State of Knowledge Report — Market Development for Weather Index Insurance Key Considerations for Sustainability and Scale Up[1]

Innovation in Catastrophic Weather Insurance to Improve the Livelihoods of Rural Households

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Using experience gained from a number of projects developing agricultural insurance and, in particular, projects in many lower income countries to introduce index insurance, GlobalAgRisk, Inc., has produced this report with the support of the Bill and Melinda Gates Foundation. The report presents an analysis of various aspects of projects and products that have the greatest potential for sustainability and scalability. Clearly, it is not possible in a general document such as this to address the circumstances of any particular project or country. Therefore, this report is not intended to provide, and should not be relied upon as providing, advice with respect to any specific project. No one should take any action with respect to guidance provided in this report without making their own assessment of the appropriateness of the ideas presented for the particular problem at hand. The report is provided on the basis that users assume full responsibility for any decisions made, or actions taken, with respect to any matters considered in this report, and neither GlobalAgRisk nor the Bill and Melinda Gates Foundation accept any responsibility for such decisions or actions.

Table of Contents

Figures

Acronyms and Abbreviations

ABIC	*Agricultural Bank Insurance Company (Vietnam)*
ADP-SP	*Agricultural Development Support Project (Malawi)*
ATM	*Automatic Teller Machine*
CGAP	*Consultative Group to Assist the Poor*
CLIMBS	*Coop Life Insurance and Mutual Benefit Services*
CRMG	*Commodity Risk Management Group (now ARMT)*
ENSO	*El Niño Southern Oscillation*
GIZ	*Deutsche Gesellschaft für Internationale Zusammenarbeit*
GRIP	*Group Risk Income Protection*
GRP	*Group Risk Plan*
HARITA	*Horn of Africa Risk Transfer for Adaptation*
IBLI	*Index-based Livestock Insurance*
MFI	*Microfinance Institution*
NOAA	*U.S. National Oceanic and Atmospheric Administration*
OIBM	*Opportunity International Bank of Malawi*
RFE	*Randomized Field Experiment*
SKR	*State of Knowledge Report*
SST	*Sea Surface Temperature*
VBARD	*Vietnam Bank for Agriculture and Rural Development*
SBS	*Superintendencia de Banca , Seguros y AFP (Peru)*

Executive Summary

This is the third in a series of State of Knowledge Reports (SKRs), produced by GlobalAgRisk, regarding various aspects of weather index insurance. The first SKR focused on data challenges that face many weather index insurance products and how those data challenges vary for different types of products and different target markets. The Data SKR also assessed the status of emerging data technologies and scientific advances that may one day reduce the need for significant investments in weather station infrastructure. Weather stations are sparse and difficult to maintain in many lower income countries. The second SKR focused on legal issues associated with weather index insurance. This SKR focuses on developing markets for weather index insurance.

Three general recommendations emerge from this SKR and the preceding reports in this series.

1. From the outset, projects supporting index insurance must formulate evaluation strategies related to targeted development objectives. When derived from a clearly defined causal theory of change, these strategies can aid investment and expansion decisions.
2. Rather than providing premium subsidies, donor and government funds should be used to invest in building local capacity and establishing the proper institutional frameworks that can support the development and growth of index insurance markets in lower income countries.
3. To address challenges in the market development process, product design should focus on:
    a. *Starting with products for risk aggregators;*
    b. *Insuring against the broader economic consequences of weather risk, not just direct losses;*
    c. *Insuring against low-frequency, catastrophic risks; and*
    d. *Reducing costs and adding value through innovative design and delivery features.*

While weather index designs can be used for various types of social protection programs, the focus in this SKR is on commercial index insurance products that are priced to reflect risk exposure and carry the usual loads -- products that are not reliant on subsidies to cover recurring operating costs. In particular, we focus on two types of weather index insurance products: those targeted to risk aggregators and those targeted to households. Risk aggregators are firms such as financial institutions and value chain firms that provide services to households. These firms are negatively affected by the correlated weather risks in a geographic region, either through direct losses or through the effects of the catastrophe on clients or customers. Weather index insurance targeted to risk aggregators can create significant indirect benefits to rural households if it leads to improved access to, and continuity of, the services provided by the risk aggregators. Weather index insurance targeted to households provides direct risk management benefits to the household.

Too often, weather index insurance projects focus almost exclusively on product design without paying sufficient attention to broader market development challenges. We contend that successful market development requires far more than just a good product design. Index insurance market development in lower income countries requires investments in various public goods that are unlikely to be provided by market participants. Among these are an enabling legal and regulatory environment, capacity building for local implementation stakeholders, and risk management education for potential index insurance purchasers. Investments in market development are likely to create long lasting benefits that extend beyond just an emerging market for a specific index

insurance product. For these reasons, this SKR presents product design issues only after thoroughly reviewing broader market development needs.

Successful weather index insurance markets must be both sustainable and scalable. They must have potential for expanding beyond small-scale pilots to become widespread and self-sustaining. Successful index insurance markets are important because they have the potential to improve economic well being by providing a formal mechanism for transferring catastrophic risk exposure out of the local area and into global financial markets. However, for a variety of reasons, it is generally not easy to create sustainable and scalable index insurance markets. Unlike some microcredit innovations, weather index insurance products cannot be easily replicated in other contexts. The existing insurance law for the jurisdiction may not allow for index insurance products. Tailored products may be needed to match local weather risks. Local insurers and regulatory authorities are highly unlikely to have knowledge of, or experience with, index insurance products. Target populations typically are unfamiliar with index insurance and in some cases may be unfamiliar with insurance generally. Efficient delivery channels must be identified that will allow index insurance products to be offered in remote, rural areas.

Index insurance projects also need an evaluation plan. Evidence of sustainability and scalability does not automatically guarantee that an index insurance project is meeting its intended development goals. This must be evaluated through using formal empirical methods that are driven by sound economic thinking. A causal model is required that clearly describes how the introduction of an index insurance market is expected to cause behavioral changes that will lead directly or indirectly to poverty reduction. The evaluation plan must also specify how empirical data will be used to assess whether the introduction of index insurance actually led to the hypothesized behavioral changes. Since impacts on poverty reduction are likely to occur only over an extended period of time, the evaluation plan should also specify intermediate performance goals that are indicative that the anticipated long-run changes will actually occur.

Market development also requires making strategic choices regarding the sequencing of investments in insurance products. An initial focus on risk aggregator products may be necessary to generate sufficient volume to attract the attention of insurers and insurance regulators. Once this initial hurdle has been overcome, extending the product to individual households can be a natural progression in the course of market development. Weak or failed pilots of household products, in contrast, discourage future investments and dampen demand.

Sustainable and scalable weather index insurance markets offer products that create value for purchasers and profit opportunities for the insurer. Among other things, the product design must specify the sales period, the underlying index, the coverage period, the payout structure of the contract, and the premium. Products must also be designed to account for limitations on available data and available delivery channels. In general, product design challenges are greater for weather index insurance products targeted to households than for products targeted to risk aggregators. Given the relatively small value of each policy sold, it is critical that household index insurance products be designed to minimize the transaction costs associated with selling policies and paying indemnities. In some cases, bundling of weather index insurance with other services (e.g., credit) may increase demand for the product.

