degree of confidence or trust that market participants have that the index is believable, reliable, and void of human manipulation; that is, that measurement risk for the index is low (Ruck 1999). The properties for a suitable index are that the random variable being measured is

1. observable and easily measured,
2. objective,
3. transparent,
4. independently verifiable,
5. able to be reported in a timely manner (Turvey 2002; Ramamurtie 1999), and
6. stable and sustainable over time.

Publicly available measures of weather variables generally satisfy these properties.[17]

For weather indexes, the units of measurement should convey meaningful information about the state of the weather variable during the contract period, and are often shaped by the needs and conventions of market participants. Indexes are frequently cumulative measures of precipitation or temperature over a

period of time. In some applications, average precipitation or temperature measures are used instead of cumulative measures.

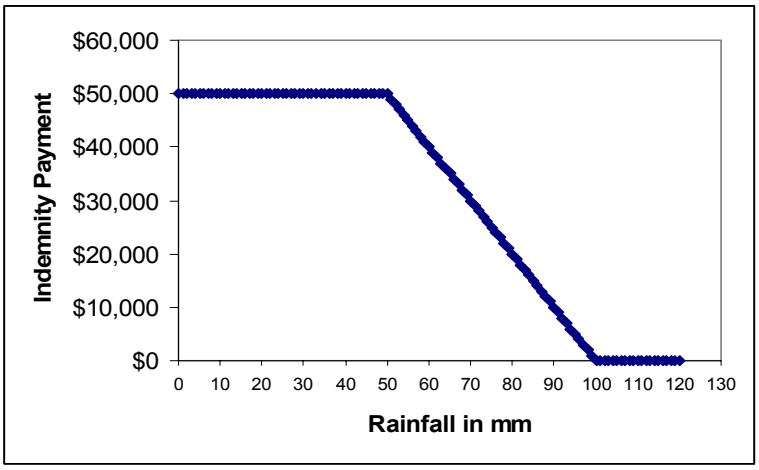
New innovations in technology, including the availability of low-cost weather monitoring stations that can be placed in many locations and sophisticated satellite imagery, will expand the number of locations where weather variables can be measured, and also the types of measurable variables. Measurement redundancy and automated instrument calibration further increase the credibility of an index.

The terminology used to describe features of index insurance contracts is more like that used for futures and options contracts rather than that used for other insurance contracts. For example, rather than referring to the threshold where payments begin as a trigger, index contracts typically refer to it as a strike. They also pay in increments called ticks.

Consider a contract that is being written to protect against deficient cumulative rainfall during a cropping season (for example, see Figure 4.1). The writer of the contract may choose to make a fixed payment for every 1 mm of rainfall below the strike. If an individual purchases a contract where the strike is 100 mm of rain and the limit is 50 mm, the amount of payment for each tick would be a function of how much liability is purchased. There are 50 ticks between the 100 mm strike and 50 mm limit. Thus, if $50,000 of liability were purchased, the payment for each 1 mm below 100 mm would be equal to $50,000/ (100-50), or $1,000.

Once the tick and the payment for each tick are known, the indemnity payments are easy to calculate. For example, if the realized rainfall is 90 mm, there are 10 ticks of payment at $1,000 each; the indemnity payment will equal $10,000. Figure 4.1 maps the payout structure for a hypothetical $50,000 rainfall contract with a strike of 100 mm and a limit of 50 mm.

Figure 4.1 Payout structure for a hypothetical rainfall contract



Source: Skees 2003

In developed countries, index contracts that protect against unfavorable weather events are now sufficiently well developed that some standardized contracts are traded in exchange markets. These exchange-traded contracts are used primarily by firms in the energy sector. However, the range of weather phenomena that can potentially be insured using index contracts appears to be limited only by imagination and the ability to parameterize the event. A few examples include excess or deficient precipitation during different times of the year, insufficient or damaging wind, tropical weather events such as typhoons, various measures of air temperature, measures of sea surface temperature, El Niño-Southern Oscillation (ENSO) that are tied to El Niño and La Niña, and even celestial weather events such

as disruptive geomagnetic radiation from solar flare activity. Contracts are also designed for a combination of weather events, such as snow and temperature (Dischel 2001; Ruck 1999). The potential for the use of index insurance products in agriculture is significant (Skees 2001).

A major challenge in designing an index insurance product is minimizing basis risk. Basis risk refers to the potential mismatch between index triggered payouts and actual losses. It occurs when an insured has a loss and does not receive an insurance payment sufficient to cover the loss (minus any deductible), or when an insured has a loss and receives a payment that exceeds the amount of loss.

Since index insurance indemnities are triggered by exogenous random variables, such as area-yields or weather events, an index insurance policyholder can experience a yield or revenue loss and not receive an indemnity. The policyholder may also not experience a yield or revenue loss and yet, receive an indemnity. The effectiveness of index insurance as a risk management tool depends on how positively correlated farm-yield losses are with the underlying index. In general, the more homogeneous the area, the lower the basis risk and the more effective area-yield insurance will be as a farm-level risk management tool. Similarly, the more a given weather index actually represents weather events on the farm, the more effective the index will be as a farm-level risk management tool.[18]

RELATIVE ADVANTAGES AND DISADVANTAGES OF INDEX INSURANCE

Index insurance can sometimes offer superior risk protection compared to traditional, farm-level, multiple-peril crop insurance. Deductibles, copayments, or other partial payments for loss are commonly used by farm-level, multiple-peril insurance providers to mitigate asymmetric information problems such as adverse selection and moral hazard. Asymmetric information problems are much lower with index insurance because 1) a producer has little more information than the insurer regarding the index value, and 2) individual producers are generally unable to influence the index value. This characteristic of index insurance means there is less need for deductibles and copayments. Similarly, unlike traditional insurance, there is little reason to place restrictions on the amount of coverage an individual purchases. As long as the individual farmer cannot influence the realized value of the index, there is no need to restrict liability. An exception occurs when governments offer premium subsidies as a percentage of total premiums. In this case, they may want to restrict liability (and thus, premium) to limit the amount of subsidy paid to a given policyholder.

As more sophisticated systems (such as satellite imagery) are developed to measure events that cause widespread losses, it is possible that indexing major events will be more straightforward and accepted by international capital markets. Under these conditions, it may become possible to offer insurance in countries that traditional reinsurers and primary providers would previously have never considered. Insurance is about trust. New risk management opportunities can develop if relevant, reliable, and trustworthy indexes can be constructed. Key advantages and challenges can be summarized in Table 4.1.

THE TRADE-OFF BETWEEN BASIS RISK AND TRANSACTION COSTS

Among the most significant issues for any insurance product is the question of how much monitoring and administration is needed to assure that moral hazard and adverse selection are kept to a minimum. To accomplish this goal, principles of coinsurance and deductibles are used to make certain that the insured is sharing the risk and that mistakes in offering too generous a coverage will be mitigated. More information is needed to tailor insurance products and to minimize the basis risk for even an individual insurance contract. More information and more monitoring involve higher transaction costs which convert directly into higher premiums to cover the administrative costs of the insurance. Index insurance significantly reduces the transaction costs. Index insurance can also be written with lower deductibles and without the concern for introducing coinsurance. When farm yields are highly correlated with the index

that is being used to provide insurance, offering higher levels of protection can result in risk-transfer superior even to individual multiple-peril crop insurance (Barnett et al., 2005).

The direct trade-off between basis risk and transaction costs has implications for product designs that are sustainable and for the role of government and markets. Chapter 5 introduces the idea of layering risk. These concepts also greatly depend on understanding the trade-off between basis risk and transaction costs. At every level of risk transfer, someone must accept a certain degree of basis risk if the products are to be both sustainable and affordable. In short, extremely high transaction costs must be paid for. The extra premium or cost to society for absorbing the extra costs can easily offset the basis risk that may have to be accepted to make the risk transfer of natural hazard risk more efficient.

WHERE INDEX INSURANCE IS INAPPROPRIATE

Index insurance contracts will not work well for all agricultural producers. There are many places in the world where agricultural commodities are grown in microclimates. For example, much of the coffee produced in the world is grown on the sides of mountains. Fruit such as apples and cherries will also be commonly grown in areas that can have very large differences in weather patterns within a few miles. In highly spatially heterogeneous production areas, basis risk will likely be so high as to make index insurance problematic. Under these conditions, index insurance will work only if it is highly localized,[19] and/or if it can be written so that it protects only against the most extreme loss events. Even in these cases, it may be critical to tie the index insurance to lending since loans are one form of mitigating basis risk.

Overfitting the data is another concern with index insurance. If one has a limited amount of crop-yield data, fitting the statistical relationship between the index and that limited data can become problematic. Small sample sizes and fitting regressions within the sample can lead to complex contract designs that may or may not be effective hedging mechanisms for individual farmers. Standard procedures that assume linear relationships between the index and realized farm-level losses may be inappropriate. While scientists are tempted to fit complex relationships to crop patterns, interviews with farmers may reveal more about what type of weather events are of most concern. When designing a weather index contract one may be tempted to focus on the relationship between weather events and a single crop. When it fails to rain for an extended period of time, many crops will be adversely impacted. Likewise, if it rains for an extended period of time, with significant cloud cover because of persistent rain during a critical photosynthesis period, a number of crops may also be adversely impacted.

Finally, when designing index insurance contracts, significant care must be taken to assure that the insured has no better information about the likelihood and magnitude of loss than does the insurer. Forecasts of weather by farmers are many times quite accurate. Potato farmers in Peru forecast El Niño at least as well as many climate experts using celestial observations and other indicators in nature (Orlove et al., 2002). In 1988 an insurer offered drought insurance in the U.S. Midwest. As the sales closing date neared, the company noted that farmers were increasing the purchase of these contracts in a significant fashion. Rather than recognize that these farmers had already made a conditional forecast that the summer was going to be very dry, the company extended the sales closing date and sold even more rainfall insurance contracts. The company experienced very high losses and was unable to meet the full commitment of the contracts. Rainfall insurance for agriculture in the United States suffered a significant setback. The lesson learned is that if one is going to write insurance based on weather events, it is critical to be diligent in following and understanding weather forecasts and any information to make forecasts available to farmers. Farmers have a vested interest in understanding the weather and climate. Insurance providers who venture into weather index insurance must know at least as much as farmers about conditional weather forecasts. Otherwise, intertemporal adverse selection will render the index insurance product unsustainable. These issues can be addressed; typically, the sales closing date must be established in advance of any potential forecasting information that would change the probability of a loss beyond the

norm. But beyond simply setting a sales closing, the insurance provider must have the discipline and systems in place to make certain that policies are not sold beyond that date.

Table 4.1 Advantages and Disadvantages of Index Insurance

Advantages	*Challenges*
Less moral hazard The indemnity does not depend on the individual producer's realized yield.	Basis risk Without sufficient correlation between the index and actual losses, index insurance is not an effective risk management tool. This is mitigated by self-insurance of smaller basis risk by the farmer; supplemental products underwritten by private insurers; blending index insurance and rural finance; and offering coverage only for extreme events.
Less adverse selection The indemnity is based on widely available information, so there are few informational asymmetries to be exploited.	Precise actuarial modeling Insurers must understand the statistical properties of the underlying index.
Lower administrative costs Does not require underwriting and inspections of individual farms.	Education Required by users to assess whether index insurance will provide effective risk management.
Standardized and transparent structure Uniform structure of contracts.	Market size The market is still in its infancy in developing countries and has some start-up costs.
Availability and negotiability Standardized and transparent, could be traded in secondary markets.	Weather cycles Actuarial soundness of the premium could be undermined by weather cycles that change the probability of the insured events, for example, El Niño events.
Reinsurance function Index insurance can be used to more easily transfer the risk of widespread correlated agricultural production losses.	Microclimates Make rainfall or area-yield index based contracts difficult for more frequent and localized events.
Versatility Can be easily bundled with other financial services, facilitating basis risk management.	Forecasts Asymmetric information about the likelihood of an event in the near future will create the potential for intertemporal adverse selection.

Source: Authors

5. NEW APPROACH TO AGRICULTURAL RISK MANAGEMENT IN DEVELOPING COUNTRIES

ROLE OF GOVERNMENT

Should the lack of effective private-sector agricultural insurance markets in developing countries be addressed through government intervention? High transactions costs preclude many markets from emerging, but this does not necessarily justify government intervention.

In the case of high-frequency, low-consequence losses, government intervention is likely to distort incentives and create rent-seeking opportunities — possibly to the extent that net social welfare is actually reduced. Farmers can employ other risk management mechanisms to cover these losses. In fact, insurance products for high-frequency, low-consequence losses are seldom offered because the transaction costs associated with loss adjustment would make the insurance cost prohibitive for most potential purchasers.

Governments may have no inherent advantage over markets in trying to facilitate the provision of individual farm-level yield or revenue insurance products. These insurance products are typically not provided by the private sector due, in part, to information asymmetries that cause moral hazard and adverse selection problems (Miranda and Glauber 1997); and it is hard to see how a government provider would have any advantage in addressing these information asymmetries.

However, government intervention may be justified in facilitating insurance markets that protect farmers against low-frequency, high-consequence loss events. As explained in the section on production/weather risk management, research suggests that many decision makers tend to underestimate their exposure to low-frequency, high-consequence losses. This tendency is accentuated by a belief that government assistance is likely in the event of a disaster. Thus, they are unwilling to pay the full costs of an insurance product that would protect against these losses. Those who do buy insurance against low-frequency, high-consequence losses often cancel the policy if they do not receive an indemnity for an extended period. Thus, it seems that, if they are to be successful, agricultural insurance products must be constructed so they will make indemnity payments at a reasonable frequency, for example, 1-in-7, or 1-in-10 years.

On the supply side, insurers will typically load premium rates heavily for low-frequency, high-consequence loss events when there is considerable ambiguity surrounding the actual likelihood of the event. Together, these effects create a wedge between the prices that farmers are willing to pay for catastrophic agricultural insurance and the prices that insurers are willing to accept. Thus, functioning private-sector markets fail to materialize or, if they do materialize, cover only a small portion of the overall risk exposure. This type of market failure is commonly cited as justification for government interventions that facilitate the provision of products or services that are not provided (or not provided in sufficient quantity) by private markets.

A subsidy for catastrophic reinsurance (see Box 5.1) is an example of a government intervention that might facilitate the provision of insurance for low-frequency, high-consequence loss events. Hardaker et al. (2004) provide the following arguments for such an approach:

1. Governments already provide disaster relief — providing assistance through reinsurance might be more efficient;

2. Having the government financially involved may address a moral hazard problem in government behavior: many catastrophes can either be prevented or magnified by government policies, or lack thereof. Having governments financially responsible for some losses might be an incentive for them to put into place appropriate hazard management and mitigation measures;

3. Financial involvement of a government in reinsurance may reduce political pressure to provide distorting and often capricious ad hoc disaster relief;

4. Governments can potentially provide reinsurance more economically than commercial reinsurers. Governments have advantages because of their deep credit capacity and their unique position as the largest entity in a country. These advantages enable them to spread the risks more broadly.

Box 5.1 Reinsurance

Reinsurance is insurance for insurers. Just like insurance, reinsurance is "fundamentally the promise to pay possible future claims against a premium today." Insurers often hold undiversifiable or extreme risk in their portfolio and since they do not wish to retain all of it, they transfer part of these risks to reinsurance companies. Reinsurers are paid a premium for taking on a portion of the risk from insurers. Reinsurers also advise insurers on product development and more complex risk-taking.

Reinsurance agreements can be "proportional" or "nonproportional." With "proportional" agreements insurers and reinsurers divide premiums and losses in a contractually defined proportion, while with "nonproportional" agreements the insurer usually pays all losses up to a defined amount and the reinsurer indemnifies for losses above that limit. "Quota-share" and "surplus" reinsurance are examples of proportional reinsurance agreements. "Excess of loss" and "stop loss" are examples of nonproportional reinsurance agreements.

Reinsurers seek to operate across boundaries in order to build globally diversified portfolios. More than 250 reinsurers in 50 countries wrote annual reinsurance premiums of circa US$176 billion in 2003.[a] Nonlife reinsurance premiums accounted for US$146 billion or circa 14 percent of the global nonlife primary insurance industry. Only US$25 billion of these premiums are written outside North America and Western Europe.[b] The ten largest reinsurers write around 54 percent of reinsurance premiums, and the two giants in the business, Munich RE and Swiss RE, write around US$49 billion of reinsurance premiums.[c]

Securitization is an alternative to traditional reinsurance through which catastrophic risks are transferred to capital markets in the form of financial securities. Securitization has been used for natural catastrophe exposures, such as earthquake and hurricanes.

Notes:

a. Standard & Poor's Global Reinsurance Highlights, 2004 Edition

b. Latin America: $US4.7 billion, Asia: $US13.8 billion, rest of the world: $US6.7 billion. For comparison, the World Bank disburses approximately $US0.5 billion per year in emergency assistance grants and loans to developing countries

c. This premium volume includes life and health reinsurance premiums.

Source: Swiss Re 2004.

If governments are to intervene in agricultural insurance markets, the social benefits of reducing the inefficiencies brought on by risk must outweigh the social cost of making agricultural insurance work. This chapter presents a framework for government agricultural risk policy formulation that focuses on policy objectives, constraints for government action, risk principles, and potential policy instruments (Figure 5.1). The framework is then used to consider alternative models for government intervention in agricultural insurance markets.

Figure 5.1 Framework for governmental agricultural risk management policy formulation

Source: Authors

POLICY OBJECTIVES

Governments that seek to spur growth and eradicate poverty almost inevitably mix economic policies that enhance efficiency and growth with social policies that address poverty and vulnerability. Governments often also pursue equity or income redistribution objectives. Thus, government policies related to agriculture and rural areas tend to pursue the following objectives:

1. *Growth.* Economic growth in rural areas — in particular higher agricultural yields and value-added processing, and also the development of off-farm activities — is perceived to be the best way out of poverty in the medium term. While better incentives for market players and an enabling infrastructure are key drivers, better management of agricultural production risk is also critical for growth, as it enhances access to credit and adoption of new technologies.[20]
2. *Reduce poverty and vulnerability in rural areas*. Government directly intervenes in a targeted manner for social and equity reasons because free markets do not necessarily alleviate poverty for those in society who cannot participate effectively in these markets. Safety nets are one tool for such government intervention.[21]

Given limited resources in developing countries and the existence of other sectors that require government attention, these objectives are typically pursued within an environment of binding fiscal constraints. These objectives target different segments of people in rural areas and different risk profiles. Growth objectives focus on increasing profitability so that less poor farmers can continue adopting production technologies even when high-frequency, low consequence loss events occur. Poverty reduction policies target the poor and seek to increase their average income, and decrease the volatility of their income and the likelihood of a risk event wiping out hard-won asset gains.

A precondition for the sustainable achievement of growth and the objectives of poverty reduction is an ex ante system for disaster risk management. Disaster risk management covers severe and very infrequent events that affect mostly the poor, because the poor are more vulnerable and tend to live in marginal and more risk-exposed areas. Major natural disasters tend to trap people in poverty due to the lack of efficient risk management at the household level.[22] Government disaster risk policies often entail some form of monetary compensation for the victims. The challenge is to deliver timely and predictable aid in disaster situations. This requires ex ante planning rather than just ex post disaster responses. This also implies efforts to forestall political demands for ex post, ad hoc government disaster assistance. Indeed, a credible and reliable disaster risk management system can put farmers and countries on a higher growth path as people are more comfortable in taking calculated and protected risks.

Naturally the growth and poverty-reduction objectives overlap, but that makes it even more important to clearly identify objectives, and design effective and cost-efficient ways to achieve them. Mixing the objectives can lead to sub-optimal outcomes. For example, many government-facilitated crop insurance programs attempt to simultaneously accomplish social welfare and economic efficiency objectives.

CONSTRAINTS IN AGRICULTURAL RISK MANAGEMENT

When making decisions about agricultural risk management programs, policy makers face a number of constraints. They must consider whether the benefits of such programs outweigh the costs, and if so, outweigh the net benefits offered by competing demands on public resources. They must construct the risk management program so as to minimize distortions in resource allocation and reduce opportunities for rent-seeking behavior. They must take into consideration the status and development of financial and insurance institutions within the country, any regulatory constraints on the operations of those institutions, and the infrastructure for enforcing contracts. Finally, it is important to consider the dichotomy that exists in many countries between smallholder farms and large farms that produce for export markets.

Cost-benefit analyses of agricultural risk management projects

Traditional economic analyses of projects (or other sector interventions) weigh social benefits against social costs, usually in monetary terms. In theory, this procedure should make it possible to compare the net benefits from these projects with the net benefit of a government risk management program. However, conducting such a comparison is not a trivial exercise, as the assumptions required to quantify the benefits of risk management are numerous and not always robust across different projects. Still, it is worthwhile to

compare the net benefits of government risk management programs with the net benefits from other projects if only to get a sense of the orders of magnitude involved.

Fiscal constraints

Government expenses for agricultural insurance programs can be quite high. This is often masked in the way that actuarial performance is presented. Governments typically report loss ratios, or cost to premium ratios, as indemnities paid, divided by total premiums collected. There are two problems with this. First, because of government premium subsidies, farmers pay only a fraction of the total premium. Second, governments typically absorb most of the administrative and operating costs. When calculating loss ratios for private sector insurance products, administrative costs are included in the numerator. By simply looking at indemnity relative to premiums (and not being concerned that some significant portion of premiums are paid by the public sector) both the U.S. and Canadian crop insurance programs have, in recent years, reported loss ratios around 1.0. These loss ratios are then cited as evidence that the programs are actuarially sound. But if administrative and operating costs are added to the numerator and government premium subsidies are subtracted from the denominator so that the loss ratio is equivalent to the standard used for private sector insurance products, the crop insurance loss ratios are about 3.6 for the United States and 2.9 for Canada.[23] Hazell (1992) estimates similar ratios for a number of government-based crop insurance programs. His estimates show the Philippines, Japan, and Brazil with programs where the loss ratios (as defined in the private sector) exceed 4.0.

Policy makers often suggest agricultural insurance programs as an alternative to free ex post disaster assistance. In principle, insurance programs have many advantages over ex post disaster assistance. For example, it is often argued that disaster assistance programs can generate perverse incentives that increase the magnitude of losses in subsequent disaster events (Barnett 1999; Rossi et al. 1982). But, in practice, agricultural insurance programs have often evolved into another vehicle for transferring wealth from the public sector to agricultural producers. Furthermore, there is not much evidence that agricultural insurance programs have been successful in forestalling free ex post government disaster assistance. For example, in the United States, more and more costly crop insurance programs have coexisted with disaster payments for well over 20 years (Glauber 2004).

Operational constraints: minimize distortions/rent-seeking opportunities

Governments should only choose to invest public resources in developing agricultural insurance if the social costs of inefficiencies caused by the lack of such insurance products outweigh the social costs of government intervention. These social costs would include not only the opportunity costs of public resources required to create and maintain the agricultural insurance products but also any resource allocation distortions that result from farmers and rural decision makers responding to incentives created by the insurance products. This can include rent-seeking and regressive effects of policies that benefit mostly large commercial farmers.

Contract enforcement

Contract enforcement is critical to effective and sustainable risk management programs. It is very difficult to develop insurance contracts if the legal and regulatory environment does not exist for contract enforcement. Purchasers will lose trust in the program if indemnity payments are not made on a timely basis or are frequently tied up in long-lasting legal procedures.[24] Likewise, insurers will lose trust in the program if they are forced to pay indemnities for losses that the contract is not intended to cover.

Level of financial sector development

Complex agricultural insurance programs are not likely to be sustainable unless they are accompanied by adequate amounts of insurance capital and expertise. In developing countries, insurance sectors are often underdeveloped and concentrated in very few lines of business such as automobile, property, and casualty insurance. Further, insurance companies in developing countries tend to be based in urban areas. They tend to shy away from rural areas where the insurance market is characterized by high transaction costs and small policies.

New products will be required if agricultural insurance is to take root in countries with underdeveloped traditional insurance sectors. For example, insurance products that are based on an index that is recognized and accepted by international reinsurers provide opportunities to bypass in-country insurance capacity constraints. If the reinsurer accepts the data and settlement procedures for the index, the insurer's capital is somewhat less relevant than for traditional lines of insurance because the reinsurer is not really accepting the insurer's underwriting risk, but rather only the risk inherent in the index. Experience with reinsurance for weather index contracts reveals that reinsurers may even be willing to take 100 percent of the risk. However, for operational and regulatory reasons, international reinsurers prefer to deal with professionally-run companies to source the risk.

Structure of agricultural sectors

Smallholder-dominated agriculture is clearly a constraint for the large-scale roll-out of sophisticated crop insurance programs or indeed, any agricultural risk management scheme. Farmers with one hectare of land or less will never be an attractive marketing target for insurance companies. The challenge is to identify suitable aggregators of risk, such as microfinance institutions, banks or cooperatives, or even local authorities who can enroll farmers in group insurance programs. Agricultural sectors need to be segmented, and distribution channels tailor-made to specific needs and local customs.[25]

Regulatory constraints

Agricultural risk transfer involves financial contracts that are regulated according to prudential principles. Insurance companies must organize the financing to pay for the worst case scenario. This constrains the type and sophistication of contracts — just as the capacity of the regulator to understand and supervise new products can be a constraint.

RISK PRINCIPLES: LAYERING AND THE ROLE OF INDEX INSURANCE

Three layers of risk

The segmenting of risk into different "layers" is a key risk management principle. Consider, for example, Figure 5.2 that shows the probability distribution for average April to October rainfall for 13 weather stations in Malawi.[26] Suppose that farmers start incurring production losses whenever rainfall is less than 1000 mm. The domain of losses might be segregated into three risk layers with different entities holding each layer:

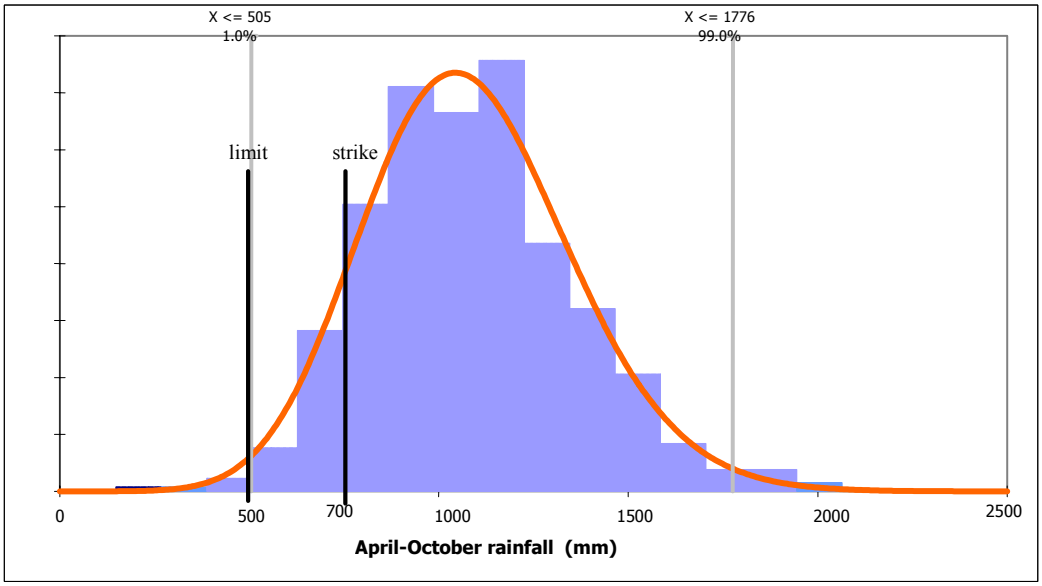
1. For rainfall in excess of 700mm, *farmers* would retain the loss risk either on their own or with financial service providers — the risk retention layer.

2. For rainfall between 500-700mm, the risk would be transferred to an insurance company via a weather index insurance product — the market insurance layer.

3. In this example, for rainfall levels below 500mm, the risk will often not be insured due to cognitive failure and ambiguity loading — the market failure layer.[27]

Farmers would absorb losses in the risk retention layer using self-insurance strategies such as those described in Chapter 2. Strategies for effectively transferring the other risk layers are described below.

Figure 5.2 Average April—October rainfall for 13 weather stations in Malawi



Source: Hess and Syroka 2005.

ADDRESSING THE MARKET INSURANCE RISK LAYER

Referring again to Figure 5.2, suppose that an insurance provider writes a rainfall index insurance contract with a strike of 700 mm and a limit of 500 mm. Limits are commonly used by writers of weather index insurance to avoid open-ended exposure to catastrophic weather events. The insured would select the amount of insurance (the liability) and the payment per tick would be calculated as

$$Payment\ Per\ Tick = \frac{Liability}{Limit - Strike} \quad .$$

Assume that a farmer has a crop with an expected value of $15,000. With only 500 mm of rainfall, it is estimated that the farmer will lose two-thirds of the value of the crop. Thus, the farmer purchases $10,000 of liability and the payment for each tick (each mm of rainfall) would be $50 ($10,000 divided by (700-500)). For example, if the realized value for the rainfall index is 600 mm, the indemnity will be $5,000 ((700-600) x $50).

The limit of 500 mm caps the insurance provider's loss exposure on the index insurance product. Without the limit, the contract would be extremely expensive since it would protect against losses in the extreme lower tail of the probability distribution. Buyers would exhibit cognitive failure regarding the probability of events with less than 500 mm of rainfall while insurance providers would load the premium for ambiguity regarding these same events. Thus, even if insurance was available to protect against rainfall events that are less than 500 mm, there would likely be few transactions since the premium would exceed most buyer's willingness to pay.

Spatial correlation of risk

Weather events that cause agricultural losses are often highly spatially correlated. In the presence of such spatial correlation, index insurance products, such as the rainfall index insurance described above, can be effective risk transfer mechanisms. However, once the risk is transferred from the farmer to a local insurance provider, spatial correlation makes it very difficult for the local insurance provider to generate much risk reduction through pooling. Unless some mechanism exists for transferring the spatially correlated loss risk out of the region or country, local insurance providers will be reluctant to offer insurance products — even if those products protect only against losses in the market insurance layer.

Risk-transfer strategies

There are at least three strategies for transferring risk from index insurance contracts: 1) direct transfer of contracts into reinsurance markets; 2) packaged transfer of independent contracts; and, 3) pooling of risk and subsequent transfer of the pool tail risk (Table 5.1). Under the first two strategies there is no basis risk, insofar as every single contract is reinsured against payouts that exceed a defined level. However, since no pooling occurs prior to the risk transfer, direct and packaged risk transfer strategies will likely have higher reinsurance premium rates than the transfer of pooled risks — even if the reinsurer offers portfolio-adjusted pricing. Under the third strategy of pooling risk prior to transfer, insurers could be exposed to some basis risk insofar as a pool of indexes does not perfectly reflect the payout likelihood of each individual contract, and only the excess risk of the overall pool is reinsured. However, if there are opportunities to diversify risks within the pool, this strategy could lead to lower reinsurance premiums relative to either of the other two strategies since the risk of the overall pool (rather than each individual contract) would be reinsured. The first strategy does not involve the government in transferring the risk. The other two strategies *may* involve government in either facilitating risk transfer (second strategy) or pooling risk and facilitating risk transfer (third strategy).

Pooling of risk

The third risk transfer strategy identified above involves pooling risks within the country or region. Risk pooling is based on the statistical law of large numbers which states that the more uncorrelated risks that are added to a portfolio, the lower the variance in the outcomes of the overall portfolio. For an insurer, this results in lower capital needs and therefore lower capital costs.

Index-based insurance contracts can be pooled and transferred in a number of ways. For example, the reinsurance contract can be based on a basket index that is a weighted average of the indexes contained in the pool. A risk management program being considered for Malawi would have private insurers sell rainfall-based index insurance contracts for various weather stations around the country. The government would purchase reinsurance protection and sell it to the insurers. For reinsurance cover, the government could use the Malawi Maize Production Index (MMPI), a weighted average of weather station indexes with each station's contribution weighted by the corresponding expected maize production from that location. The more highly spatially correlated the risks on the underlying indexes, the better the basket index will perform as a reinsurance mechanism (that is, the lower the reinsurance basis risk). But, of course, the more highly spatially correlated the risks on the underlying indexes, the less advantage there is to pooling within the country as opposed to simply transferring the underlying weather station indexes to the reinsurance market using either of the first two strategies identified above.

A pool of index insurance risks can also be transferred using traditional stop loss reinsurance. In this case, in exchange for a reinsurance premium, the reinsurer would simply cover all losses in excess of a predefined percentage (for example, 110 percent) of the total premium dollars in the pool. With this type of reinsurance (and unlike reinsurance based on a basket index), the pool would not be exposed to basis risk. However, the transactions costs for the reinsurer will be much higher since the reinsurer will need to

conduct due diligence on not only the underlying indexes but also the underwriting of the pool. All other things equal, higher transactions costs will cause reinsurers to charge higher reinsurance premiums. Despite this, if spatial diversification opportunities are sufficiently high, pooling may reduce risk exposure to such an extent that reinsurance premium costs are reduced.