Chapter 1 Introduction

Catastrophic weather events negatively affect both firms and poor households in rural areas of lower income countries. Direct effects are often shockingly apparent — assets destroyed, incomes reduced, costs increased. Indirect effects are less obvious but no less devastating. In response to these direct and indirect effects, firms operating in vulnerable regions tend to adopt highly risk averse business strategies that limit access to the services that they offer, for example, lenders may be reluctant to make loans in regions that are vulnerable to extreme weather events. These limiting risk averse strategies, in turn, constrain opportunities for households and other businesses in the region that could benefit from greater access to these services. Households in vulnerable regions also tend to adopt highly risk averse strategies for utilizing household assets. Protecting their assets that have been obtained at very high opportunity cost in the form of foregone consumption becomes a principal concern. While understandable, these behavioral responses to catastrophic weather risk reduce economic growth and contribute to the perpetuation of poverty in rural areas of many lower income countries.

The overarching message of this State of Knowledge Report (SKR) is that, in many contexts, weather index insurance[2] has significant potential for improving economic well-being by providing a formal mechanism for transferring catastrophic risk exposure out of the local area and into global financial markets. However, an important part of this message is that it is generally not easy to create sustainable and scalable index insurance markets.

While it is difficult to separate the various processes involved with market development of index insurance products, we consider that the objective of any effort should be to create sustainable markets with scalable index insurance products that contribute to economic growth by transferring spatially correlated weather risks out of the local region.

Over the past ten years, much has been written about index insurance, many feasibility studies have been funded by donors, and dozens of index insurance pilot programs have been implemented, but very few have scaled up beyond the pilot stage. The exceptions have often utilized large government or donor-funded premium subsidies to attract buyers — a strategy that almost certainly cannot be sustained. Why have widespread examples of scalable and sustainable index insurance markets not yet emerged, and what constraints have been encountered? What institutional or technological innovations are needed to address those constraints? What types of index insurance products show the most promise in the near future, and what types of products may require more patience for institutional or technological innovations to emerge? What does the current state of knowledge on index insurance imply about the recommended sequencing of future donor investments? In short, where should we go from here?

This SKR provides answers to these questions based on our own extensive research and field experience as well as careful attention to the work of others. The report does not provide a comprehensive review of all existing index insurance products; rather case examples are used to

[2] For ease of exposition, unless stated otherwise, the terms, index insurance, and, weather index insurance, will be used synonymously to refer to insurance products based on weather indexes.

illustrate particular concepts. We are also careful to present approaches that may differ from our own.

We focus on two general classes of market-based index insurance products: those designed for risk aggregators and those designed for households. We use risk aggregator to denote firms such as financial institutions and value chain enterprises whose businesses are negatively affected by the correlated weather risks in a geographic region, either through direct losses or through the effects of the catastrophe on their clients or customers. Products targeted to households can protect against a wide range of losses resulting from catastrophic weather events. To date, many household products have been designed to protect against yield losses for a particular crop. However, these are but one type of household index insurance product. Index insurance can be used to protect households from a host of direct and consequential costs and losses caused.

1.1 Challenges Associated with Market Development of Index Insurance

Index insurance is an innovative insurance mechanism with a recent history. Index insurance in lower income countries is still fairly new, with less than ten years of pilot implementation. In developed countries, effective adoption of financial innovation typically takes a full generation. Thus, it is premature to fully understand what works and what does not work when developing index insurance markets in lower income countries. For comparison, experimentation and implementation with microfinance programs have been ongoing for more than thirty years. Though microfinance programs have become widespread, questions still remain about the magnitude of their welfare benefits for poor households (Armendáriz and Morduch, 2010).

Uncertainty and disillusionment in regard to testing index insurance are not openly addressed. Failure to openly communicate uncertainties about index insurance, to learn from past mistakes, or share past successes, may lead to the funding of poorly structured projects that hold little promise. If a number of pilot tests fall short of expectations, widespread enthusiasm is likely to be followed by disillusionment and dwindling support. Considering the crippling effects of unmanaged weather risk — perpetuating poverty and stunting economic growth — it would be unfortunate to discourage future investments in an innovative instrument that has the potential to address at least certain aspects of financial market failures associated with spatially correlated weather risks.

Index insurance products and pilots are not easily standardized or replicable. In recent years, donors have made significant investments in developing index insurance programs in lower income countries. Products have been developed and pilot-tested in dozens of countries across the globe. These investments have been motivated by an expectation that index insurance will follow the path of microfinance and microinsurance products (e.g., life insurance) in reaching some degree of standardization that will lead to widespread growth. However, it is highly unlikely that this expectation can be fully realized. If any clear lesson can be learned from experiences to date it is that index insurance products cannot be easily standardized and replicated. The mixed results of index insurance pilots, and the lack of widespread scale-up of those pilots considered successful, have stimulated thinking about what adjustments are needed for these products to become scalable and sustainable (Hazell et al., 2010; Hellmuth et al., 2009; Skees et al., 2007; Mechler, Linnerooth-Bayer, and Peppiatt, 2006).

Experience to date suggests that index insurance products must be designed in a manner that is responsive to a host of heterogeneous geographic, meteorological, cultural, political, legal, regulatory, economic, and institutional factors. Some features of index insurance products may be replicable across different contexts, but outcomes are ultimately influenced by unique characteristics of the local context such as the risk profile, data availability, economic and cultural characteristics of the target market, availability of other risk management mechanisms, and the capacity and commitment of local stakeholders, who are critical to the implementation of these products (e.g., insurance providers, regulators, etc.). For this reason, a replicable "off-the-shelf" product that can be easily transplanted to different settings is unlikely to emerge.

1.2 Transitioning from Initial Funding Phases of Index Insurance Pilot Programs to Market Sustainability

Large upfront funding of public goods is required. Because of heterogeneous local factors, significant upfront investments are required in the initial phases of index insurance market development. Thus far, the funds required for catalyzing markets for index insurance have been supplied by the donor community. Index insurance products will almost certainly be novel in most countries and tremendous variation will exist across countries in the extent to which businesses or households have experience with any type of insurance product. Thus, scalability is limited by the extent to which sustainable market foundations have been laid through investments in public goods such as weather data infrastructure, consumer education, capacity building of local implementation actors, and the development of appropriate legal and regulatory frameworks that can address the unique characteristics and supervisory challenges associated with index insurance. These are large public goods investments that the private sector cannot assume.

Where best to target donor funding. Funds invested in developing index insurance markets are obviously not available to be invested in other development priorities. So it is important to recognize the significant opportunity cost associated with investments in index insurance and make careful decisions about which public goods to support. For example, given the considerable maintenance costs, one must question the long-run sustainability of donor investments in hundreds of automated weather stations to support index insurance offers targeted to households in a particular area. Such investments extend well beyond the initial installation. Automated weather stations require constant maintenance to ensure quality data. By changing the product design and target market it may be possible to introduce index insurance into an area with far less investment than is required for obtaining and maintaining a large number of new weather stations. This would allow resources to be reallocated to other public goods such as consumer education or building the capacity of local stakeholders — important investments for long-run sustainability.

Transferring capacity to local stakeholders to manage the market as donor funding phases out. Because outside support carries the risk of creating dependency, it is critical that capacity building occurs among local partners so they can manage the market as donor support is phased out. Moreover, transferring capacity from outside facilitators to local stakeholders allows index insurance to evolve and adapt to the needs of the target market — an important condition for scalability and sustainability. Building a sustainable market foundation will expedite scale up

and, by reducing the high transaction costs of initial setup, encourage the introduction of additional new insurance products.