Table 5.1 Risk-Transfer Strategies

Strategy	*Advantages/Disadvantages*	*Role of Government*
Direct risk transfer Contracts are transferred directly from insurers to reinsurers.	No basis risk. Pooling occurs at reinsurer level. If spatial diversification opportunities exist, reinsurance premium rates will likely be higher than if risks were pooled at insurer level (even if the reinsurer offers portfolio adjusted reinsurance premiums). Reinsurer will need to perform extensive due diligence on index but little due diligence on insurer.	Government is not involved in facilitating risk transfer.
Packaged risk transfer Contracts are bundled among companies and transferred to one (syndicate) of reinsurers.	Same as above only may pay lower reinsurance premium rates because bundling reduces transactions costs for the reinsurer.	Either government or an association of insurers can facilitate the bundling and transfer of contracts to the reinsurance market.
Pooling and transfer Contracts are pooled within the country and/or region with only the tail risk of the pool transferred to reinsurers.	Some basis risk. If spatial diversification opportunities exist, reinsurance premium rates will be lower than with other strategies. In the case of pool reinsurance based on traditional stop loss cover[a] transactions costs may be higher since the reinsurer will need to perform due diligence not only on the index, but also on the pool. In case of reinsurance based on index insurance, pool due diligence is avoided, but basis risk would be higher	Either government or an association of insurers can facilitate the risk pooling and transfer of pool tail risk to the reinsurance market.

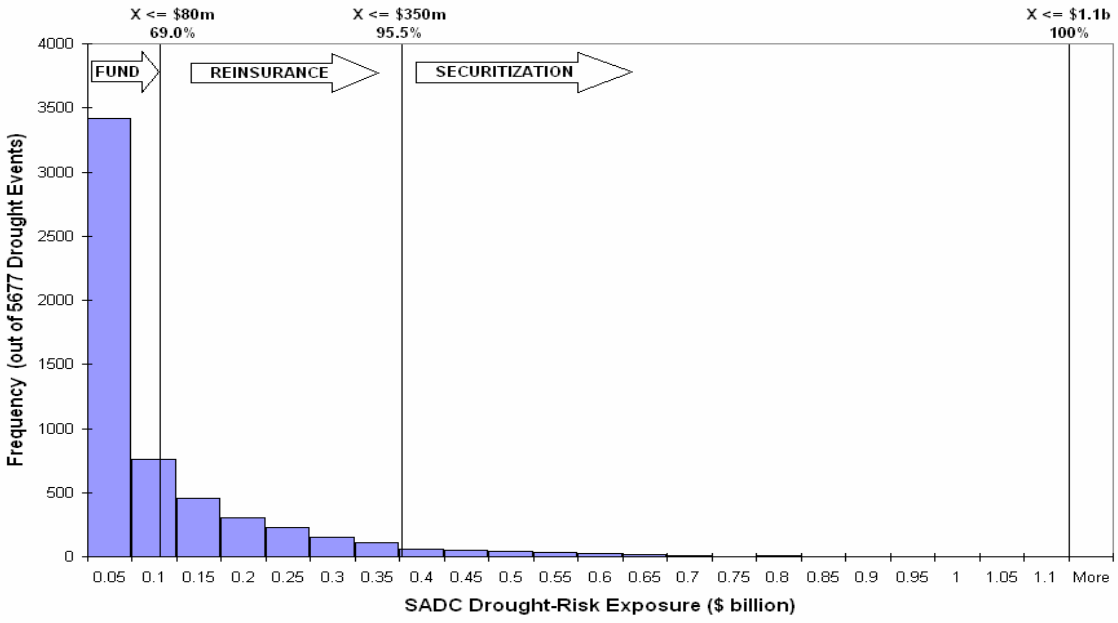
a. For the agricultural insurance pool proposed by the Mongolian project of the World Bank, see the case study in Chapter 6.

Source: Authors

This concept can be extended to the pooling of multi-country risks within a region. Weather-risk can be retained and managed internally if the areas under management are significantly diverse in their weather risk characteristics. This immediately suggests that the weather sensitivity of neighboring countries must be taken into account when considering a country's weather-risk profile and its need for outside reinsurance. Consider the example of the region of the Southern African Development Community (SADC; Figure 5.3). Analysis shows that on average, two countries in the region suffer a drought each

year. However, the distribution of drought events in SADC is extremely long-tailed, with the possibility of widespread drought events that could potentially devastate the region.

Figure 5.3 Histogram of simulated SADC drought events



Source: Hess and Syroka 2005

A SADC pool of rainfall-based index insurance contracts could be constructed with each member country being charged an actuarially fair assessment of the risk transferred to the pool. Suppose the financial impact to the pool of four SADC countries experiencing simultaneous droughts is about US$80 million. The pool may wish to transfer the risk of losses beyond US$80 million to the international reinsurance market. This could be done in layers with, for example, one layer of US$80-350 million being transferred using reinsurance mechanisms.[28] Losses in excess of US$350 million, as might occur with simultaneous droughts in 10 SADC countries, occur with a frequency of about one percent. Instruments such as catastrophe (CAT) bonds might be used to transfer this extreme layer. CAT bonds allow the transference of very large exposures into financial markets and often have tenures of up to three years.

More efficient means of transferring risk implies that costs could be greatly reduced for the member countries by transferring risk as part of a regional strategy rather than by transferring the risk one country at a time. For example, the SADC pooling approach above would reduce insurance costs by 22 percent for one of the countries, Malawi, due to risk-pooling effects (Hess and Syroka, 2005). However, managing a pool requires a high degree of underwriting and actuarial sophistication. Reinsurers will conduct due diligence and will be very reluctant to write traditional excess of loss reinsurance unless they are convinced that the pool is being managed appropriately.

MARKET FAILURE LAYER

Private decision makers will likely not purchase adequate insurance at this catastrophic loss layer due to cognitive failure, ambiguity loading of premiums rates, and perhaps, expectations of government or donor disaster relief. Some form of government intervention may be required to facilitate adequate transfer of the risk in this layer.

POLICY INSTRUMENTS

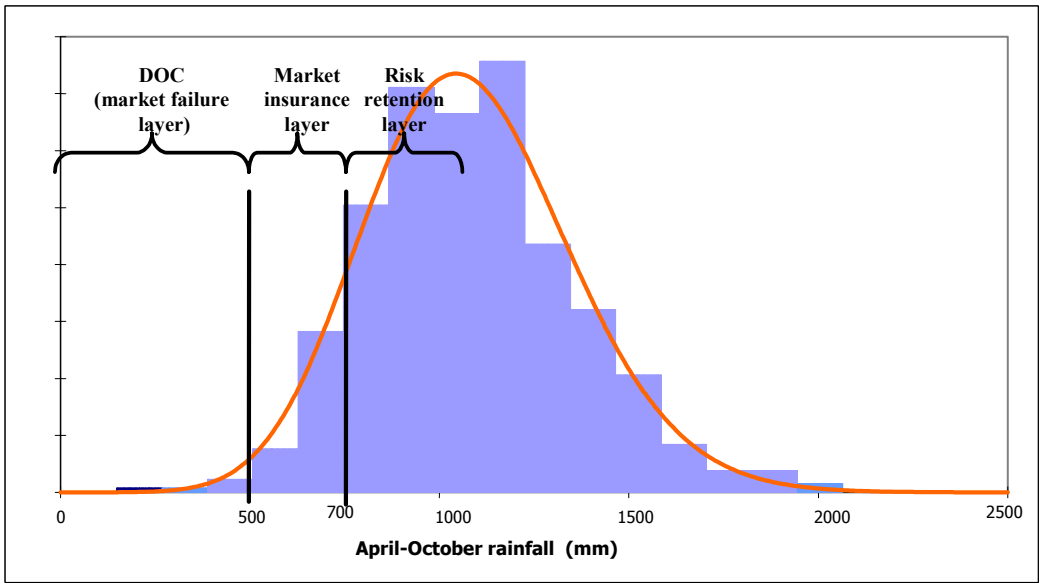
Risk layering provides an extremely helpful conceptual framework for thinking about government intervention in risk transfer markets. In the previous discussion of the market insurance layer, reference was made to situations where government packaging or pooling of risk could potentially reduce the transaction costs associated with risk transfer and thus the premiums paid by end users. We next consider other possible government interventions. Specifically, we address government facilitation of risk transfer in the market failure layer, the role of government subsidies in risk transfer markets, and potential uses of index insurance instruments to finance government disaster relief and safety net policies.

Government disaster option for CAT risk: a policy for the market failure layer[29]

Cognitive failure and ambiguity loading occur primarily with events in the extreme tail of the loss distribution — previously mentioned as the market failure layer. For this reason, and as a substitute for ad hoc disaster relief payments, governments may decide to cofinance risk transfer mechanisms for these events. For example, the government could design Disaster Option for CAT risk (DOC) index reinsurance contracts for catastrophic risks. Returning to the example in Figure 5.2, a DOC could insure against rainfall less than 500 mm with a payment per tick of say, $50. Primary insurers could then offer coverage beyond the earlier imposed limit of 500 mm and transfer the catastrophic tail risk to the government using the DOC. Even if primary insurers are selling traditional crop insurance they could use a DOC to transfer part of the catastrophic tail risk in their portfolio of crop insurance policies. DOCs could be offered for a variety of strikes and settlement weather stations, as long as the coverage is for catastrophic risk layers and can be offset in international weather risk markets. The government could even offer other DOC indexes (for example, excess rainfall or wind speed) to reinsure other lines of insurance, such as property and casualty (see Figure 5.4).

The government would reinsure DOCs in international reinsurance or capital markets using any of the three risk transfer strategies described earlier.[30] Since DOCs would address only extreme catastrophic loss events, reinsurance premium rates would likely contain an ambiguity load. Premiums could be subsidized to offset part of this ambiguity load so DOC purchasers would pay something closer to a pure premium rate. DOCs could be tailor-made to individual insurers needs, for example, DOCs could be based on individual weather stations or written as regional weighted average baskets of weather stations. Strikes should be set so that the DOC covers only infrequent events (for example, an expected frequency of 1-in-30 years or less). This is the domain of the probability distribution over which potential insurance purchasers tend to experience cognitive failure and insurance providers engage in ambiguity loading. Primary insurers and ultimately insured parties would pay a premium for this catastrophic protection, but significantly less than what the market would charge.

Figure 5.4 The government-sponsored DOC as risk transfer product between national and international risk markets



Source: Hess and Syroka 2005.

Those who reinsure DOC contracts will insist on verifying the credibility of the underlying indexes. The premium required to transfer the risk to international markets would provide a baseline from which to base DOC premium rates.

The risk-layering approach proposed here would institutionalize the social role of government in subsidizing extreme risk events at the local level. Premium rates could be subsidized to offset ambiguity loading. Furthermore, by organizing DOC contracts at the local level, isolated severe events that do not capture the attention of national policy makers could still have some structured assistance.

To summarize the major advantages of offering index-based DOCs:

1. DOC contract provisions established ex ante allow for better planning than ad hoc disaster payments.

2. DOCs provide a structure that provides more spatial and temporal equity in government disaster assistance.

3. DOCs facilitate commercial insurance product development by providing a means by which catastrophic risk layers can be effectively transferred into international markets.

4. DOCs can be subsidized to address the market failure associated with ambiguity loading and cognitive failure.

5. Governments can estimate their own DOC subsidy cost exposure based on actuarial estimates of the risk inherent in the index. Reinsurance coverage adds a market check on the credibility of the index and the adequacy of DOC premium rates.

6. While DOCs may be partially subsidized, end users still pay part of the cost to transfer the risk into international markets. This reduces the potential for perverse incentives that could encourage excessive risk taking.

Subsidies[31]

Governments frequently subsidize agricultural insurance products. These subsidies take a variety of forms. The government may cofinance insurance purchasing with direct premium subsidies, or may reimburse primary insurers for administrative or product development costs, or may provide reinsurance at below market premium rates. Regardless of the form, government subsidies are generally designed to increase insurance purchasing by lowering the premiums charged to agricultural insurance purchasers.

Such subsidies are extremely controversial. They tend to benefit operators of larger farms more than operators of smaller farms. A wide range of stakeholders can and will engage in rent seeking once subsidies are introduced. Subsidies are costly to maintain and are subject to close scrutiny regarding the social costs versus the social benefits. Many times subsidies are provided based on the rationalization that markets for agricultural insurance are missing or incomplete without careful consideration of the core reasons why such market limitations exist. This document has carefully considered why agricultural insurance is missing or incomplete in many settings: adverse selection and moral hazard, high transaction costs, cognitive failure and ambiguity loading, and exposure to highly correlated loss events. Any government subsidies should be carefully targeted to address one of these specific sources of market failure. However, even then it may be that the costs of addressing that market failure are simply too high to justify use of limited government resources to that end.

Even when subsidies are carefully targeted, the resulting rents can be captured by politically powerful elites. Government insurance subsidies may crowd out demand for private-sector risk transfer instruments. The World Bank supports the development of financial institutions that operate profitably on a commercial basis by offering products and services that meet the needs of a wide range of clients, including the poor. Thus, any World Bank efforts to facilitate the provision of risk transfer instruments should be based on careful consideration of whether subsidies or grants can be provided without distorting or inhibiting the growth of private-sector financial markets.

Some types of subsidies are likely less distorting than others. Subsidies and grants for supporting financial intermediaries and financial infrastructure, such as technical assistance and data systems needed to develop effective index insurance products, are likely to be the least distorting. Beyond distortions in the markets, there are legitimate reasons for supporting infrastructure to improve market access among the rural poor. Finally, some public support for product development may be justifiable because of the free rider problem. It is costly to develop innovative insurance products. Yet it is difficult to recoup these costs in a competitive market. Any firm can simply copy the new product and compete without having to recover the product development costs. Furthermore, developing index insurance products is an area that is unfamiliar in many developing countries.

Examples of subsidies for financial intermediaries and infrastructure include:

- Providing technical assistance to financial intermediaries to improve systems that enhance efficiency, such as management information systems;
- Developing and introducing demand-driven products on a pilot basis;
- Helping develop or improve service delivery mechanisms that enable greater outreach into rural areas;

- Covering a portion of the cost of establishing new branches in areas that do not have financial intermediaries that serve the poor;
- Creating capacity within regulatory and supervisory bodies;
- Supporting the creation of industry associations;
- Developing training institutes and insurance information agencies;
- Supporting data for weather stations or other data that will be used to develop effective indexes; and
- Providing technical assistance to develop new products in an emerging market in developing countries.

Premium Subsidies

While it is common for developed countries to cofinance premiums for farmers with direct premium subsidies, these types of subsidies are particularly problematic. Generally, direct premium subsidies reflect income enhancement objectives as much or more than risk management objectives. Such subsidies are typically provided on a percentage basis. This clearly benefits higher risk areas relatively more than lower risk areas. Even attempts to subsidize to levels that represent a pure premium or expected loss basis may favor higher risk areas relatively more than lower risk areas since in a commercial market, premium rates for higher risk areas would likely contain higher catastrophic loads. Thus, any attempt to introduce premium subsidies will likely be distorting.

In principle, if subsidies are targeted to the "market failure layer" as described above, market distortions should be minimal. Given the ambiguity loading and cognitive failure that occur in this layer, carefully targeted subsidies (such as cofinancing of DOCs) may even be welfare enhancing. However, for the "market insurance layer," subsidies should, in general, be avoided. If subsidies are provided in the "market insurance layer," they should be targeted to reducing uncertainty loads in premium rates. Commercial insurers will tend to load premium rates based on the quantity and quality of data used to generate pure premium rates. The better (worse) the data used to generate the pure premium rates, the lower (higher) the premium load. These loads could be offset with cofinancing from donors. However, here again, one would need to be very clear about the level of these subsidies and the intent.

INDEX INSURANCE AS A SOURCE OF CONTINGENT FUNDING FOR GOVERNMENT DISASTER ASSISTANCE AND SAFETY NET PROGRAMS

In addition to rural economic growth, governments also want to: 1) better manage disaster assistance efforts; and, 2) try to combat poverty by pursuing social and equity objectives. Rather than listing the multitude of social policy responses to these objectives, this document focuses on the link between funding for social policy tools and risk. Specifically, index insurance is proposed as a source of contingent funding for government disaster assistance and safety net programs.