Focus on market-based approach and commercial insurance products. An emphasis on long-run sustainability motivates this document's focus on market-based index insurance products, i.e., commercial insurance products priced to reflect the risk exposure, including the usual loading, and not reliant on subsidies to cover long-term operating costs.[3] A market-based approach ensures that the cost of the assumed risk is clearly communicated to decision makers. The cost of risk informs decisions such as whether to invest in risk mitigation, to expand activity, or to exit a current economic activity that is simply too risky.

Commercial insurance markets for low-probability, catastrophic events tend to fail. This focus on market-based approaches does not preclude a role for governments and/or donors in transferring an extreme catastrophic risk layer. Much research on the psychology of risk has shown that individuals have great difficulty making rational decisions about low-probability, catastrophic events. When the probability is extremely low (even though the consequences of an occurrence may be extremely high) it is common for individuals to treat the probability as zero. In contrast, insurers do not ignore low-probability, catastrophic events in their decision making and significantly load premium rates for insurance that protects against extreme layers of risk due to uncertainty about both the likelihood and magnitude of loss. Due to the distinctive features of decision making for these two groups, the combined result for insurance markets for extreme, catastrophic risk layers is they tend to fail — that is, the market clears at less than socially optimal quantities of catastrophic risk transfer. For this reason, it may be necessary in market-based index insurance programs for governments and/or donors to support the transfer of an extreme catastrophic risk layer. In these cases, it is important to carefully segregate the social program that provides protection against the extremely rare, highly catastrophic, risk layer from the market-based insurance that protects against more frequent (though still potentially catastrophic for policyholders) risk layers.

1.3 Findings from Previous State of Knowledge Reports (Data Issues and Legal and Regulatory Issues)

This is the third in a series of SKRs regarding various aspects of index insurance. The first SKR focuses on data challenges that frequently occur with index insurance products and how those data challenges vary for different types of index insurance products and different target markets. That SKR also assesses the status of emerging technologies that may reduce current limitations on available weather data and significantly change what is possible in the future. The second SKR focuses on legal and regulatory issues associated with index insurance and, in particular, the critical need to review how to position index insurance under the insurance laws of a specific country. The specific nature of legal and regulatory challenges can vary across jurisdictions and also depends on how the insurance product is classified by regulatory authorities. The second SKR considers the legal risks typically associated with index insurance and how those risks may be mitigated and reduced. In particular, that SKR considers the

[3] We do not explicitly consider the use of index insurance for disaster relief or social protection in this document, however, many of the principles presented here for a market-based approach to sustainable market development are relevant to such applications as well.

potential of classifying index insurance contracts as *valued policies* versus *contingency* or *fixed sum insurance*. Rather than attempting to summarize the sometimes complex legal issues concerning index insurance in this SKR, interested readers are encouraged to consult the legal and regulatory SKR (GlobalAgRisk, 2010a).

The following themes emerge from the two prior SKRs:

1) **Index insurance can be used to protect against a variety of consequential losses.** While most pilot projects to date have focused on using index insurance to protect against yield losses for a single crop, catastrophic weather events affect firms and households in many different ways, reducing both returns on investments and wealth positions.

2) **Index insurance is for catastrophic risk.** Insurance is a relatively expensive instrument so it is best used to transfer extreme risks that cannot be managed efficiently using other methods. Other instruments, such as savings and credit, are more efficient mechanisms for managing moderate risks.

3) **Data constraints are lowest for risk aggregator products.** Risk aggregators, such as rural banks and members of the agricultural value chain, can use risk pooling to manage their exposure to idiosyncratic risks but not their exposure to correlated weather risks. Index insurance is designed to transfer spatially correlated risks. The data systems required to support the offer of index insurance products to risk aggregators also require less spatial specificity than those required for household insurance products.

4) **The legal status of any proposed index insurance product is critical to its success and should be addressed by developers early in the development process.** The legal classification of an index insurance product has important implications for long-run sustainability and scalability. It may be possible to design the legal contract to provide additional flexibility.[4]

5) **Developers of index insurance products initiate and maintain contact with the insurance regulator.** Regular contact with the insurance regulator throughout the design and implementation process may allow appropriate design changes to be made to accommodate the product within the country's regulatory framework.

1.4 Organization of the SKR

The remainder of the report is organized as follows: Chapter 2 provides a brief review of index insurance and its advantages and limitations for managing weather risk in lower income countries; Chapter 3 considers how index insurance can contribute to economic growth and poverty reduction; Chapter 4 describes challenges for market development: developing scalable and sustainable index insurance markets; Chapter 5 focuses on the role of feasibility assessments as a tool for assessing the potential scalability and sustainability of index insurance markets; Chapter 6 discusses practices for evaluating if, and how, index insurance brings about desired changes; This chapter also presents some of the challenges associated with assessing the impact of an intervention such as index insurance that is characterized by voluntary market

[4] For example, in the legal and regulatory SKR (GlobalAgRisk, 2010a) we consider whether it is appropriate to design and classify index insurance as a type of valued policy or as contingency or fixed sum insurance.

participation; Chapters 7 and 8 describe how market development and product design efforts, respectively, can address important challenges to scalability and sustainability; Case studies are utilized to demonstrate key points; and lastly, Chapter 9 offers recommendations derived from the discussion in the previous chapters.

Significant challenges remain in developing scalable and sustainable index insurance markets. Nevertheless, we remain optimistic that index insurance will play an important role in economic development as adjustments are made while creating these markets. The growing interest in index insurance has been motivated by much careful thought about how the risk of catastrophic weather events contributes to slow economic growth. Because it is uniquely designed to transfer spatially correlated weather risk, index insurance holds considerable potential as a tool for poverty reduction and economic development. This report aspires to bring that potential closer to fruition by stimulating an exchange of ideas with practitioners and academic colleagues. For this reason, we welcome feedback and comments.

Chapter 2 What Is Index Insurance?

Traditional non-life insurance products are generally written as indemnity insurance contracts, under which the payment made is intended to indemnify the policyholder for actual measurable losses.[5] For example, the payout received from a homeowner's property and casualty insurance policy will depend on the extent to which the home was damaged by a covered peril such as fire or storm. The payout received from many types of agricultural insurance policies will depend on the extent to which the realized yield was less than its expected value due to a covered peril.

Two types of indexes. Index insurance payouts are based, not on the actual losses incurred by the policyholder but rather, on the realized value of an underlying index. It is important that there be a general correlation between the index and losses, in the sense that larger variations in the value of the index, are related to greater the value of the losses. Index insurance products can be classified in two broad categories: *indexes that aggregate losses* over a group and *weather-based indexes*.

> **Indexes that aggregate losses.** Aggregate loss data describe losses across many individuals, typically in the same geographic region. An index of group losses serves as a proxy for the losses of individual members of the group. The Group Risk Plan (GRP) and Group Risk Income Protection (GRIP) in the United States and the Index-based Livestock Insurance (IBLI) Program in Mongolia are examples of index insurance products based on aggregate loss measures. The GRP uses county-yield data for a specific crop as the index for calculating payouts (Skees, Black, and Barnett, 1997). GRIP is a revenue insurance design based on the product of the county yield and a futures market price. The Mongolia IBLI uses government-developed estimates of soum (county)-level livestock mortality by species as the index for determining insurance payouts (Mahul and Skees, 2007). With these products, aggregate data are of a large enough scale to reduce the likelihood that any individual policyholder can significantly influence a payout.