Ex ante disaster risk management

Disaster financing has generally focused on providing resources for ex post relief operations to cope with shocks rather than with making dedicated resources available ex ante. This has often meant that in-kind emergency resources are made available rather than cash resources. Additional "transient" needs are met through emergency relief operations that often duplicate ongoing interventions; that is, public works and

assistance to the vulnerable. Moreover, due to delays in declaring emergencies, mobilizing and then distributing resources, relief often takes significant time to arrive, and indeed can arrive too late.

Index insurance could be used to provide contingent ex ante funding for emergency relief operations. The relief could be distributed through normal emergency channels but would benefit from ex ante funding and timelier provision of assistance. Current funding for emergency activities in food-insecure countries is based on a protracted appeals-based system that delivers food aid well after crop failures and weather shocks. By this time, people may have already had to sell productive assets and/or migrate. Additionally, the support that does come is not consistent and is delivered as a result of appeals to individual donors and their own approval processes and budget cycles, which makes deliveries unpredictable. The use of index insurance as a means of contingent funding for emergency assistance may mitigate some of the shortcomings of the current system. Index insurance provides timely and predictable payouts during emergencies that could fund early relief and thereby preserve livelihoods and to some extent preempt emergencies (Skees et al. 2005; Goes and Skees 2003).

Safety nets

Safety nets are the response to the needs of the poorest and most vulnerable. Safety nets provide livelihood support and contribute to immediate food security, often based on community-driven public works schemes and transfers to vulnerable labor-poor individuals. In times of adverse climatic shocks, the number of households in need of assistance dramatically increases, hence the need for a scale-up of the safety net. However, there is currently a limited ability for existing safety net interventions to respond to emergencies. Therefore, traditional safety nets could be complemented with index-based disaster insurance.

The scaled-up safety net is limited by two factors:

1. *Design*. Safety nets often focus on addressing chronic poverty rather than transient poverty. Although efforts have been made to scale up safety nets in time of drought, this has proved difficult due to delays in mobilizing financing and organizing activities.

2. *Capacity*. Existing safety net operations have increasingly focused on implementation through local government structures. This is a positive development as it will lead to enhanced local capacity in the long-run, but capacity at the local level is limited and scaling up rapidly and effectively in times of need requires substantial existing capacity.

Safety nets could be enhanced using index insurance. For example, a rainfall index could be used to automatically trigger payments to districts where the drought-affected population in need of assistance will be concentrated, with the sums insured based on the likely size of the affected population. Targeting to the household level would then be used to determine which individuals in the district should receive the payments. Cash financing would be distributed early to districts (that is, immediately after the weather shock and before harvest) to scale up existing safety nets as rainfall measures indicate where production shortfalls will occur. This allows cash distribution to occur during the critical coping period several months earlier than under current emergency arrangements, before the hungry period has set in.[32] This mechanism would not replace emergency operations but would instead provide timely contingent funding to scale up existing safety net structures. Providing assistance in the early stages of a disaster event may preempt the need for more extensive and long-term emergency responses.

6. FROM THEORY TO PRACTICE: PILOT PROJECTS FOR AGRICULTURAL RISK TRANSFER IN DEVELOPING COUNTRIES

In the previous chapter, the conceptual foundations for how to develop risk transfer were presented. This chapter is more pragmatic and offers concrete examples of the progress using index insurance for agricultural risk transfer in several developing countries. Index insurance is not a new concept. Chakravati in India was writing about this type of insurance as early as 1920. Sweden and Quebec, Canada, had area-yield insurance programs dating to the 1950s and 1970s, respectively. The United States introduced the Group Risk Plan in 1992 (Skees et al. 1997). The conceptual base for developing index insurance based on area rainfall followed many of the previous efforts with area-yield insurance.

The World Bank and other donors were involved in working on crop insurance projects in the 1970s and 1980s. However, these efforts were soon abandoned as many of the problems with introducing multiple-peril crop insurance became insurmountable constraints in developing countries. Hazell (1992) emphasized the problems with traditional crop insurance and recommended using rainfall insurance. Hazell and Skees (1998) participated in the first efforts of the World Bank in returning to crop insurance work. This work was in Nicaragua. Skees and Miranda (1998) followed the work in Nicaragua and this lead to the development of the Skees, Hazell and Miranda (1999) document. In 1999, a team of World Bank professionals and outside consultants obtained a *Development Market Place* award to work in Morocco, Nicaragua, Ethiopia, and Tunisia. Many of the efforts describe in this chapter follow the conceptual development of that project.

As with any innovation, there is a life cycle associated with the adoption process. It is not uncommon for an idea to be largely ignored for decades and then to be slowly adopted. Once the idea has been tested, the replication phase begins. The overall efforts described in this ESW are just entering the replication phase. Initial efforts to introduce the concepts in Nicaragua and Morocco have been slow in developing into projects. Nonetheless, these efforts and the experience of performing feasibility studies in these countries proved invaluable in the overall adoption process.

There is no unique sequence in presenting the case studies. Table 6.1 presents the country case studies in the same order that they are presented in this chapter. The order of the presentation begins by explaining what has happened in the first two countries of work (Nicaragua and Morocco). Next, India and Ukraine are presented, as both countries have had sales of weather index insurance. The set of African countries (Ethiopia, Malawi, and the SADC) are presented next as they have some common elements. Peru and Mongolia are unique and they are presented toward the end. Finally, current progress of the Global Index Insurance Facility is presented as this activity is much broader in scope and could significantly facilitate risk transfer for all of these efforts and any future activity.

Table 6.1 Summary of Case Studies

			Objectives			
Country	*Initial Work by the World Bank*	*Status*	*Growth*	*Better Disaster Risk Mgmt*	*Social and Poverty Reduction*	*Conceptual significance of risk-transfer model*
Nicaragua	1998	Pilot in 2005	✓		✓	The direct link to loans and reduction of interest rates when farmers purchase the index insurance.
Morocco	2000	No project	✓		✓	More efficient and effective drought risk management for cereal producers.
India	2003	Three years of sales	✓			Large scaling-up and mainstreaming of weather insurance for smallholders
Ukraine	2002	First sales in 2005	✓			Regulatory approval under traditional insurance legislation and piloting of weather index insurance (first weather insurance contracts sold in April 2005)
Ethiopia Micro	2003	Pilot in 2005	✓	✓	✓	World Bank addressing rural risk in comprehensive manner, weather insurance for smallholders,
Ethiopia Macro	2003	Pilot project planned for early 2006			✓	WFP/WB jointly developed ex ante weather insurance based financing of early response to weather failure leading to negative coping strategies
Malawi	2004	Pilot 2005	✓	✓	✓	Weather Insurance for groundnut farmers
SADC	2004	Feasibility Stage			✓	Introduction of scaled-up safety nets Improve food security risk management comprehensively
Peru	2004	Pilot planned for 2006	✓			Systematic approach to dealing with agricultural risk by government
Mongolia	2001	Pilot planned for 2006	✓	✓		World Bank pilot project mainstreaming designed to learn if herders will pay a commercial rate for mortality index insurance. Prepaid indemnity pool coupled with a structure to completely protect the financial exposure.
Global Index Insurance Facility		Concept Note	✓	✓		Reinsurance intermediation for micro- and macro level insurance for insurers, governments, and banks.

Source: Authors

NICARAGUA: A SEVEN-YEAR INCUBATION PERIOD

Country context and risk profile

The contribution of agriculture to the Nicaraguan GDP has been in decline but still remains a significant economic activity. In 2003 agriculture accounted for nearly 18 percent of the US$4.1 billion GDP of Nicaragua. The major commodities produced include coffee, meat, shrimp, corn, sugar, and beans. In Nicaragua, 30 percent of the population is involved in agricultural activities; however, agriculture has experienced little, and often negative growth since the 90s and Nicaragua has remained a net food importer of cereals and grains. Agricultural production is hindered by exposure to drought and flood risks.

Nicaragua is the World Bank's first experience in recent history where the idea of rainfall insurance was seriously considered. Hazell and Skees provided the first feasibility study in the spring of 1998. Subsequently, Skees and Miranda (1998) examined the issue in more detail and made specific recommendations about rainfall insurance in the major cereal production area of northwest Nicaragua where the major risk to cereal production is insufficient or excess rainfall. In this work, they suggest that rainfall index insurance contracts could be introduced and sold to individual farmers to hedge against the risk of both drought and excess rain. Nonetheless, they also point to the large hurdles in making such an introduction in a developing country. Four key recommendations are made for progressing with a plan to introduce a rainfall index insurance pilot and deemed necessary for the development and sustainability of the insurance scheme:

1. *Analytical work and development of human capital*. Extensive data analysis and modeling would be necessary to design and price the insurance contracts. It would be equally important to train Nicaraguans in these methods to develop the capacity within the country for future work.

2. *Pilot development for demonstration, education, and evaluation*. The first year of the pilot should start small and be targeted primarily at learning and demonstration. Education, marketing, and sales would be primary goals. Only three stations should be used in the first year: 1) Leon; 2) San Antonio; and 3) Chinandega. This market is contiguous and would cover no more area than 800 square kilometers. To obtain the most effective risk management, only those within 10 kilometers of the stations should purchase the rainfall contracts.

3. *Infrastructure development and pilot expansion*. During year one of the pilot, investments in additional, secure weather stations should be made to increase the density of stations within the original 800 square kilometer market area. By year two, the sales and exposure should increase to about US$10 million.

4. *In-country project management and support*. It is essential to have a key person in Nicaragua who can manage and support the pilot project. This person should know all aspects of the project and be active in every dimension of the project. One key goal of the individual will be to monitor the activity and give international reinsurers the comfort to participate in this activity. Beyond the pilot test area, this person should be willing to investigate other possibilities for new regions that may stand on their own with private support. Fostering similar activity in other regions will help entice the international reinsurance community. This person should also facilitate an active education program. Beyond the educational effort, there should be funds for advertising and promotion.

Some progress was underway in discussions within both the Nicaraguan public and private sectors on these concepts when Hurricane Mitch arrived with its devastation in October of 1998. After this event, the focus on World Bank efforts to provide technical assistance in Nicaragua shifted to developing an

aggregate weather index that would provide disaster financing to the government of Nicaragua during severe events. The work developed to the point of a specific set of weather stations that were indexed into a single aggregate index for protecting against catastrophic risk. The index was even priced in the global reinsurance markets. Once the contract was priced, the government rejected the idea on the grounds that they did not need to purchase insurance because they could depend on the global community for assistance when major catastrophes occurred. At this point, no further activity on index insurance was pursued in Nicaragua. Nevertheless, a number of significant lessons learned from the Nicaraguan experience:

- *It takes time to develop innovation.* The literature on innovation emphasizes that it takes time to gain acceptance of new ideas. Innovation can take a full generation before it is widely accepted. The Nicaraguan experience fits perfectly with this theory. While the original idea was presented seven years ago, new products that fit with the ideas presented are just being introduced. It is reasonable to think that part of the reason that Nicaragua is only now introducing these ideas is because other countries have ventured into this domain.

- *There is an inherent moral hazard in expecting that countries will purchase catastrophic protection.* The excellent work completed after Hurricane Mitch to develop a mechanism for the government of Nicaragua to indemnify catastrophic losses from extreme weather events was met with a cool reception. The government was likely correct in their evaluation that they did not need this type of protection since the global community has been very responsive with free aid after major catastrophes.

- *Linking index insurance to banking in Nicaragua is an excellent addition to work that is ongoing around the globe.* Early indications are that the banks in Nicaragua have agreed to reduce interest rates for production loans when their farmers purchase the new weather index insurance products. Nicaragua may be the first country where there is an explicit tie between interest rates and the amount of index insurance purchased. This is an important development in Nicaragua that should be evaluated to be more fully understood.

Proposed agricultural risk management structure

In November of 2004, CRMG responded to interest expressed by INISER for developing a local weather index insurance market for agriculture. CRMG provided technical assistance to analyze potential markets for a pilot project in 2005 and decided to concentrate on developing a pilot project for the groundnut sector to secure lending to the sector. Banks have expressed their interest to internalize some part of the risk reduction by lowering the interest rate, while also providing financing for the farmers to pay the premium as an incentive for a proactive financial risk management approach.

Armed with prototype contracts INISER/CRMG has launched consultations with end users, financial intermediaries, and the insurance regulator. Final contracts have been designed and priced by reinsurers, but still require approval from the regulator.

The government of Nicaragua had adopted a “wait-and-see" strategy, based on several previous failures to launch either traditional or weather index insurance for agriculture. It was not until the most recent proposal was being developed and the government could clearly see that there was interest and participation from the international financial markets, that the government opened the door for serious policy dialogue on the issue. In particular, the government has offered to support INISER in the implementation phase with economic resources as well as guidance to upscale the current pilot project. This has open the door to work with several productive sectors, including small farmers, in a comprehensive context of economic development where insurance becomes a useful tool to facilitate investments in the sector.

MOROCCO EXPERIENCE

Country context and risk profile

In Morocco 47 percent of the total population and most of the poor live in rural areas. Agriculture plays a crucial role for rural livelihoods. On average, agriculture accounts for about 17 percent of the GDP, but this percentage fluctuates, mainly due to climatic—especially rainfall—variations. Moroccan agriculture is characterized by a dichotomy between the traditional and commercial sectors. The traditional sector consists of small farms in rain fed areas involved predominantly in cereal, legume, and livestock production. The commercial sector operates mainly in irrigated areas. Farm surveys indicate that about 70 percent of farms are small in size (under 5 hectares) and account for 23 percent of total land under cultivation. Farms less than 20 hectares (ha) in size represent 96 percent of the number of farms in operation. The average size of a farm in Morocco is 5.7 ha. Almost 90 percent of Moroccan agriculture is nonirrigated, and since most of the crops rely on adequate rainfall, this has translated to wide variations in yields and production. For example, the production of cereals fell from 9.5 million tons in 1994 to 1.6 million tons in 1995 due to drought.

Current response

In 1995 the Moroccan government activated the *Programme Secheresse* (Drought Program), a state-sponsored insurance program managed by the local mutual agricultural insurance company (MAMDA) that addressed the drought problem through the implementation of a yield insurance scheme. The program, revised in 1999, is structured on the coverage of three revenue levels of 1,000, 2,000, and 3,000 Moroccan Dirhams (MAD) per hectare (ha). Payments are triggered by a ministerial declaration certifying the occurrence of drought. For the first revenue threshold, the payout is based on an area-yield base mechanism, while for the 2,000 and the 3,000 MAD/ha level, specific farm-yield assessments are required. The program proved to be popular but also affected by typical yield insurance problems such as high costs for supporting insurance premiums and severe management problems related to individual farm-yield assessment (Hess et al. 2003).

Proposed agricultural risk management structure

Given the limitations of the Drought Program, the Moroccan government agreed to participate in a World Bank research project aimed at exploring the feasibility of weather-based insurance as an alternative to traditional yield insurance. The investigations led the team project to conclude that a drought insurance program based on rainfall indexes could have potentially significant benefits over the current scheme, minimizing moral hazard and adverse selection risk and promoting a more rapid, streamlined pay-out process, in addition to increasing the potential interest of international reinsurers and capital markets in investing in the program. Based on analysis of rainfall and cereal-yield data across the country, the study determined that an index-based rainfall insurance product could be feasible in Morocco. Following the feasibility study, an international team sponsored by the IFC and the Italian Technical Assistance Trust Fund assisted MAMDA in structuring the insurance coverage to be launched as a pilot program in some cereal growing regions.

Products

The structure of the product proposed for implementation was that of a rainfall index insurance contract that would indemnify cereal producers when the rainfall index in a determined area would fall below a specified threshold.

The indexes, developed by local agronomists together with farmers' representatives, added important insights on the rainfall-yield relationship and were not just cumulative measures of rainfall but included

specific weights for different plant growth phases and a "capping" procedure in order to take into account the fact that water in excess of storage capacity is lost and does not contribute to plant growth. This process allowed the indexes developed to reach correlation values of over 90 percent (Stoppa and Hess 2003) and to be greatly appreciated by potential end users.

Constraints

Despite the wide consensus gained by the proposed rainfall index contracts among government officials, insurers and producers, the implementation of the foreseen pilot programs in Morocco did not take place. The main reason for the failure of the implementation process was the fact that rainfall precipitation in the selected areas showed a downward trend. Consequently, the reinsurance company involved in the deal made the cost of the insurance prohibitive for producers. The experience developed with the feasibility study and the implementation project for Morocco generated expertise that led to the realization of other WB-facilitated deals (for example, India) and of other independent programs (for example, Colombia).