[5] Of course, the compensation may be subject to a deductible and/or co-payment and losses attributed to certain causes may not be compensated.

Weather-based indexes. Weather-based indexes use measurements of weather events that are correlated with losses of the policyholder as the basis for an insurance payout. The weather index serves as an indicator or predictor of the risk event itself, e.g., rainfall measurements as an indicator of flood or drought.

Both types of indexes have their relative merits and shortcomings, and feasibility assessments determine which types of indexes are possible. However, in lower income countries, weather data are often easier to obtain and may be less prone to tampering than aggregate data on crop yields, for example. This report focuses primarily on weather-based indexes as these are more commonly used for index insurance in lower income countries, however the ideas presented for developing sustainable and scalable products applies to both types of indexes. In addition, while our focus here is on weather index insurance, many of the principles can also be applied to index insurance products based on other natural disasters (e.g., earthquakes).

Why use index insurance and not traditional, loss-based insurance? Why would an insurer in a lower income country offer index insurance instead of traditional, loss-based insurance? In many respects, traditional insurance is the most straightforward way to insure against losses because payouts are based directly on the measurable losses experienced by the policyholder. But this direct connection between the loss experienced by the policyholder and the payout received also causes significant problems.

Adverse selection. Some potential policyholders will have greater loss exposure than others. To offer a traditional insurance product, the insurer must be able to accurately estimate the loss distribution for each potential policyholder and charge a premium rate that accurately reflects the potential policyholder's loss exposure. So those with higher (lower) loss risk will be charged higher (lower) premium rates. The difficulty is that the data required to estimate a loss distribution for every potential policyholder are often not available. If the insurer is unable to accurately classify potential policyholders according to their loss exposure, *adverse selection* occurs — the pool of insurance purchasers will be disproportionately composed of those who have been offered premium rates that understate their actual loss exposure. Adverse selection undermines the long-run sustainability of an insurance product.

Moral hazard. *Moral hazard* is another problem with traditional insurance products — policyholders' incentives to reduce their exposure to losses diminish since insurance payments will at least partially compensate for any realized losses. Moral hazard can be controlled to some degree by policy provisions requiring the policyholder to utilize specific risk mitigation strategies, but the cost of monitoring and enforcing these policy provisions can be excessive. Deductibles and co-payments are also often used to help control moral hazard.

High operational costs. A final problem with traditional insurance is the very *high operational costs*. As indicated earlier, the insurer must assess the loss exposure (estimate the loss distribution) for every insurance applicant. This often requires traveling to the exact location where any insured losses would occur. After an extreme event triggers an insurance payout, a representative of the insurer may again have to travel to the location to assess the magnitude of loss and determine the appropriate compensation to the policyholder. These operational costs are quite high even in developed countries where transportation

infrastructure is good, insurers have access to the latest computer and communications technologies, and the insured value for a single policy may be quite large. In lower income countries, transportation infrastructure tends to be underdeveloped and sporadic (especially in rural areas), insurers often lack access to modern information technologies, and the insured value for a single policy is often quite small.

High operational costs, along with adverse selection and moral hazard, typically render some types of traditional insurance infeasible in rural areas of lower income countries. Moreover, without adequate reinsurance, traditional insurance falters when faced with large magnitude losses resulting from correlated weather risk exposure. By design, index insurance is well-suited to address each of these market failures. With index insurance there is little potential for adverse selection or moral hazard because the payout is based on the realized value of the index rather than on the policyholder's realized loss. Administrative and delivery costs are greatly reduced because there is no need to assess each potential policyholder's risk exposure, no need to monitor for violations of policy provisions by policyholders, and no need to assess the actual losses experienced by policyholders. However, index insurance does have a *basis risk* problem.

2.1 Basis Risk Is a Primary Limitation of Index Insurance

Since index insurance payouts are triggered by the realized value of an index rather than the policyholder's realized losses, it is quite possible that the policyholder will receive a payout that is either greater than or less than the actual realized loss. It is even possible that the policyholder may suffer a loss and not receive a payout. Likewise it is possible that the policyholder may receive a payout without incurring any loss. This lack of perfect correlation between payouts and losses, *basis risk,* is one of the primary limitations of index insurance.[6]

Technically, basis risk can be conceptualized as the variance of the conditional distribution of the policyholder's losses given a specific value of the index. Since sufficient data are generally not available to estimate this conditional distribution, practitioners tend to measure basis risk as the linear correlation (or covariance) between the index and a policyholder's losses. However, the simple historical correlation between the index and losses may fail to accurately assess basis risk because the dependence is likely not linear (see GlobalAgRisk, 2010b, for a more technical discussion). The correlation between the index and the losses is likely higher (lower) for more (less) catastrophic weather events.

Reducing basis risk. While basis risk cannot be completely eliminated, steps can be taken to reduce it. Basis risk is less likely to pose hurdles when index insurance is properly marketed and clients understand which risks are covered by the insurance policy and which risks are not. In addition, product design can significantly reduce basis risk. Concentrating on the most severe and highly spatially correlated risks minimizes basis risk, as does carefully choosing the target market for the index insurance product. Basis risk is particularly troublesome for products with

[6] It is important to note that some degree of basis risk also occurs with many loss-based insurance products due to errors in estimating expected values and losses (Barnett et al., 2005). Additionally, other financial contracts used to manage risk, such as commodity futures, also have basis risk. A wealth of literature demonstrates the value of these risk management mechanisms despite basis risk; therefore, we do not repeat those same arguments here for index insurance. Rather, our discussion of basis risk focuses on methods used to conceptualize, estimate, and manage it with index insurance.

high data requirements, and the target market determines how data intensive the product design must be.

2.2 What Are Index Insurance, Microfinance, and Microinsurance?

The term, *microfinance*, is broadly defined as banking services (e.g., credit and savings) destined for the lower income market. Microcredit, i.e., the provision of small loans to the poor, is a subset of microfinance. Microinsurance is similar to traditional insurance, but characterized by small financial transactions per policy and intended for low income households who generally lack access to commercial insurance. Microinsurance products vary in type, the most frequent being health, life, disability, and property insurance (assets, livestock, etc.). Index insurance can be sold as microinsurance but there are important differences between index insurance and the traditional lines of microinsurance. This section compares and contrasts index insurance with the traditional lines of both microinsurance and microfinance.

Index insurance relies on many contextual factors that prevent products from being easily replicable and transferable. In contrast, microfinance and most traditional microinsurance products are often standardized and are thus more easily replicable and transferable. The potential for market volume makes these products more efficient and profitable for providers. Additionally, these products require much lower investments in capacity building and market development. In contrast to index insurance, local stakeholders, such as insurers and regulators, tend to have greater familiarity with microfinance and traditional microinsurance products and there are precedents for their regulation and governance.

Index insurance and traditional microinsurance. Certainly there are similarities between index insurance and traditional lines of microinsurance. A major focus for both has been developing insurance markets in regions where insurance has largely been nonexistent. As a result, these efforts have required significant investments in capacity building. These projects have demonstrated that developing insurance markets for households should be done with a long-term vision as these markets develop slowly.