INDIA: PRIVATE SECTOR-LED ALTERNATIVE AGRICULTURAL RISK MARKET DEVELOPMENT

Country context and risk profile

In 1991 a household survey addressing rural access to finance in India revealed that barely one-sixth of rural households had loans from formal rural finance institutions and that only 35-37 percent of the actual credit needs of the rural poor was being met through these formal channels (Hess 2003). A survey based on the Economic Census of 1998, (Hess 2003) shows that Indian formal financial intermediaries reportedly met only 2.5 percent of the credit needs of the unorganized sector through commercial lending programs. [33]

Current response

Farmers respond to the lack of formal financial services by turning to moneylenders; reducing inputs in farming; overcapitalizing and internalizing risk; and/or by overdiversifying their activities which leads to sub-optimal asset allocation. Smallholders cannot risk investing in fixed capital or concentrating on the most profitable activities and crops, because they cannot leverage the start-up capital and they face catastrophic risks, such as drought, that could wipe out their livelihoods at any point in time. The challenge for banks is to innovate a low-cost way of reaching farmers and helping them better manage risk.

Proposed agricultural risk management structure

An initial study explored the feasibility of weather insurance for Indian farmers to determine if it would be possible to extend the reach of financial services to the rural sector by reducing the exposure to weather risk (Hess 2003). The study identified several potential project partners. In response to this study, CRMG, in collaboration with the Hyderabad-based microfinance institution, BASIX, and Mumbai-based insurance company, ICICI Lombard, a subsidiary of ICICI Bank, initiated a project to launch a small weather insurance pilot program for groundnut and castor farmers in the Andhra Pradesh district of Mahahbubnagar, the first weather insurance initiative ever to be launched in India.

The insurance contracts, protecting farmers from drought during the groundnut growing season, were designed by ICICI Lombard with technical support from CRMG and in consultation with BASIX. The products were marketed and sold by Krishna Bhima Samruddhi Local Area Bank (KBS LAB)[34] extension officers to the four villages through workshops and meetings with the BASIX borrowers. In total, 230 farmers bought the insurance for khariff (monsoon season, June-September) 2003: 154 groundnut farmers and 76 castor farmers; most fell into the small farmer category, with less than 2.5 acres of landholding.

The entire portfolio of weather insurance contracts sold by BASIX was insured by ICICI Lombard, with reinsurance from one of the leading international reinsurance companies.

ICICI Lombard was also involved in another project in khariff 2003 in Aligarh, Uttar Pradesh, where 1,500 soya farmers bought protection against excessive rainfall. ICICI Lombard filed all the necessary forms and terms of insurance with the Indian insurance regulator, registering their products before the programs were launched.

A second pilot program was launched in khariff 2004 and introduced significant changes to the 2003 design following farmer feedback from the pilot program, with technical assistance from CRMG. The program was extended to four new weather station locations, in two additional districts in Andhra Pradesh: Khammam and Anantapur. The weather insurance contracts were offered to both BASIX borrowers and nonborrowers and marketed and sold through KBS LAB in the Khammam and Mahahbubnagar districts and Bhartiya Samruddhi Finance Ltd. (BSFL)[35] in the Anantapur district through village meetings, farmer workshops, and feedback sessions in the month leading up to the groundnut and castor growing season. New contracts were also offered for cotton farmers in the Khammam district and an excess rainfall product for harvest was offered to all castor and groundnut farmers. In total, over 400 farmers bought insurance through BASIX in 2004, and a further 320 groundnut farmers, members of a the Velugu self-help group organization in the Anantapur district, bought insurance directly from ICICI Lombard. Several farmers were repeat customers from the 2003 pilot. In contrast to 2003, ICICI Lombard did not seek reinsurance for the BASIX farmer/weather insurance portfolio in 2004.

In 2004, a number of other transactions also took place within the Indian private sector in response to the 2003 pilot program initiated by CRMG. In 2004, BASIX themselves bought a crop lending portfolio insurance policy based on weather indexes. For the first time, BASIX used this protection to cover their own risk and passed neither the cost nor the benefits to their farmers. The protection allowed BASIX to keep lending to drought-prone areas by mitigating default risk through the insurance policy claims in extreme drought years. BASIX bought a policy to cover three business locations, which was insured by ICICI Lombard, with structuring support from CRMG, and then reinsured into the international weather market.

During 2004, not only did BASIX expand their weather insurance program, a number of other institutions, including the originator ICICI Lombard, began expanding the market for weather insurance in India. IFFCOTokio, a joint venture insurance company, launched weather insurance contracts similar to the 2003 contracts in 2004, selling over 3000 policies to farmers throughout India. In conjunction with ICICI Lombard, the Government of Rajasthan launched a weather insurance program for orange farmers, insuring 783 orange farmers from insufficient rainfall in khariff 2004, and 1036 coriander farmers in rabi (October-March season) 2004. The National Agricultural Insurance Company (NAIC), responsible for the government-sponsored area-yield indexed crop insurance scheme, also launched a pilot weather insurance scheme for 20 districts throughout the country in 2004 reaching nearly 13,000 farmers — the scheme was even mentioned in the government of the Indian budget for the financial year 2004-2005. Therefore it is estimated that nearly 20,000 farmers bought weather insurance throughout India in 2004.

In 2005, BASIX/ICICI Lombard further improved the weather insurance product and automated underwriting and claims settlements. Thus, BASIX will sell area-specific weather insurance products in all of its 50 branches in 7 Indian states, targeting 10,000 farmers. In addition, ICICI Lombard is scaling up its agricultural weather insurance sales and is expanding into other sectors, while NAIC and IFCCO-Tokio are stepping up their efforts to sell weather insurance products and developing better products for farmers.

An important element of the new pilot programs will be monitoring. Ultimately it will be important to learn not only if farmers are buying these products, but how it is changing their behavior and the lending behavior of local financial institutions. Box 6.1 describes the monitoring that is beginning for the India

weather insurance products. Early results that are targeted to learn why farmers are purchasing the insurance are also reported in Figure 6.2.

Box 6.1 India Impact Assessment

CRMG and DECRG [a] conducted a baseline survey[‡] partnering with the International Crop Research Institute (ICRISAT). ICRISAT is part of a network of crop research institutes worldwide. ICRISAT of Andhra Pradesh was commissioned to study the introduction of the rainfall insurance products designed by ICICI Lombard and marketed through BASIX. The main objectives were to assess 1) the take-up rate, that is, the factors influencing the decision to purchase the insurance product and 2) the impact of the insurance product in the treated villages as compared to the control villages. A sample was drawn from Hindupur, Anantapur district, and Narayanpet, Mahahbubnagar district of 1,052 farming households, including 267 buyers, 186 nonbuyers that attended the marketing meeting, and 299 non attendees in the treated villages. In addition, 300 farming households were interviewed in control villages.

Anantapur and Mahahbubnagar are characterized by low and uncertain rainfall, low levels of irrigation, and shallow and infertile soils. Anantapur has virtually a monoculture of groundnut, while Mahahbubnagar has castor bean, groundnut, sorghum, pigeon pea, maize, cotton, paddy, finger millet. Crop failure is very frequent in these districts, mostly triggered by droughts. Indeed, 80 percent of farmers considered drought as their main risk. In a drought year, farmers can lose about 25 percent of income. Drought affects most villagers at the same time; therefore, informal insurance networks do not work. Instead, in bad years, farmers sell livestock or their few assets and migrate to urban areas or other states. In addition, they borrow from formal and informal rural financial institutions. The union and state governments offer employment generation schemes, watershed development programs, and other welfare schemes in these districts to stem migration and the misery of the people.

The rainfall insurance product was explained by BASIX and ICICI in village meetings. Most people who heard about the meeting decided to attend; of those, 35 percent attended because they trusted BASIX and another 35 percent because friends and neighbors attended. Only 27 percent of the buyers purchased the insurance during the marketing meeting, because the product was new and meeting attendees lacked funds. Meeting participants well understood the crop that the rainfall insurance was linked to, premium and payouts, but not the trigger levels. In fact, insurance trigger levels are expressed in millimeters of cumulative rainfall, but most farmers do not understand the concept of a millimeter. Most farmers determine when to sow by analyzing the moisture in the ground, and indeed, only 10 percent were able to make an estimate of the minimum accumulated rainfall required to sow in millimeters.

However, take-up was high. Buyers said they purchased the insurance for security reasons (exposure to rain, large cultivation of castor or groundnut, etc.) and because they were advised by others. Among nonbuyers, 40 percent either did not like the product or did not understand it, 30 percent had no cash at the time of purchase, and another 20 thought the rain gauge was too far away. In fact, a majority of the respondents said that the rainfall insurance payouts should be based on the rainfall received at the village level, and not on the basis of the rainfall recorded at the mandal (sub-district) level, as there is a considerable variation between both. Buyers are generally more educated, have more land (total and irrigated), had more savings at the time of purchase, and are more likely to trust the insurance product and BASIX compared to nonbuyers. Most farmers in treatment villages would like to purchase the insurance for the next khariff (main monsoon) in June 2005. In addition, 14 percent of poorer farmers said they would like to open a savings account in November to save for the premium. Again, when asked why they would like to buy the insurance in 2005 (see Table 6.2), 60 percent cited security reasons, but a full 30 percent cited the experience of a payout in 2004.

The preliminary analysis conducted was unable to detect differences in input usage or area devoted to cash crops as a result of the insurance policy purchase. It appears that farmers are still experimenting with the product.

Note:

a. Financed by Swiss Trade Commission, SECO.

Source: This write-up is based on preliminary findings of economist, Xavier Gine, advised by Robert Townsend, professor at the University of Chicago.

Table 6.2 Reasons for Buying Weather Index Insurance in India

	Khariff 2004		*Khariff 2005*	
Reasons for buying insurance*	***Freq.***	***%***	***Freq.***	***%***
Security /risk reduction	144	54.8	181	53.2
Could not afford to lose harvest income	25	9.5	11	3.2
Low premium	19	7.2	1	0.3
Advice from progressive farmers	18	6.8	0	n/a
Other, trusted farmers bought insurance	17	6.5	5	1.5
Advice from village officials	10	3.8	1	0.3
High payout	10	3.8	10	2.9
I grow a lot of castor	7	2.7	4	1.2
Product was well explained	5	1.9	0	n/a
I grow a lot of groundnut	4	1.5	0	n/a
Luck	4	1.5	5	1.5
Paid out for previous year	0	n/a	107	31.5
Advice from BUA members	0	n/a	11	3.2
TOTAL	263	100	340	100

*The categories listed were created from open-ended survey responses to the question, "Why did you buy the insurance product for the last khariff?" The same categories may not apply for both years.

Source: ICRISAT survey, courtesy Xavier Gine

UKRAINE EXPERIENCE

Country context and risk profile

Rural financial institutions in Ukraine increasingly use future harvests as collateral since farm equipment is generally antiquated and of limited value. These lenders also tend to require harvest insurance to hedge against crop losses.[36] The major banks active in agricultural lending, such as Aval (with a total of 4600 loans and 30 percent market share), do not lend on the basis of uninsured collateral, so to obtain credit, a farmer must have a proper insurance policy written by a preapproved insurer. To provide for the lending insurance needs of farmers, most banks set up their own insurance companies. Most farmers do not yet understand the particular nature of weather index insurance, but are familiar with weather risk and would like to have protection against natural, multiple perils.

Crop risk is diverse throughout Ukraine. Crop-yield data for five major crops (maize, sunflowers, sugar beets, wheat, and barley) in all 25 oblasts in the 1970-2001 period show there is a substantial geographic spread of the agricultural values concentrated in central and southern Ukraine. The correlation of crop yields between eastern Ukraine and the southern region near Odessa is nearly zero, facilitating risk pooling and in-country retention of a large share of natural risks.

Current response

In this market, the types of insurance policies currently offered are input cost insurance, generally linked to agricultural credit collateral requirements and limited to very low insured sums, and harvest insurance, covering hail, storm, excessive precipitation, frost, and fire risk. Drought is offered by only a few companies, but in general is not covered. Two crop insurance pools were founded in 2003 as part of attempts to provide more secure crop insurance to Ukrainian farmers. Five and sixteen insurance companies, respectively, agreed to pool their agricultural risks to improve their risk-bearing capacity and to obtain access to international reinsurance markets. Nevertheless, crop insurance policy sales were very limited (around 80 for both pools). Market participants cited the following reasons for the low uptake: inability to pay for the policy, unclear loss adjustment and underwriting procedures, mistrust of insurance companies, and insufficient information available to farmers. Moreover, by providing ad hoc disaster assistance to farmers in 2003 and 2004, the government of Ukraine (GoU) lowered incentives for farmers to pay for commercial insurance premiums. According to recent market information, by the end of 2004, the biggest agricultural insurance pool shrunk to six companies.

Policy objectives

The GoU has experimented with compulsory crop insurance and is now establishing a crop insurance subsidization scheme. The regulator has approved weather index insurance as an insurance product and a few weather insurance policies were sold to farmers in the first pilot sales season of 2005.

A feasibility study by CRMG presents a risk management framework and considers several options for government intervention in the sector. An investment phase would consist of the acquisition and installation of automated weather stations, including the analysis of the density of the network required for the weather exposure of Ukraine and the design of an adequate maintenance program to ensure the quality of observations across time.

In addition, the GoU could consider a Backstop Facility for Weather Risk Insurance Retention. Ukrainian insurance companies would need international reinsurance for insuring against systemic risks. A risk pool "facility" in Ukraine would allow for the underwriting of agricultural reinsurance based on preestablished guidelines to retain as much risk inside the country as possible. This pool would then reinsure itself through a GoU fund. Extreme or catastrophic risk would be reinsured on the international reinsurance market based on transparent and competitive premium ratemaking principles; that is, once the pool and the GoU fund are depleted, international reinsurers would pay the remaining claims. Through the aggregation and layering of risk, reinsurers would be interested in reinsuring risk in Ukraine and forced to price the risk competitively. Individual insurance companies sometimes face insurmountable difficulties even accessing international reinsurance markets, let alone obtaining competitive prices. The combination of introducing a transparent index insurance product and an efficient and well-regulated risk pool can overcome this market failure. Risk layers representing relatively frequent (but mild) adverse events would be insured by the GoU risk fund. Intermediate risk layers (for example, 1-in-20–year events to 1-in-100–year events) could be transferred to the GoU Backstop Facility. The catastrophic risk layer (the 1-in-100–year event) could be transferred to international reinsurance markets.

ETHIOPIA: ETHIOPIAN INSURANCE CORPORATION AND DONOR-LED EX ANTE DISASTER RISK MANAGEMENT

Country context and risk profile

Ethiopia is one of the poorest and least developed countries in the world, ranking 169th of 175 countries in the Human Development Index. More than 85 percent of the population make their living in the agricultural sector which accounts for 39 percent of Ethiopia's GDP (2002/2003) and 78 percent of

foreign earnings. In Ethiopia, agriculture is predominantly rain fed and more than 95 percent of its output comes from subsistence and smallholder farmers. The staple diet for the majority of Ethiopians is coarse grains including maize, teff (a cereal grain), and sorghum. Production of coarse grains is valued at around US$380 million and cereals at US$585 million.

At the household level, adverse weather patterns, primarily lack of rain, are detrimental to yields and outputs and result in significant income losses and negative impacts on the livelihoods of farmers. Ethiopia faces highly variable rainfall and suffers from both national and regional droughts that can have extreme impacts on farmers who utilize traditional agricultural practices, using little irrigation, and rely on the country's 35 million head of livestock. This rainfall variability, in addition to limiting the ability and motivation of farmers to invest in agricultural technology and yield-increasing assets, reduces overall production, which can decrease both consumption and income of households. At the national level, average grain production in the country is 8.9 million metric tons (MT) and is prone to recurrent drought. The Ethiopian ministry of agriculture has indicated that the level of production is too low to feed the whole population even in good rainfall years.

Current response

With 10 percent of the population of 72 million requiring food aid assistance each year, food insecurity is a chronic issue. Emergency responses have been frequent if not constant, accounting for an annual average of 870,000 MT of food aid between 1994 and 2003. In 2003, a record 13 million Ethiopians required emergency assistance as a result of drought and the corresponding failed harvest in 2002. These emergency responses have saved millions of lives in the short term, but destitution has worsened, people's assets have eroded, and vulnerability has increased. The uninsured loss of income and assets caused by natural disasters, primarily droughts, in developing countries such as Ethiopia, threatens the lives and livelihoods of vulnerable populations. Insurance is a critical requirement for development as uninsured losses lock entire populations in vicious cycles of deepening destitution. It is estimated that in sub-Saharan Africa, approximately 120 million people are at risk to natural disasters and for these populations, humanitarian aid provides the only insurance that protects their lives and livelihoods. But humanitarian aid is often too unreliable, unpredictable, and often times too untimely to provide an effective insurance function.

To partly address this issue, in 2003 the government of Ethiopia (GoE), donors, United Nations agencies, and nongovernmental organizations (NGOs), launched the New Coalition for Food Security, whose goal is to achieve food security for the population in Ethiopia who have been categorized as "chronically food-insecure" and significantly improve food security for the additional 10 million people who are vulnerable in the next five years. To achieve these goals, the organizations are working through the government to introduce a productive safety net for 5 to 6 million people starting in January 2005. The safety net is not an emergency activity but an attempt to change the vulnerability and risk profile of the chronically food insecure. From January 2005, responses to chronic and emergency food shortages will be addressed by different channels: the former, essentially a development activity, will be addressed through the productive safety net program coordinated by the Food Security Coordination Bureau and the latter, a response mechanism to unpredictable humanitarian needs, will be tackled through the Disaster Prevention and Preparedness Commission (DPPC). Accordingly, those households that are not covered by the safety net program, but are still considered in need of government relief assistance, will fall under the emergency program through early warning and annual needs assessments.

Proposed agricultural risk management structures

In order to address the current situation in Ethiopia, two agricultural risk management structures are currently being considered, one at the farmer, micro-level and the other at the government, macro-level.

Micro-Level —Weather Insurance: The state-owned Ethiopia Insurance Corporation (EIC) plans to launch a small pilot weather insurance program for wheat farmers in southern Ethiopia in the wereda (district) of Assassa, Arsi Zone. The EIC has previously experimented with agricultural insurance for farmers but with little success. They are keen to explore new potential products to address the risks of larger, commercial farmers in the country. The pilot program is due to start in June 2005 and the EIC is receiving technical support from CRMG for the pilot. Part of the work includes the demand assessment and participatory design of the contracts with farmers in Assassa.

Macro-level — Ex Ante Funding of Emergency Relief Operations: The World Bank and the United Nations World Food Program (WFP) are investigating the feasibility of index-based weather insurance as a reliable, timely, and cost-effective way of funding emergency operations in Ethiopia. Specifically, the aim is to address the more extreme emergency situations, for example, as mechanisms to cope and mobilize small or localized emergency operations already established within the system, with the availability of the GoE strategic grain and cash reserve. Hence the aim is to target vulnerable populations who are not food insecure and are not included in the country's new safety net program but are "at risk" to income and asset losses and consumption shocks resulting from the more severe natural disasters. It is estimated that at least a further 35 percent of the population, above those estimated as chronically food insecure and covered by the safety net, is at risk from hunger in the event of an extreme drought such as in 1984. For example a traditional food aid response to a catastrophic drought in today's prices would be estimated to cost about US$1.6 billion, for all beneficiaries, chronic and nonchronic. [37] Instead of the traditional funding approaches that rely on protracted appeals to international donors following a drought, the insurance approach focuses on transferring this risk to the reinsurance and capital markets. Such a mechanism will ensure predictable and timely availability of funds for the DPPC to launch emergency relief operations and appropriate interventions in the event of a well-defined rainfall deficit at harvest time. Some of the benefits of this type of insurance-based emergency funding include objective payouts, timely delivery, and funding in cash. In the case of Ethiopia, the insurance approach would allow intervention four months earlier than the traditional appeals-based system.

Policy objectives

Both proposed agricultural risk management structures are in line with the GoE current poverty reduction strategy, which focuses on 1) agricultural-led, rural-based growth, recognizing the importance of improving the environment for exports, private-sector growth, and rural finance; and linked to this, 2) food security. Clearly the micro-level weather insurance initiatives are complementary to the government's primary focus on agricultural development.

The poverty reduction strategy is characterized by strong country ownership and focuses on a broad-based participatory process. In particular the GoE favors a gradual shift from food assistance, assistance in-kind, towards financial assistance that could be destined for the purchase of food from the domestic market. The New Coalition for Food Security is a testament to the government's ambitious poverty reduction strategy: the main features of the safety net are multi-annual funding, transition towards cash-based programming, scaled-up public/community works, linkages with broader food-security programs, harmonized budgeting, and monitoring and evaluation. The Food Security Coordination Bureau has been created, under the Ministry of Agriculture and Rural Development, to coordinate all food-security programming, including the safety net. Targeting the nonchronically hungry but food-insecure or vulnerable populations, an index-based weather insurance approach for Ethiopia that aims to provide contingency cash funding for responses to severe and catastrophic drought is clearly in line with the government's strategy and complementary to the safety net initiative.

If the World Bank-WFP feasibility study indicates this is an appropriate approach for Ethiopia and the WFP, the aim is to pilot the concept and design an insurance contract for the WFP, transferring the risk to the international reinsurance markets for the 2006 growing season. In effect, in the pilot stage of the

initiative, the WFP will be the counterparty to any commercial transaction with the international reinsurance markets and it is expected that donors will pay for the premium associated with this risk transfer. However, the ultimate aim of the initiative ideally would be for the GoE to take responsibility for this risk management program as part of their overall and long-term poverty reduction strategy.

Constraints

There are two major constraints that in the short term can limit the proposed risk management frameworks:

1. The first constraint comprises the weather-observing network and the weather data in Ethiopia. The National Meteorological Services Agency (NMSA) is responsible for a network of over 500 weather stations and rain gauges throughout Ethiopia. However, not all of the weather stations have the reporting capabilities or the historical data of the quality sufficient to transfer risk to the international markets or even to perform an actuarial analysis of the weather risks involved. Furthermore, given the large size and challenging topography of the country, the spatial distribution of the network is inadequate to protect the entire country from weather risk. These issues will hamper both micro- and macro-level efforts. On the micro-level, initially, only farmers who live near good weather stations will benefit from the availability of weather insurance. Furthermore, the EIC may find it difficult to secure reinsurance for this risk until the quality and security of the NMSA network improves. On the macro-level scale, the weather protection can only be designed using weather stations that adhere to the strict quality requirements of the international weather market. This will naturally limit the scope of the project in the first years.

2. The second constraint, more relevant for the macro-level weather-risk transfer, comprises fiscal constraints; namely, the ability of the government of Ethiopia to eventually take over the ex ante funding of the emergency relief operations program and take responsibility for the premium payments necessary to have this funding mechanism in place.

Products and risk transfer structure

Both micro- and macro-level proposals are focused on index-based weather risk management solutions.

Micro-level*:* At the micro-level, the EIC will market and sell weather insurance contracts to kebeles (small groups of farmers) and/or farming cooperatives to protect their farmer members from the financial costs associated with crop failure as a result of adverse weather. The products will be similar in concept to the products offered to farmers in India, but it will be sold at the group rather than individual level in line with farmer preferences identified during discussions and focus groups in Assassa. The EIC will then seek international reinsurance for their portfolio of weather risk.

Macro-level*:* At the macro-level, lack of rainfall is the dominant, immediate cause of emergency relief operations in Ethiopia. It is therefore an appropriate proxy for representing economic loss due to drought, and also a simple, objective basis for index insurance. The appropriate index must be based on a weighted average, or "basket," of as many stations as possible to capture the macro-level nature of the risk the GoE faces. The government may be able to cope with small, localized droughts by transporting food supplies from other regions of the country and by sourcing government budget reserves. Retaining such risks will most probably be a more cost-effective solution than seeking insurance, and Ethiopia should be able to take advantage of any natural diversification of the country to reduce its insurance costs. However, in situations where drought affects several regions, is national, or when there is a severe regional drought, this reallocation of resources may not be manageable for the government, and it would be appropriate to utilize the basket-based insurance product to fund the expected emergency relief operations in a predictable and timely manner if such an event occurs. The basket approach also reduces the risk of

reliance on one weather station and also the associated issues of moral hazard and basis risk. On this note, including more stations in the basket not only gives better national coverage and hence representation of the index, but also increases the placement potential of the structure in the international reinsurance markets.

In the pilot stage of the program, the WFP will be the counterparty to any commercial transaction with the international reinsurance markets and it is expected that donors will pay for the premium associated with this risk transfer. However, in the event of an extreme and catastrophic drought, any payment triggered by the insurance would be made available to the GoE DPPC. This would allow the provision of resources early to the GoE and thus the beneficiaries to ensure appropriate consumption smoothing and to avoid distressed sale of assets, which is vital if the intervention is to play an effective and protective role. With the availability of cash, the intervention can also be used to fund activities, other than food aid, that are already established in other parts of the country such as: cash-transfers, food-for-work, or cash-for-work schemes. Ultimately the long-term objective would be for the GoE to go directly to the market and take responsibility of this program, rather than through the intermediary WFP.

MALAWI AND SADC: WEATHER RISK TRANSFER TO STRENGTHEN LIVELIHOODS AND FOOD SECURITY [38]

Country context and risk profile

Malawi is dominated by smallholder agriculture, cultivating mostly maize — the staple food. Maize is very weather sensitive and requires a series of inputs. The economy and livelihoods are affected by rainfall risk (and resulting food insecurity), soil depletion, lack of credit, and limited access to inputs. Malawi suffers serious capacity constraints because it is ravaged by poverty and AIDS. Very few people have the energy and skills to build financial service programs.

Current response

Malawi used to have a paternalistic state culture. The role of the state in agricultural marketing (mainly tobacco, and also maize) is still strong and therefore, prices are not free and smallholder incentives are distorted due to food aid and the state marketing board sale of subsidized maize. The state and donors respond to recurrent drought-induced food crises by ad hoc disaster relief programs.

Proposed agricultural risk management structures

Micro-level: At the farm level, weather-based index insurance allows for more stable income streams and could thus be a way to protect peoples' livelihoods and improve their access to finance. **A**n insurance product can be based on a maize production index constructed from weather data recorded at Lilongwe (capital of Malawi) airport weather station. Analysis and simulations conducted for the Lilongwe area indicate that the match between potential insurance payouts and farm-yield losses would be adequate. All that is needed is for demand to be aggregated at product distribution channels such as the National Smallholders Association (NASFAM). Rural financial institutions could finance the insurance premiums and lower interest rates to borrowers since the financial institutions stand to benefit from reduced default risk.

At the intermediary level, banks can package a loan and the weather insurance into a single product, a weather-indexed maize production loan. The farmer would enter into a loan agreement with a higher interest rate that includes the weather insurance premium that the bank pays to the insurer. In case of a severe drought impacting maize yields, the borrower would pay only a fraction of the usual loan due and would be less likely to default, thus strengthening the bank's portfolio and risk profile. Historical simulations of such a product in Malawi demonstrate that the years of reduced loan payments coincide

with the drought years where farmers suffered from much lower yields, mainly, 1992 and 1994. Recently CRMG partnered with Opportunity International (OI) to develop weather insurance products to secure credit for groundnut farmers. The first policies are expected to be sold in 2005.

Macro-level: A specific nationwide maize production index for the entire country could form the basis of an index-based insurance policy or an objective trigger to a contingent credit line for the government in the event of food emergencies that put pressure on government budgets. Applying the Lilongwe maize farmer index approach to the macro-level situation, we can define a Malawi Maize Production Index (MMPI) as the weighted average of farmer maize indexes measured at weather stations located throughout the country, with each station's contribution weighted by the corresponding average or expected maize production in that location. Given the objective nature of the MMPI, and the quality of weather data from the Malawi Meteorological Office, such a structure could be placed in the weather risk reinsurance market. Analysis shows that Malawi could need up to US$70 million per year to financially compensate the government in case of an extreme food emergency. Given the size, such a transaction would be treated on a stand-alone basis, with an estimated premium of approximately three times the expected loss for the reinsurer. In this case, the expected loss — given 40 years of historical rainfall data and assuming that the government retains the cost associated with deviations in maize production up to 25 percent away from normal — is US$2.32 million, implying a premium of US$6.96 million or an insurance rate of 10 percent for such a product.

The weather index/drought risk management approach suggested for Malawi is one that could be extended to a regional level to include all members of SADC at some point in the future. Weather risk can be retained and managed internally if the areas under management are significantly diverse in their weather risk characteristics. This immediately suggests that the weather sensitivity of neighboring countries, the SADC members, must be taken into account when considering Malawi's weather risk profile and its need for outside insurance. Analysis of the SADC region shows that on average, two countries suffer a drought each year. However, the distribution of drought events in SADC is extremely long-tailed, with the possibility of widespread drought events that could potentially devastate the region. This indicates that the most efficient way to layer and thus manage the risk is as follows:

SADC Fund: If the average financial impact of four average droughts in the region is approximately US$80 million, this could be the size of the SADC fund, with each member contributing its share determined by an actuarially fair assessment of the expected claim of each country.

Reinsurance and/or contingent credit lines: SADC-wide events incurring a financial loss of say US$80-350million could be transferred to the weather-risk reinsurance/professional investor market. Alternatively, the SADC members could have access to a World Bank contingent credit line in such situations.

Securitization: The final and extreme layer of risk, such as drought in 10 countries, occurring 1 percent of the time, could be securitized and issued as a CAT bond (investors lose the principal if the event occurs in exchange for a higher coupon) in the capital markets. The advantage of capital markets for this risk transfer is the immense financial capacity of these markets and also the longer tenure of CAT bonds — up to three years, possibly longer.

A more efficient means of transferring risk implies that costs could be greatly reduced for the member countries by transferring risk as part of a regional strategy rather than by transferring that risk one country at a time. For example, the SADC fund approach above would reduce insurance costs by 22 percent for Malawi due to risk pooling effects.

PERU: GOVERNMENT-LED SYSTEMIC APPROACH TO AGRICULTURAL RISK MANAGEMENT

Country context and risk profile

Peru is currently negotiating a Free Trade Agreement with the United States. One of the most vulnerable sectors to the opening of the economy is the agriculture sector because of its lack of competitiveness. In this context, the Ministry of Agriculture (MA) is preparing a multidimensional strategy that involves extension services to farmers and the engineering of innovative financial schemes, with the participation of the private sector to facilitate access to better technology and new markets. Due to farmers' lack of bankable collateral, the MA intends to facilitate the emergence of a sustainable private agriculture insurance market

Current response

There have been two major efforts in the last decade to introduce agriculture insurance in Peru with disastrous results. The lack of technical knowledge and exposure to catastrophic events like El Niño generated big losses in the industry. From the consumers' perspective, the previous schemes were not transparent and the lack of education translated into dissatisfaction about the scope and use of this financial instrument. Currently, crop insurance or similar instruments are not available to farmers.

Proposed agricultural risk management structure

The government of Peru (GoP) created a special commission in 2003 to draft a strategic plan for the implementation of an agriculture insurance scheme in Peru. The treasury ministry, agriculture department, insurance regulator, private and development bank representatives, farm unions, and insurance representatives participated in the discussions and recommendations for the strategic work plan. A specific body designed for that purpose is the Technical Committee for the Development of Agriculture Insurance (TCDAI), which was created by ministerial resolution in September, 2004, and is housed in the agriculture ministry. The TCDAI is currently working on several technical studies related to the design and implementation of agriculture insurance in Peru.

Policy objectives

The main objectives of the GoP are to 1) maintain prudent fiscal, monetary, and exchange rate policies, essential to attract investment and promote continued growth; and 2) complement growth with direct interventions to address inequality and poverty, focusing on excluded groups: indigenous people; Afro-Peruvians; and at-risk groups — youth and single mothers (Peru, 2004-6).

Constraints

In addition to fiscal constraints, Peru's agricultural sector is divided between powerful export-oriented, high-value agricultural producers concentrated in 12 valleys along the coast, and the sierra- (highlands), and selva-based (jungle) smallholder agricultural producers.

Products

The technical committee, assisted by CRMG, proposes the following work plan:

Design of prototype index contracts: The feasibility of these types of contracts is tested for several crops located in the three main areas of Peru (coastal, sierra, and selva). The contract design requires weather data from the Peruvian weather service (SENAMHI). This is a priority for the work plan.

Demand assessment: This activity will aim at gauging the demand for weather insurance by type of producer and will include participatory design sessions that will address questions such as what types of

contracts to develop and for what periods. This activity will include the training of potential end users (farmers) regarding index insurance basics (for example, types of indemnities, how are they calculated, how the contracts are settled, how the premiums are calculated).