Despite these similarities, index insurance differs from traditional microinsurance in important ways. First, index insurance is not limited to the micro level. Although most index insurance applications have focused on household products targeted to smallholders, its design is not limited to this application. Index insurance can be offered to risk aggregators, such as financial institutions, and other businesses and groups. Index insurance can also be used to provide contingent risk financing to the public sector. Second, many lines of microinsurance focus on largely uncorrelated risks and thus may not require access to international reinsurance markets. Because it protects against spatially correlated losses, index insurance providers generally must have access to reinsurance even for relatively small pilots. Third, because of their unique characteristics and exposure to basis risk, index insurance products require larger investments in consumer education than traditional microinsurance products.

Index insurance and microfinance. Index insurance targeted to households is similar to microfinance in that both provide formal financial services to low-income populations that have previously been underserved or excluded from the formal sector. Thus, there are common challenges to overcome such as reducing transaction costs to make products more efficient, as well as more affordable and accessible to the poor. In the past, the poor being excluded from

formal financial services led to government interventions (e.g., state-owned development banks that offered highly subsidized low interest loans and highly subsidized crop insurance) that proved to be unsustainable (Armendáriz and Morduch, 2010). Microfinance and index insurance emerged as promising alternatives that could address problems of adverse selection, moral hazard, high transaction costs, and correlated risk that have traditionally reduced access to formal financial services in low-income communities (Barnett, Barrett, and Skees, 2008). However, microfinance remains exposed to systemic risks. In fact, this is some of the motivation for microinsurance, i.e., to protect borrowers from the risks of default and loss of their investment as a result of illness or death of the borrower, or damage to their productive assets.

There is growing recognition that access to complete financial markets that include credit, savings, and insurance increases the potential for economic growth and resilience. Microfinance initially focused on the provision of microcredit but has evolved over time to include a stronger emphasis on facilitating and encouraging savings. As will be discussed later in this document, index insurance is also being shaped by emerging evidence from ongoing pilot applications.

Index insurance is in a separate class. While there are similarities, index insurance differs from microfinance and traditional lines of microinsurance in important ways. Index insurance faces a separate set of challenges, including limited potential for replication, large up-front costs for product development, capacity building, and consumer education, unique legal and regulatory requirements, and the need for access to global reinsurance markets. These challenges in turn put index insurance in a separate class with its own standards against which to judge its pace of progress. Therefore, the expectations for index insurance cannot be equated to the experience and evolution of microfinance in becoming a mainstream product. Still, what one can glean from the experience with microfinance is that it takes time, fortitude, substantial support, and many tests and learning experiences for financial innovations to grow into sustainable markets in lower income countries.

2.3 Index Insurance and Climate Change

Some of the current interest in, and funding for, index insurance has been rationalized by concerns about climate change. To suggest a potential role for index insurance in climate change adaptation, some have even begun referring to weather index insurance as "climate insurance" — terminology that we believe is confusing and unfortunate. For this reason, it seems important to clarify a few key points about index insurance and climate change.

First, index insurance is not being used — and almost certainly cannot be used — to insure against long-term climate change (Collier, Skees, and Barnett, 2009). Instead, almost all index insurance contracts are in force only for a defined period within a single year. They insure against extreme weather events within a given year, not long-term climatic changes.

Second, to the extent that climate change leads to more extreme weather variability, demand will likely increase for financial instruments, such as index insurance, that transfer catastrophic weather risks. However, the importance of index insurance is not contingent on climate change. As described in Chapter 3, index insurance has the potential to address various development challenges related to catastrophic weather risk exposure and thus, contribute to poverty reduction. So while climate change may cause index insurance to be even more important in the future, it is no less critically important today.

Third, while increased weather variability may increase demand for index insurance, it will also lead to higher premium rates. An increase in the likelihood and/or magnitude of the underlying weather variable implies higher expected index insurance indemnities — and higher expected indemnities imply higher premium rates. Any climate change-induced increase in weather variability is expected to occur gradually, so concerns over climate change are not sufficient to rationalize dramatic year-to-year changes in index insurance premium rates; however, uncertainties surrounding expectations about climate change may lead to increases in the risk loads applied to weather insurance premiums by insurers and reinsurers. Yet, premium subsidies are not the appropriate response to high risk exposure and premium rates, as they can reduce incentives for adaptation and risk reduction (see Section 8.4.2).

In summary, index insurance is a financial tool that generally provides coverage against a specified extreme weather event for a defined period within a given year. It cannot insure against long-term climate change nor is the importance of index insurance conditional on a changing climate. If climate change leads to increased weather variability, demand for index insurance may increase. But the cost of index insurance will increase as well. Thus, while index insurance is a tool that some may use to help facilitate adaptation, it will not protect organizations or households from the costs imposed by significant climatic change.

Chapter 3 Poverty and Risk, Insurance, and Economic Growth

Projects to develop index insurance markets in lower income countries are motivated by a desire to stimulate economic growth and reduce poverty. This section of the document presents a theoretical discussion of how catastrophic weather risks contribute to poverty and how index insurance markets can help manage these risks.

3.1 Poverty

For our purposes, poverty can be conceptualized as a household's inability to generate per capita income in excess of a level sufficient to meet basic consumption needs. This definition is based on the notion of poverty line, an imperfect yet convenient measurement based on a threshold (e.g., monetary, nutritional, etc.) below which individuals are considered poor (Ray, 1998). To be clear, poverty is a highly dynamic concept nonetheless. Households that are well above the poverty line today may be thrust below the poverty line at any moment. Thus, while the poorest segments may not have access to financial services, it is quite important that the working poor do have access.

Impoverished households face a number of livelihood constraints, among these include: insufficient quantity or quality of household productive assets; limited access to competitively priced production inputs; limited access to processing and marketing opportunities further down the supply chain; inadequate production technologies; and limited access to competitively priced credit. These factors are typically interrelated and may be compounded by other conditions of the community such as lack of communication or transportation infrastructure and poor law enforcement and/or judicial systems. Alleviating these constraints can provide poor households with new opportunities for production and wealth accumulation.

Understanding the dynamics of poverty in any given community is crucial for determining what, if any, interventions should be employed. An important related question is, "How long are households likely to remain in poverty?" Some households experience poverty as a transitory phenomenon due to illness, loss of employment, or catastrophic events such as drought or flooding. While the shock creates temporary difficulties, these households have sufficient access to markets and levels of household assets that they would be expected to recover relatively quickly and generate income levels in excess of the poverty line. Other households experience poverty as a chronic phenomenon. Because they lack access to critical markets and/or lack sufficient levels of household assets, they remain trapped in poverty.

3.1.1 Inhibited Capital Flows

Among the many factors that contribute to the existence of chronic poverty, a common element is the lack of or limited access to capital. Households can lack assets because they lack access to capital sources from which to fund the purchase of additional assets or improve the quality of existing assets. Households can lack access to competitive input markets because input suppliers lack access to capital or to processing and marketing opportunities because firms in those industries lack access to capital with which to expand their supply of those services. Similarly, the lack of technology, infrastructure, and even law enforcement and judicial systems can be explained, in part, by a lack of access to capital.

But this limited access to capital is itself a puzzle. Standard economic theory indicates that there are diminishing marginal returns to capital. This implies that areas with relatively little capital (such as rural areas of lower income countries) should provide opportunities for relatively higher rates of return on capital investments. Thus, capital should flow naturally from capital-rich, developed countries to capital-poor, lower income countries. Those in developed economies with funds to invest benefit from the higher rates of return offered in lower income countries while those in lower income countries benefit from increased access to capital that can be used to improve the quantity and/or quality of assets.

Lack of efficient mechanisms to transfer risk is a major inhibitor of economic growth. So why does capital not flow naturally from capital-rich areas to capital-poor areas in search of higher rates of return? There are a number of reasons but scholars generally agree that a major inhibitor of capital flows is risk and the high transaction costs required to reduce risk (Besley, 1995, Armendáriz and Morduch, 2010). A central premise of this document is that for rural regions in many lower income countries the lack of efficient (low transaction cost) mechanisms for transferring catastrophic weather risk contributes to low levels of capital investment and thus, limited economic growth (Collier, Skees, and Barnett, 2009).

3.1.2 Credit Constraints

Credit markets are a primary mechanism for facilitating capital flows. Credit creates opportunities to leverage non-liquid assets (e.g., land and human skills) into liquid productive capital. Credit markets also allow borrowers to leverage wealth intertemporally. The borrower pays a price (the interest rate) to have a sum of money that will be repaid in the future. In other words, the borrower is leveraging their future wealth in hopes of increasing their current productivity.

Borrowers pursue credit based on the expectation that the benefit of the credit (of having access to the productive capital) is greater than the interest they pay for this leveraging. The lender is willing to accept this tradeoff only if convinced of the borrowers' ability to generate sufficient future income to repay the loan with interest. When borrowers have access to credit, the monetary net benefits (the value of increased current productivity minus the interest cost) can be reinvested to further increase the assets of the household or business, setting it on a higher growth trajectory.

To see how catastrophic weather risk can interfere with this process, consider a financial institution whose customers are geographically concentrated in a rural area prone to a spatially correlated weather event such as drought. Many households in this area are living in poverty: they depend heavily on income derived from agricultural production that only meets their basic consumption needs; other households are not poor and may even have access to formal financial services, but are on the margins of poverty: one weather event such as drought could wipe them out and thrust them into poverty. Similarly, many local businesses either provide services to agricultural producers or sell consumer goods to households dependent on agriculture. When a drought occurs, a large proportion of the financial institution's non-poor customers will simultaneously experience dramatic income shortfalls. Agriculture-dependent households will experience lower incomes due to crop losses. Many businesses will also suffer as households in the area will now purchase fewer production inputs and consumer goods.

Savings deposits at the financial institution will be withdrawn to cover consumption needs and many borrowers will be unable to meet their debt obligations. The combination of reduced deposits and increased non-performing loans will create severe liquidity problems, reduced income (less funds are available to lend), and increased operating costs for the financial institution. In extreme cases, it may even threaten the institution's solvency. Recognizing the potential for drought to severely damage its business, the financial institution will respond by rationing credit and/or increasing interest rates for households and businesses perceived to be highly exposed to drought.

Ray (1998) provides a simple model of how loan default risk affects interest rates. Assume a lender's expected profit π is

(1) $$\pi = L\left(p\left(1+i\right)-\left(1+r\right)\right)$$

were p is the probability of non-default (thus, $1 - p$ is the probability of default) that is the same for all loans, i is the interest rate charged to borrowers, r is the lender's opportunity cost of funds used for loans, and L is the amount of funds loaned. In a perfectly competitive market, profits would equal zero in equilibrium so

(2) $$i = \frac{1+r}{p} - 1 .$$

Now suppose that the lender's cost of funds r is 10%. If the probability of default is zero ($p = 1$) then the interest rate charged to borrowers is also 10%. However, if the probability of default is 10% ($p = 0.9$) then the interest rate charged to borrowers would more than double to 22%. Keep in mind that for areas exposed to catastrophic weather risks, the actual default rate would not be 10% each year. Instead it would be quite small in years when catastrophic events do not

occur. But when the catastrophic event occurs, the default rate will be quite high, perhaps approaching 50% or higher.

Beyond the increased default risk of individual borrowers, the lender's cost of managing correlated risk is also passed on to borrowers. These increased costs occur because strategies traditionally used to manage uncorrelated risks are not effective for correlated risks. For example, the law of large numbers allows lenders to manage uncorrelated risks through diversification (i.e., reducing the concentration of the portfolio by loaning to many clients). However, diversification is much less effective in reducing the exposure of a lender to a correlated risk. As an illustrative example (adapted from Katchova and Barry, 2005), consider a loan portfolio comprising *n* identical households exposed to an uncorrelated risk (e.g., death of the borrower) and a correlated risk (e.g., drought). As a result of correlated risk, interest rates will also include the cost of managing the correlated risk in the credit portfolio associated with the loan. Thus, the lender's profit equation becomes

$$\pi = L\left(p(1+i)-(1+r+c)\right) \tag{3}$$

where $c \geq 0$ represents the cost of managing correlated risk.[7] Interest rates would now be calculated as

$$i = \frac{(1+r+c)}{p} - 1\,. \tag{4}$$

The lender's cost of managing correlated risk becomes imbedded in the calculation, further increasing interest rates.

Finally, note that this simple example assumes a competitive market for loans. In rural areas of lower income countries, there are often very few formal lenders and sometimes, very few informal lenders. This lack of competition can cause market interest rates to be even higher relative to the lender's opportunity cost of capital.

In this way, weather and other natural disaster risks directly affect local credit markets. Credit constraints and higher costs of borrowing reduce rates of asset accumulation for smallholder households and the businesses that provide services to them, thus retarding economic growth and perpetuating poverty.

While the effective use of credit can increase the trajectory of asset accumulation, borrowing also increases risk. Debt service is a fixed cost that must be paid regardless of realized income and regardless of whether the assets purchased with credit are still productive or have been destroyed due to some unforeseen event such as a catastrophic weather event (e.g., higher yielding crop varieties and associated inputs purchased with credit but the crop is lost due to drought). Reduced income or asset losses caused by a negative shock could saddle the household or business with large debts for the foreseeable future. Thus, in areas prone to catastrophic weather events or other natural disasters, risk averse households and businesses may be reluctant to use credit even when it is available.

[7] As an example, this cost could be excess reserves held by the bank. This cost is represented as a multiplicative scalar because these costs are likely to increase for larger loans that increase the concentration of the portfolio and create larger risk for the portfolio when borrowers default.

3.1.3 Lack of Market Access Due to Catastrophic Risk

While the previous subsection focuses on access to credit, similar opportunities to increase net income and thus, the rate of asset accumulation can result from improved access to other types of markets. New or expanded output markets provide opportunities to increase sales. New or expanded input markets provide greater choices of inputs and more competitive prices. Improved access to labor markets increases employment opportunities for rural households. Of course, the converse is also true: reduced market access tends to reduce rates of asset accumulation.

Households and businesses located in rural areas of lower income countries are generally handicapped by a lack of access to well-developed, spatially integrated, output and input markets. There are many reasons why markets fail to develop, but in rural areas of many lower income countries, catastrophic weather risk is an important constraint on market development. Supply chains can fail to emerge because of catastrophic risk exposure and the credit constraints caused by catastrophic risk.

3.2 Insurance Availability Can Facilitate Asset Accumulation

Appropriate insurance products can facilitate asset accumulation in rural areas of lower income countries. In the most direct sense, insurance can provide at least partial compensation to households and businesses that lose income and/or assets due to negative shocks such as catastrophic weather events.