Delivery model design: Based on a mapping of rural financial intermediation in Peru, this activity will evaluate segmented delivery models that would be used for real distribution channels to reach farmers with small- and medium-sized farms with viable production potential. Prototype contracts by institution and client segment will be used to work with potential intermediaries for contract designs.

Regulatory review: The purpose is to develop a strategic work plan with the insurance regulator to prepare the necessary technical documentation for the index insurance product to be approved under the guidelines of property insurance.

The TCDAI has defined the following crops and areas of interest for the feasibility study:

1. Rice — San Martín
2. Mango — Piura
3. Yellow maize — Lima
4. Potato — Huanuco
5. Coffee — Cuzco
6. Cotton (Tangis) — Ica
7. Cotton (Pima) — Piura
8. Asparagus — Lima

Risk-transfer structure

The GoP seeks to enhance risk-taking capacity in the country generally by facilitating special risk transfer arrangements with insurance companies in Peru — particularly those that wish to launch agricultural insurance. Specifically, the GoP wishes by set up a US$50 million fund that will take agricultural risk, managed by the leading second-tier bank (COFIDE). In addition, the technical committee plans to develop index-based products for insurers that can be directly transferred into international risk markets.

MONGOLIA: WORLD BANK CONTINGENT CREDIT FOR LIVESTOCK MORTALITY INDEX INSURANCE[39]

Country context and risk profile

The economy of the Mongolian countryside is herder-based. Agriculture contributes nearly one-third of the national GDP and herding accounts for over 80 percent of agriculture. Animals provide sustenance, income, and wealth, protecting nearly half the residents of Mongolia. Shocks to the well-being of animals have devastating implications for the rural poor and for the overall Mongolian economy. Major shocks are common as Mongolia is a harsh climate and animals are herded with limited shelter. From 2000-2002, 11 million animals perished due to harsh winters (*dzuds).* The government of Mongolia has struggled with the obvious question of how to address this problem.

The Mongolian government requested specific assistance in coping with extreme livestock losses. Given the nature of highly correlated death rates for animals in Mongolia, an index-based livestock insurance (IBLI) product was proposed and in May 2005, the World Bank approved a loan to Mongolia to finance the Index-Based Livestock Insurance Project. This project will support a three-season pilot program in three states in Mongolia and includes a contingent debt facility to serve as a mechanism for protecting against extreme losses during the pilot. The major objective of the pilot program is to determine the

viability of IBLI in Mongolia, including testing herders' willingness to pay for an IBLI product. The index would pay indemnities based on adult mortality rates by species and by soum (province). By law, Mongolia performs a census of animals each year. Elaborate systems are in place to assure the quality of the data. The proposed pilot involves three distinct layers of risk: 1) self-retention by the herder; 2) a base insurance product (BIP) for mortality rates in a certain range; and 3) a disaster response product (DRP) for livestock losses beyond the layer covered by the insurer.

An index-based insurance program was recommended because of significant concerns about moral hazard, adverse selection, and extreme monitoring costs associated with any individual livestock insurance program in the vast open spaces of Mongolia. Weather index insurance was considered; however, it was determined that the weather events contributing to livestock deaths were too complex to develop this alternative. The project will support continued research to strengthen the mortality index by incorporating other indexes, for example the Normalized Difference Vegetation Index (NDVI), as a means of establishing a more secure index for paying losses.

While it is believed that the index-insurance product can be effectively underwritten, significant financial exposure for a nascent insurance market that has extremely limited access to global risk-shifting markets remains among the largest challenges. Given concerns about financing extreme losses, the pilot design involves a syndicate pooling arrangement for companies. Pooling risk among the insurance companies offers some opportunity to reduce the exposure for any individual insurer. In the short term, the government of Mongolia will offer a 105 percent stop loss on the pooled risk of the insurance companies. Herder premiums go directly into a prepaid indemnity pool. Insurers must replace the reinsurance cost and the exposure above 100 percent for the prepaid indemnity pool.

In the syndicated pooling arrangement, participants share underwriting gains and losses based upon the share of herder premium they bring into the pool. Each insurer also pays reinsurance costs that are consistent with the book of business they bring into the pool. This gives the reinsurance pool the benefits of the pooling arrangement and provides the opportunity to build reserves for the overall activity. The reinsurance pool pays for the first layer of losses beyond the 105 percent stop loss. Once the reinsurance pool is exhausted, the government of Mongolia can call upon the contingent debt to pay for any remaining losses.

A major advantage of having a prepaid indemnity pool is that all other lines of the insurance business are protected from the extreme losses that can occur from writing an agricultural risk policy that is highly correlated. In addition, the long-term vision is for the syndicate to be well positioned to find risk-sharing partners in the global community quickly, as the pooling arrangement is both risky and profitable. Reinsurers might be willing to provide capital and enter quota-share arrangements on that risk. To the extent that the risks within the pool are standardized, using the same measures and procedures, one can also envision this mechanism serving as a means to securitize the risk. Finally, the design also offers the opportunity to transition the system to the market once it is learned whether herders find the BIP an acceptable product and demonstrate a willingness to pay.

The first challenge to the risk transfer structure is the uncertainty of the livestock mortality index based on an annual government census of all animals in the country. Several systems are in place to monitor potential problems during the pilot, for example the movement of animals across soum borders. From the perspective of the reinsurer, even the government could have the incentive to tamper with the data if this data determines the level of reinsurance claims. The project seeks to establish systems to verify losses using third-party audits. A second challenge to this structure is the sustainability of the proposed pooling mechanism that determines reinsurance premiums for each participating insurer using advanced modeling procedures. Human capital within the country must be developed to perform these duties. Pooling mechanisms generally tend to fail because of collective action problems and high transaction cost. The

challenge in Mongolia will be to move the pooling mechanism to a private-sector entity by the completion of the pilot; otherwise the system will likely be unsustainable if left to the government to maintain.

GLOBAL STRATEGY: THE GLOBAL INDEX INSURANCE FACILITY (GIIF)

Background

Economic growth prospects of developing countries are negatively impacted by external shocks, which create both short- and long-term physical and financial distress. The lack of coherent and timely response to shocks coupled with indirect impacts on growth and investment compound the cost of direct physical damage. Uninsured enterprises also do not develop their full earnings potential because they engage in low risk/low return activities to minimize downside risks. Generally too much capital goes into nonremunerated self-insurance. OECD countries, on the other hand, tend to be better equipped to manage shocks since they have larger diversified economies that can withstand such events and because private assets are insured. Demand for risk management instruments is often frustrated by market gaps and entry barriers. International reinsurers, for example, require substantial minimum risk amounts: "The greatest challenge is not to find capacity, but to find a large enough portfolio to make it worth underwriting," (Tobben, 2005).

The GIIF seeks to close the gap between developing country demand for insurance against severe shocks at public and private levels and index insurance markets. The World Bank Commodity Risk Management Group (CRMG) already addresses the knowledge gap through technical assistance and the demonstration effects of pilot transactions, but credit and market gaps will limit its ability to scale up. GIIF would lower the entry barrier for international risk transfer by pooling smaller transactions and would thereby scale-up risk transfer out of developing countries.

Present

The European Commission has allocated a total of €25 million for a commodity risk management facility and submitted the concept as part of the "conditional billion" package, the final tranche of the 9th EDF/2003-2007, to the Council Working Group of Member States. CRMG is putting together a proposal for a Global Index Insurance Facility (GIIF) that would intermediate weather, disaster, and price risk (all index based) between developing country-based primary insurers, governments, banks, and organized markets. CRMG is in intense dialogue with market makers as to the risk-taking capabilities of the GIIF, with a focus toward "crowding-in" rather than "crowding-out" the private sector. The facility would consist of a €100m capital investment in a risk-taking entity which would underwrite global weather, disaster, and price risks in developing, and in particular, the African-Caribbean-Pacific (ACP) countries. The main objective of the facility would be to achieve returns on equity and build a diverse portfolio of developing country risk that has previously not been transferred to the capital and insurance markets, and thereby leveraging private risk transfer. The main development objective would be to alleviate poverty by facilitating effective disaster insurance and risk reduction which allows countries and enterprises to profitably invest resources instead of wasting resources with inefficient self-insurance. The GIIF would further facilitate risk transfer by absorbing transaction costs for developing country clients through cofinancing of premiums, funded separately by EC/ACP funds and through reinvestment of dividends by public sponsors.

Types of risks underwritten by the GIIF

The facility would provide cover for disaster, weather, and price risks by underwriting index-based insurance contracts. Index insurance also allows very timely automatic settlements, which is crucial for effective disaster response. Price risk management contracts will be based on liquid exchange-traded

instruments, set at market prices. All indexes have to be objective, transparent, published, and sustainable; price indexes have to be liquid. The GIIF would regularly publish insurable indexes.

Exit strategy

This facility seeks to catalyze a commercial market for index-based insurance products in developing countries by "crowding in" the private sector. Following the start-up phase of the GIIF, it is expected that the market for developing country risk will be sufficiently developed and competitive, to offer risk management products to end-user countries and clients at a reasonable cost. This period could vary from 7 to 10 years.

7. POTENTIAL ROLES FOR GOVERNMENTS AND THE WORLD BANK

Agricultural producers and other rural residents are often exposed to a variety of biological, geological, and climatic factors that can negatively affect household income and/or wealth. In addition, agricultural producers are often faced with tremendous variability in output and/or input prices. Given this environment, risk-averse individuals will often make investment decisions that reduce risk exposure but also reduce the potential for income gains and wealth accumulation. Thus, risk contributes to the "poverty trap" experienced by rural people in many developing countries.

For a variety of reasons (discussed in Chapter 2), markets for transferring these risks are typically either very limited or nonexistent. This "market failure" has stimulated a number of policy responses. Many developed countries have highly subsidized, farm-level agricultural insurance programs. Critics argue that, in addition to being very expensive, these programs stimulate rent-seeking activity, are highly inefficient, and may actually increase risk exposure by encouraging agricultural production in high-risk environments (Chapter 3). Regardless, given fiscal constraints in most developing countries, highly subsidized, farm-level agricultural insurance programs are not a realistic policy option.

Index-based insurance products have been proposed as an alternative risk-transfer mechanism for rural areas in developing countries. While not a panacea for all risk problems, index-based insurance products may prove to be valuable instruments for transferring the financial impacts of low-frequency, high-consequence systemic risks out of rural areas (Chapter 4). However, for a variety of reasons, government intervention may be required to generate socially optimal quantities of risk transfer. Governments need to carefully consider the extent and nature of any intervention in markets for index-based insurance products (Chapter 5). These efforts can be facilitated by World Bank policy advice, lending instruments, and monitoring and evaluation systems (see World Bank, 2004, 2005b). This chapter sets out policy and operational implications for governments and subsequently for the World Bank operational agenda.

GOVERNMENT ROLES

Risks in rural areas need to be managed at the macro-, meso-, and micro-levels. Governments need to 1) Understand the country's rural risk profile; 2) Quantify the impact of this risk on the economy and revenues; 3) Design a rural risk management framework; and 4) Implement risk reduction and risk transfer.

Identify the risk profile for private and public assets and business flows

A natural risk assessment identifies the types of risks that affect major private and public assets and economic activities in rural areas.[40] This assessment distinguishes between micro-level risk and macro-level risk and considers both geographical and seasonal variations. Identification of risks at the micro-level is typically based on household surveys and also specific risk surveys. The objective is to understand the types of risks that affect households and the nature of those risks. At the macro-level the assessment would consider the aggregate economic effect of household risk with a particular focus on government budget exposure.

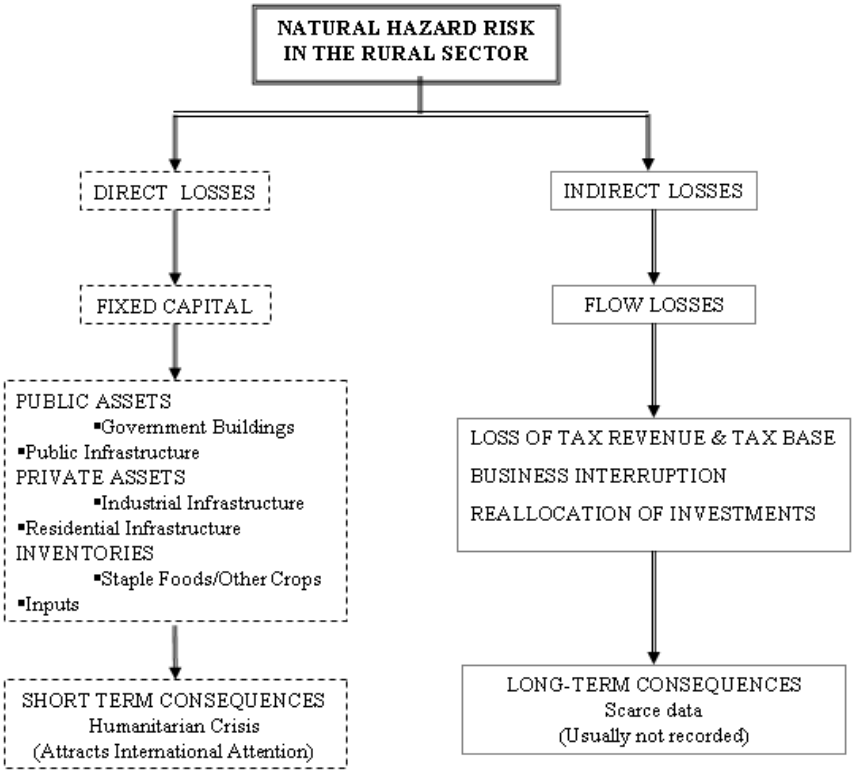
Quantify risk impacts at all levels

Once the major risks have been identified, governments need to quantify the potential impact of those risks. What is the magnitude of potential physical and indirect losses for different types of assets and economic activities? As represented in Figure 7.1, a variety of indirect business flow losses often compound the direct physical losses caused by natural hazards.

Design a rural risk management framework

Government intervention in risk transfer markets needs to be based on a careful analysis of market shortcomings and a clear statement of how government involvement will address those shortcomings (Chapter 5). A well-designed rural risk management framework clearly delineates public and private roles in the ex ante world of risk reduction and risk financing and also the ex post world of emergency response. This framework takes country-specific objectives and constraints into account instead of replicating developed country historical models (Chapter 3). The objective is to learn from these historical examples and then apply that understanding to country-specific efforts that incorporate new and innovative risk transfer instruments (Chapter 4). Private decision makers need to know where and how government would intervene at different risk levels in order to plan accordingly. Agricultural enterprises, for example, might intensify production if a credible and reliable insurance cover is in place.

Figure 7.1 Potential impacts of natural hazards



Source: Authors

Implement a risk management strategy

To be successful, a well-conceived risk management strategy must be supported by a credible government commitment that is sufficiently funded over the long term. While appropriate government roles will vary to reflect country-specific circumstances, one strategy might be government intermediation of index-based risk management products that are available in international capital and reinsurance markets and

also the creation of infrastructure to support the development and implementation of new private risk management products.

WORLD BANK ROLES

The World Bank can engage in a number of activities that, in coordination with governments, may lead to increased risk-transfer opportunities for agricultural producers and other rural residents in developing countries. In general, these activities include educational efforts, incorporating risk management into holistic rural development strategies, investment lending operations designed to encourage the development of risk transfer markets, ex ante coordination of donor responses to natural disasters, and monitoring and evaluation of the performance of index insurance instruments.

Continue to build global knowledge of this new approach to agricultural risk management

The World Bank is uniquely placed to reach governments and decision makers on all continents. The World Bank, in general, and ARD, in particular, can facilitate technology transfer across continents. This economic and sector work of ARD will be disseminated outside the World Bank: in FY-06, CRMG is planning Global Distance Learning events that will have a component on agricultural risk management concepts and also two workshops in two different regions, possibly in connection with weather insurance pilot project launches; and inside the World Bank, mainly through "brown-bag" lunches and a workshop.

Risk management strategies should be explicitly incorporated into rural development strategy formulation and development policy lending programs

While the World Bank and the IMF have a long history of assisting governments in dismantling unsustainable mechanisms for managing price risk, often this is done in the absence of alternative risk management tools or a clear risk management agenda for deregulated markets. This gap has contributed to a breakdown in marketing arrangements and credit channels so that these efforts have sometimes not produced the projected results (Kherallah et al. 2002). The importance of addressing issues of collateral policies and institutional development as an integral part of reform is now widely understood, but in many circumstances, this is not a quick or easy task.