Insurance availability can also indirectly facilitate asset accumulation. Creditors will often offer more credit and/or better credit terms to borrowers who are insured against income and/or asset losses. In some cases it may be possible for creditors to insure themselves against consequential losses (reduced income and/or increased expenses) that result from catastrophic weather events. To the extent that insurance purchasing makes creditors more resilient, more credit will be available in the affected area both before and after a catastrophic event.

Similarly, insurance availability can indirectly facilitate asset accumulation by improving the resiliency of other businesses that provide valuable market services. The resiliency of households to catastrophic weather events is inextricably tied to the resiliency of the businesses with which they interact, purchasing inputs and selling outputs. Likewise, the resiliency of any business is tied to the resiliency of upstream and downstream firms in the supply chain.

Households and businesses often engage in low-risk, low-return productive activities in an effort to protect limited assets from loss. The implicit risk premium from these decisions can be extremely high (Zimmerman and Carter, 2003; Morduch, 1995). For example, Rosenzweig and Binswanger (1993) find that in the semi-arid tropics of India, poor farmers who engaged in low-risk activities to reduce their exposure to rainfall variability were giving up as much as 35 percent of potential annual profits. If effective insurance could be purchased at a comparatively lower risk premium, households and businesses could switch to productive activities that promise higher rates of return thus also creating the potential for higher rates of asset accumulation.

Chapter 4 Considerations of Sustainability and Scalability

If index insurance is to contribute to long-run economic growth and poverty reduction, it must be both sustainable and scalable — that is, index insurance products must have potential for expanding beyond small-scale pilots to become widespread and self-sustaining. For commercially sold index insurance, the concepts of sustainability and scalability are interrelated. An insurance product that does not exhibit the potential for sustainability will never be scaled up, as the insurer's interest will last only to the extent that the product elicits commercially sustainable demand. Similarly, an insurance product will not last long in the marketplace (it will not be sustainable) if it does not exhibit the potential for achieving sufficient market volume so that economies of scale can be realized.

4.1 Sustainability First

Sustainable insurance products have long-run viability in commercial markets. For an insurance product to be sustainable there must be effective demand for the risk transfer provided by the product and the insurer must be able to supply the product at a price that creates value for policyholders and profit for the insurer.

Sustainability has multiple dimensions. Here we focus on financial viability, operational capacity, and the legal and regulatory environment. These dimensions of sustainability are influenced by product design, market conditions, and government policy.

Financially sustainable commercial insurance products have a premium sufficient to cover all costs, while also providing a return on investment competitive with alternative investments that carry a similar level of risk. The cost of insurance consists of the expected payout, which is often called the "pure premium," and operational costs associated with marketing, underwriting, sales and delivery, data collection and processing, accounting, legal services, and claims adjustment.

In lower income countries, index insurance products are typically developed with donor-funded research and development support. Operational capacity refers to the ability of local stakeholders (insurers, weather bureaus, etc.) to maintain service with limited intervention after external start-up and technical support has been withdrawn. Achieving operational sustainability is not simple as it depends on the capacity and commitment of the local insurance market. Operational sustainability also involves the ability of stakeholders to refine and modify the products in response to changes in the market or the risk environment. These factors are critical and justify investments in education and capacity building as products are developed and implemented.

Sustainability also depends on an enabling legal and regulatory environment to support the development and maintenance of index insurance products. Developers of index insurance products often focus most of their attention on the data analysis and risk modeling required for product design and pricing. While these issues are important, it is also critical to focus on other factors such as what types of insurance products may or may not be authorized under the country's insurance legislation, the enforcement and supervision policies of the insurance regulator, and mechanisms for contract enforcement. For an innovation such as index insurance,

creating such an enabling environment typically requires significant investments in building the capacity of key legal and regulatory stakeholders such as legislators and insurance regulators.

4.2 Scalability

Development professionals often talk about whether it is possible to scale up particular interventions. In this sense, "scale up" is used in a manner that is largely interchangeable with "massification" — a term borrowed from business management to describe a process where a product or service is (re)designed and made available to a broader market. A new development intervention or a new market-based product or service is said to be "scalable" or have "scalability" if it can, in principle, be replicated or transferred to a new environment with little need for additional investment in research and development. In the context of index insurance, scalability implies the potential to transform a small-scale pilot into a larger program or the potential for widespread marketing of a particular index insurance product by a private insurer. Either way, scalability implies that the product has the potential to reach a broader target market.

From the perspective of an insurance supplier, achieving scale refers mainly to market volume measured either in terms of the sum insured or the premium sufficient to support the commercial viability of an insurance product. This obviously depends on having a product design that creates value for a large number of customers. Similarly, development professionals tend to think of scale in terms of identifying "what works" in technical assistance interventions. Both concepts are relevant when thinking about the scalability of index insurance products targeted to rural areas of lower income countries. However, asking "why" a particular strategy works may be more informative as it is the interaction of both the environment, broadly speaking, and the intervention mechanisms that produces results, and it is useful to be able to distinguish between the two effects (Pawson and Tilley, 1997). Understanding why a particular index insurance intervention works is best achieved when enquiry is informed by an underlying causal model that can be generalized to different contexts (Deaton, 2010).

4.3 Challenges to the Sustainability and Scalability of Index Insurance

It is difficult to develop index insurance products targeted to rural areas of lower income countries. The general problems of introducing new insurance markets in areas with little insurance experience are compounded by unique challenges of index insurance products. This section describes common sustainability and scalability challenges as a prelude to subsequent chapters that offer recommendations for how best to address them.

1.1.1 Index Insurance Products Are Not Easily Replicable

In contrast to other pro-poor financial innovations such as microfinance, index insurance is not easily replicable. This is not always apparent. To reduce transaction costs and uncertainty associated with product development, attempts have been made to create standardized contracts that can be extended to different settings. One such effort was the World Bank Commodity Risk Management Group (CRMG) drought index insurance contract for smallholder maize and groundnut producers (Osgood et al., 2007). The contract, which was tied to credit for improved inputs, was first piloted in Malawi with hopes of extending the product to Kenya and Tanzania.

Although initial results appeared promising, operational difficulties changed the course of the pilot in Malawi. Due to loan recovery issues, the pilot transitioned from maize and groundnuts to tobacco — a high-value commodity with a strong supply chain and a reliable mechanism for loan repayment. Since tobacco production is sensitive to both drought and excess rainfall, the insurance contract had to be modified to cover both risks. Additionally, the product shifted from the micro-level (smallholder farmers) to the risk aggregator level (tobacco processing/trading company). In Kenya, in addition to the need to change the contract structure to better reflect the relationship between the local climate and the crop (a prolonged growing season for maize required a three-phase contract), uncertainties as to whether drought represented the dominant risk for farmers blocked the way forward. In Tanzania, operational difficulties (complications with coordinating participation of partner institutions) necessitated a "dry run," which never reached a full pilot stage. The variable factors presented in this example clearly illustrate the difficulties of scaling up index insurance using standardized contracts. Given all the operational challenges encountered in the field, a more complex strategy is required — even when working in settings that appear to be quite similar.

Although some aspects of product design may be transferable such as marketing strategies or possibly, delivery mechanisms, an off-the-shelf product that can easily be transplanted to diverse settings is unlikely to emerge. Rather, index insurance products must conform to the local context. When designing an index insurance product, practitioners must: 1) recognize geographic differences in household and business production activities, weather risk vulnerabilities, and the availability of weather and loss data; 2) identify and address catastrophic weather risk transfer needs without "crowding out" existing risk transfer mechanisms; and, 3) be innovative, but also recognize the bounds imposed by local market institutions and legal and regulatory constraints. To summarize, sustainable and scalable products must be designed in a manner responsive to a host of heterogeneous geographic, meteorological, cultural, political, legal, regulatory, economic, and institutional factors. These adaptations all come at some cost. Gaining more knowledge about these start up and maintenance cost will provide a more realistic view of the potential for longer term sustainability.