While the index-based risk management tools discussed here are not a cure-all, they can help credit institutions, producer organizations, and (in some cases) producers directly, to manage production risk, and by doing so they can help reconnect farmers to output and credit markets. In assisting policy makers in the design of reform programs, the World Bank should routinely consider how to facilitate the development of risk management instruments in the country, and should be prepared to support this process through policy advice, and in some cases, lending operations. Often, this may require reforms of collateral, macroeconomic, or regulatory policies. For example, risk management instruments using international markets cannot operate properly while exchange controls are in place. Often local regulations affecting insurance or financial markets will also need to be revised.

Because government or World Bank involvement in any risk management program may require trade-offs with other means of enhancing rural development and reducing vulnerability (for example, irrigation, infrastructure, etc.), the program should be embedded in an overall rural development strategy so these trade-offs can be carefully weighed. This will also allow for linkages with other rural development objectives (for example, rural finance).The overall rural development strategy should take a holistic approach to risk management, recognizing that diversification of income sources (remittances, off-farm employment) is often an important means of reducing rural vulnerability. In addition to formal risk management markets, the strategy should consider what reforms are needed to encourage income diversification and allow farmers full choices in a functioning market place. This may include, for example, market liberalization and privatization, investments in transportation, communication, and

market infrastructure, legal rights that guarantee market access (especially for women and ethnic minorities), provision of market information, and measures to better integrate rural and nonrural labor markets (see Siegel 2005; Lanjouw and Feder 2001; Lloyd-Ellis 1999; and Mead and Liedholm 1998). Attention should also be dedicated to safety nets designed to minimize the need to liquidate productive assets in times of emergency that can be scaled up quickly and efficiently (see Jorgensen and Van Domelen 1999; Jutting 1999; and Morduch 1999).

Investment lending operations can be used to encourage risk management

At the macro-level, a number of World Bank instruments (and those of other donors) exist or are being explored to cushion the fiscal and balance of payments adjustments required when countries are faced with shocks from natural disasters or international price movements of major commodity exports or imports. These include automatic mechanisms to adjust debt service — or even augment financing — in response to exogenous shocks. (For a full discussion, see World Bank, 2004, 2005b.)

At the meso-level, risk management tools can be used to improve the functioning of government social safety net programs, either at the central or more decentralized levels. For example, index-based insurance instruments could be used to provide ex ante contingent funding that would allow safety net programs to expand when they are most needed, without the delays and uncertainties caused by reliance on the budgeting process or on external aid. Likewise, use of index-based insurance by individual farmers, associations, processors, or rural finance institutions would reduce their degree of uncertainty and facilitate primary producers' access to credit and input markets.

Although the primary World Bank tool now being used to support the development of risk management markets is AAA, investment lending projects may also be useful in some cases. Examples can be found in World Bank-facilitated price risk management efforts. In Turkey, for example, a Commodity Market Development Learning and Innovation Loan (LIL) had the objective of first supporting the development of physical commodity markets, which in the long term could evolve into a domestic platform for trading futures contracts. The project financed the upgrading of testing laboratories, warehouse facilities, and regional market infrastructure, and also technical assistance to enhance and harmonize grades and standards for some commodities, upgrade the warehouse receipts system, and improve the operations of the commodity market regulatory authority. While there is still no domestic futures trading, there has been progress toward the more limited objectives of establishing better linkages between producers and buyers and encouraging forward contracting for spot delivery, which is another means of reducing price risk. In addition, the project has facilitated more efficient price discovery: the prices for cotton and wheat determined on two exchanges which participated in the project are now used as the official record of domestic market prices for those two commodities.

A possible project to set up a regional system of weather insurance in southern Africa is being explored (see Box 7.1).

Box 7.1 Examples of Potential World Bank Investment Lending Projects to Facilitate Risk Management

Global level

Global Index Insurance Facility: The facility would consist of a capital investment in a risk-taking entity that would underwrite global weather, disaster and price risks in developing countries. The main development objective would be to absorb costs for initial transactions for developing country clients through cofinancing of premiums, funded separately and through reinvestment of dividends by public sponsors. The main commercial objective of the facility would be to generate a modest return to its shareholders through active management of a diverse portfolio of developing country risk that has previously not been transferred to the capital and insurance markets. The facility would perform several commercial functions that could provide benefits to developing countries.

National level

Infrastructure*:* Fallback stations, new weather stations, maintenance of weather stations, communications equipment for weather services, contract with data vetting service (such as UK Met Office), set-up of weather databases (online), cleaning and enhancing of weather data;

Regulatory assessment*:* Review of legislation, drafting of new regulations, general policy framework review, country-specific policy framework review (including recommendations on subsidy levels, national weather risk funds, basis risk matching funds, etc.);

International market/pilot transactions*:* Travel to international reinsurance market contacts, technical assistance from international experts (including CRMG), and premium cost-sharing funds. These premium support funds would compensate the extra premium costs that international and national insurers add in the infancy stages of the product and as a result of data uncertainty. These premium support funds would be phased out as volumes increase and as the extra costs for premiums decline;

Knowledge transfer*:* Travel costs, expertise, design of methodologies and tools to quantify risk exposure, underwriting guidelines, manuals, operational system development, study tours.

Financial backing of risk-taking entities*:* Governments can intermediate catastrophic risk between international risk insurance markets and insurers or other risk takers in the country and could either set up a separate risk-taking vehicle or could enter into a contingent credit agreement with the World Bank to lower annual premium costs.

Regional level

Financial contribution to a regional index insurance fund*:* Pooling systemic risk at the regional level could significantly lower premium costs and warrant the set-up of a regional risk fund that would insure its members according to sound actuarial rates before it lays off risk in international markets.

Climate prediction and forecasting technologies: Can be cost effectively rolled out only at a regional level that achieves economies of scale and forces collaboration.

Source: Authors

The target of the project, as currently conceptualized, would be individual farmers but a project like this could be targeted at the meso-level as well. Pooling risk at the sub-regional level (a complex climate system) can reduce financing requirements by taking advantage of scale. The sub-region as a whole is more attractive to international insurance markets (through risk-spreading) than individual countries. Other direct benefits are that ideas can be spread faster and capacity developed more effectively through cross-country collaboration, and that regional institutions are in place that could support project implementation.

Donor coordination

Like farmers, governments may suffer from a form of moral hazard. Donor response to catastrophes can reduce the interest of the developing country government in using markets to shift natural disaster risk, as was the case in Nicaragua following the overwhelming response to Hurricane Mitch. The problem with such donor responses is that they cannot be predicted with certainty and are often not timely. Furthermore, localized disasters, which may devastate a community but have limited impact outside this area, may get overlooked by the international community. A better solution would be to take advantage of

these donations in a more structured and ex ante fashion. Donors could, for example, contribute to an insurance pool for the country or region. The World Bank — particularly the teams in countries that are especially prone to disasters — can play a leading role in this through the consultative group process.

A special case of aid in response to disasters is food aid following a serious drought. Here, the need for an improved approach is particularly acute, as in-kind assistance often has counterproductive effects in undermining development of local production and marketing channels. Also, aid given ex post in response to droughts is often late in arriving, forcing starving victims to liquidate productive assets, and perpetuating a cycle of poverty. Use of an index-based instrument to fund emergency food aid holds the promise of a response which would be 1) much more rapid, since payment would be triggered by weather events far in advance of the actual food shortages; and 2) far less disruptive of local markets, since payouts to the food aid agency would be in cash, and would be used to procure food locally if possible, or to pass payments directly to beneficiaries as cash. The World Bank is collaborating with the World Food Program and other donors to pilot such an approach.

Monitoring and evaluation of transactions

The work on index insurance in developing countries is still in an early stage and its development impact is not yet proven. A number of assumptions about the value of these instruments, their utility at the farm level, and their development impacts, need to be evaluated. CRMG has launched a first baseline study with DECRG (Research Department of the World Bank). Generally utility at the farm level can be gauged by the level of take-up of unsubsidized and unbundled products and particularly the level of repeat buying. Panel studies will reveal the actual impact of these products. Indicators are level of inputs used and diversification of farm activities, particularly the share of cash crops in the overall portfolio. Another important linkage will be to gauge if index insurance products improve access to credit or improve the terms of credit for small farmers in developing countries. Both the Indian and the Mongolian pilot project have very explicit monitoring and evaluation components that will attempt to gauge these activities.

As with any innovation, index insurance products for agricultural production risk will go through some significant changes in the next few years. It is likely that we will learn that they work under some circumstances and not under others. Mistakes will be made. Learning from those mistakes will take careful evaluation and adjustments. At this stage, the key value added from index insurance products appears to be the opportunity for structured ex ante financing of catastrophic risk that is tied to highly correlated losses resulting from weather risk in agriculture. Such risk cannot be pooled at the local level and the special structures introduced in this ESW give hope that they can be shifted into global markets.

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Notes

[1] The ex ante or ex post classification focuses on the point in time in which the reaction to risk takes place: prior to the occurrence of the potential harming event (ex ante) or after the event has occurred (ex post).

[2] While the focus of this document is on natural disaster risks, the World Bank is also heavily involved assisting the transfer of commodity price risk for certain commodities. CRMG will produce a separate document on lessons learned in the price risk management area in 2006.

[3] Given the combination of price risk and weather risk management transfer, to the extent that farmers have storage, it is also possible to reduce risk and improve income as farmers are in better position to store commodities and bargain for higher prices.

[4] For similar classifications, see Hardaker et al., 2004; and Harwood et al., 1999.

[5] For other classifications, see Hazell, 1992; World Bank, 2001; Anderson, 2001; Dercon, 2002; Townsend, 2005; Siegel, 2005.

[6] This section is based on Townsend, 2005.

[7] See Dercon 2002; and World Bank 2001, for a discussion of the role of safety nets in risk management in developing countries.

[8] Examples are the Tanzanian coffee and cotton hedging activities of a major cooperative and CRDB Bank Ltd., the leading private agricultural bank on the New York coffee and cotton futures markets.

[9] See the Skees, Barnett, and Hartell background paper for more discussion of "cognitive failure" and "ambiguous loading."

[10] For more detailed reviews of the U.S. program, see Glauber 2004; Skees 1999a; and Skees 2001.

[11] The remaining 2 percent of premium is for a variety of other insurance products.

[12] Under certain conditions, policyholders can choose to divide farms into smaller units that are insured separately.

[13] The catastrophic policy only covers yield losses in excess of 50 percent of the APH yield. The rate of indemnity is only 60 percent of the expected market price.

[14] Information in this section is based on Pikor and Wile 2004.

[15] This section is based on the a background paper by Skees et al. 2005.

[16] This paper does not address the responses to the price risk management needs in developing countries, as CRMG is preparing a separate analysis and evaluation (possibly in an ESW) of the ongoing transaction support and capacity building work in this area by CRMG.

[17] By contrast, area-yield indexes in developing countries are often not measured in a reliable and timely manner.

[18] Basis risk also exists with traditional farm-level multiple-peril crop yield insurance. Typically, a very small sample size is used to develop estimates of the central tendency in farm-level yields (for example, 4-10 years in the United States.). Given simple statistics about the error of small sample estimates, it can be easily demonstrated that these procedures sometimes generate large mistakes when estimating expected farm-level yield. This makes it possible for farmers to receive insurance payments when yield losses have not occurred, and not to receive payments when payable losses have occurred. Thus, basis risk occurs not only in index insurance but also in farm-level yield insurance. Another type of basis risk results from the estimate of realized yield. Even with careful farm-level loss adjustment procedures, it is impossible to avoid errors in estimating the true realized yield. These errors can also result in under- and overpayments. Longer series of data are generally available for area-level yields or weather events, than for farm-level yields. Because of this, the square-root of n rule suggests that there will be less measurement error for index insurance products than for farm-yield insurance products when estimating the central tendency. If the standard deviation of the random variable used for the index is lower than the standard deviation of farm-level yields (as would be the case if the index is based on area-level yields), the index insurance will have even less measurement error relative to a farm-level insurance product.

[19]For example, temperature can be measured with field lodged temperature gauges that automatically transmit data to a central server.

[20] Byerlee (2005) distinguishes between growth strategies for irrigated high potential systems and areas with limited market access in marginal dry lands. Strategies for these two very different types of agricultural systems put different emphases on agricultural policy options of intensification, diversification, increasing farm-size, enhancing off-farm activities, or encouraging exit from agricultural activities.

[21] Dercon (2005; p. 161) also cites the importance of macroeconomic stability and better functioning asset markets because they increase the usefulness of self-insurance. In addition, "Better access to alternative economic activities and increased income-earning opportunities could strengthen income-based strategies. Public safety nets could be a useful alternative, although initiatives to develop such programs should take into account their effect on existing

risk-coping strategies. Strengthening self-insurance through group-based savings, for example, is an alternative that remains insufficiently explored."

[22] Little et al. (2004; pp. 15-17) describe how disastrous droughts in Ethiopia were the key external factor that "pushed vulnerable households into poverty out of which many had not recovered by 2003," (3 years after the major drought event). Moreover, "the occurrence of periodic droughts tends to wipe out asset gains that poor households attain."

[23]These estimates are from Skees et al. (2005). U.S. Summary of Business data were used for the U.S. estimate and data from Pikor and Wile (2004) were used for the Canadian estimate.

[24] The timely payment of claims was one of the key reasons for the success of the Indian weather insurance pilots.

[25] CRMG, for example, conducts participatory sessions with farmers in order to identify contract and delivery model designs. In Ethiopia, smallholders designated kebeles (local elected leaders of around 600 farmers) to collect insurance premiums for group insurance. In a Malawian village, villagers wanted the village leaders to contract weather insurance, allowing smaller farmers to be serviced by their smallholder farmers' association. In India, microfinance institutions are the trusted intermediaries for small farmers. In some places, cooperatives have gained the necessary trust with farmers to deliver insurance products.

[26] This probability distribution was developed using procedures that smooth historical data. In reality, there are few observations below the 500 mm level.

[27] To be clear, there is no known threshold where cognitive behavior begins. In this example, 500 is used for illustration purposes only. If the value were known with certainty, it would also be relatively easy to develop an analytical solution for the "optimal subsidy" level.

[28] International donors could also reinsure this layer through a contingent credit.

[29] This section draws on an idea formulated in Skees and Hess (2003) where a "standing disaster insurance program" is proposed.

[30] DOC contracts would most likely be reinsured using direct or packaged transfers of the underlying indexes. Pooling prior to transfer is likely to offer only minimal benefits since in-country spatial diversification opportunities are generally limited for catastrophic layers.

[31] This section borrows from World Bank 2005a.

[32] The weather shock insured safety net concept has been launched by a Malawian government official, Patrick Kabambe, and is more broadly based on the work of the World Bank CRMG-Social Protection unit (Harold Alderman, Will Wiseman), and the CRMG-Southern Africa rural sector unit (Rick Scobey) on the subject of covariate shock insurance in Africa.

[33] The unorganized sector corresponds to the informal or submerged economy, such as small-scale nonregistered businesses in India, particularly in rural areas.

[34] A BASIX subsidiary that is a Reserve Bank of India licensed bank, providing microcredit and savings services in three districts.

[35] BSFL is another BASIX subsidiary company. Launched in 1998, BSFL is the "flagship" company of the group and is a Reserve Bank of India registered nonbank financial company, engaged in microcredit and retailing insurance and providing technical assistance. Source: www.basixindia.com

[36] A 2002 IFC survey of agricultural enterprise participants in Ukraine reveals that the failure of farmers to repay credit was often due to low sale prices of, and limited demand for their products; lack of market information; and high interest rates. Only 12 percent of respondents cited bad harvests as the reason for farmers' inability to repay

their debts. In the years before the survey was taken, there were marketing problems for grains and good harvests. The 2002/2003 crop failures due to frost and drought would likely significantly change the perceptions of farmers.

[37] $1.6 billion was estimated by assuming WFP costs for the 1999-2000 drought, where the WFP was responsible for 45 percent of the total food aid deliveries appealed by the DPPC. Using that cost estimate to determine 100 percent of the cost of the drought in 1999-2000, then multiplying this cost by the magnitude of the 1984 drought (which has been assumed to be the worst case scenario), the total cost today of a 1984 drought was estimated to be $1.6 billion.

[38] See Hess and Syroka, 2005, for more details on Malawi and the SADC region.

[39] Skees provided some of the background for this section; See also Mahul and Skees, 2005.

[40] For information on this topic see the World Bank Hazard Risk Management Unit Web site: http://www.worldbank.org/hazards/