4.3.1 Data Limitations

The limited availability of data in many lower income countries poses significant challenges to the development and scalability of index insurance products. Sufficient data on the underlying weather variable are required to establish premium rates. In lower income countries, the available time-series of weather data are generally not long enough to be statistically relevant. This makes it difficult to assess and price the risk. Insurers respond to this ambiguity by adding loads into their estimation of the pure premium rate.

The limited spatial specificity of available weather data in lower income countries is likewise often a problem. The more sparse the spatial distribution of weather stations, the higher the potential for basis risk — because of the greater likelihood that the weather experienced by the policyholder may differ from that measured at the weather station. Sparse weather stations also make it difficult to achieve geographical scale up of an index insurance product.

Historical data on losses caused by the underlying weather variable are also typically limited. Such data are important for assessing basis risk for a proposed index insurance product. Qualitative data and the expert judgment of local stakeholders can compensate to some degree

for limited quantitative loss data; however, care must be taken to elicit qualitative data in a rigorous and systematic fashion (GlobalAgRisk, 2010b).

As Chapter 5 explains, limitations of the type of data available and how data correspond to actual losses will determine the feasibility of index insurance and impose boundaries on the type of insurance products that can be developed.

4.3.2 Basis Risk, Transaction Costs, and Product Design

Basis risk can be an obstacle to product scale up. Basis risk arises from the very feature that makes index insurance appealing for insuring weather risk in lower income countries. Using an exogenous index rather than actual losses to determine payouts reduces moral hazard, adverse selection, and operational costs. However, basis risk can limit demand for the product as consumers may not be willing to accept the risk of receiving an insurance payout that does not fully compensate for the loss incurred. Thus, designing index insurance products with the greatest potential for long-run sustainability requires balancing data requirements for reducing basis risk against the transaction costs of maintaining data sources.

Products that require geographically precise measurements, and therefore geographically dense data systems infrastructure, will experience significant basis risk if this infrastructure is not in place. Designing index insurance against drought in a region characterized by varied microclimates, for example, requires individual weather stations and separate products for every microclimate location, which can be prohibitively expensive.

Practitioners have surmised for some time that spatially separated weather variables commonly used in index insurance design, such as rainfall at different weather stations within a defined geographic areas, have a higher correlation in the tails of the distribution. This suggests that the more severe the event, the lower the potential for basis risk, since individual losses are likely to be more highly correlated. In the data SKR (GlobalAgRisk, 2010b), we presented two propositions about extreme drought events when rainfall levels reached certain extreme levels: 1) the variance-covariance matrix among crop yields likely changed so as to increase the correlation among crop yields; and 2) the spatial correlation increased.

In 2010, GlobalAgRisk commissioned a study to test the later proposition empirically (Miranda and Liu, 2010). The study looks at the degree of tail dependence exhibited by historic Iowa county-level rainfalls for the month of June, using advanced econometric modeling (copula and spatial econometric model estimates). The results indicate that the spatial correlation of June Iowa county rainfalls is higher in the years of drought than in years of normal or above normal rainfall. The practical implication is that

> "…the rainfall stations on which index contracts are to be written may be geographically more dispersed than would be suggested by standard statistical modeling methods that are explicitly or implicitly based on normal distribution methods." (Miranda and Liu, 2010, p. 2)

These results support our conclusions from the data SKR (GlobalAgRisk, 2010b) that writing index insurance for catastrophic events would likely reduce the basis risk problem.

Even when risks are highly correlated however, the potential for basis risk still exists. Developers have tried to minimize basis risk by structuring the product around complex models relating

weather variables used for the index to the production cycle of specific crops. The technical expertise required to develop and assess these models can create a knowledge barrier that hinders local capacity and product demand. Such models may also create expectations among consumers that basis risk is significantly minimized, when in fact it may not be, leading to reputational risk for the insurance product and index insurance in general, if policyholders receive a payout that is significantly less than the loss incurred.

4.3.3 Lack of Index Insurance Experience

Individuals inhabiting rural areas of lower income countries often have little experience with any type of insurance product (and typically none with index insurance) and little knowledge of insurance providers. Being risk averse, these households are often understandably concerned about the risk involved with paying a premium now in exchange for a large payout at a specified future time period should some defined catastrophic weather event occur. Even individuals who have some knowledge of insurance are likely familiar only with traditional loss-based insurance products such as automobile collision insurance and any effort to introduce them to index insurance products must be accompanied by extensive education. Thus, an initial target market for index insurance products is likely to be risk aggregating businesses that generally have more familiarity with insurance products and providers.

Local insurance providers also typically lack experience with index insurance products and require careful capacity building efforts in order to ensure a product's sustainability and scalability. While employees of these firms understand basic insurance principles, their understanding is grounded in the traditional loss-based products currently being offered. That frame of reference can make it difficult for them to understand the unique characteristics of index insurance.

Government policy makers and insurance regulators are also likely to be unfamiliar with index insurance. Laws that regulate insurance markets and govern insurance contracts vary widely across jurisdictions so it is difficult to generalize about legal issues that may be encountered when introducing index insurance to a region. Index insurance products can take on different legal classifications depending on factors such as the delivery mechanism and the extent to which the policyholder is considered to have an insurable interest. It is critically important to ensure that the index insurance product being developed fits into a classification that is considered as an insurance contract under law and is recognized by regulatory authorities. Obtaining local legal advice and initiating discussions with the insurance regulator are not activities that can wait until after the product is developed; rather, they are early and integral parts of the product development process. Unless the regulator has had previous experience with index insurance products, this will likely require a significant capacity building effort.

4.3.4 Accessibility versus Efficiency

Costs and inefficiencies in product delivery can impede the performance and affordability of the product. In lower income markets, having efficient delivery channels is particularly important due to small transaction values and the pressure to minimize transaction costs to maintain as low a premium as possible for the client. However, ensuring that product education and sales are easily accessible to the consumer is important for generating sufficient demand and market

volume. Thus, the tradeoff between accessibility and transaction costs has implications for the scalability of index insurance, particularly when the insurance is targeted to households.

A delivery channel must be evaluated in the larger context of product design and market development. Market characteristics, such as the capacity of the insurance provider and the use of automated services (e.g., mobile telephones) among the target market, influence what is feasible and most suitable for achieving the desired objectives. These considerations apply primarily to household products where there is greater need for highly efficient delivery mechanisms. Clearly, the laws and regulatory rules must also be considered to identify what types of delivery models are permissible.

4.3.5 Limited Demand

Generally speaking, household demand for insurance against catastrophic natural risks is low. People tend to underestimate the likelihood of a catastrophic event and thus are likely to undervalue the insurance (Kunreuther, 1996, 1976; Kunreuther and Slovic, 1978; Tversky and Kahneman, 1973). In lower income countries, demand is further reduced by limited household income. Given other immediate needs, the opportunity cost of funds used for an insurance premium is very high.

Low uptake of an index-based flood insurance product in Indonesia was attributed to low consumer demand for a product that insures only against catastrophic levels of flooding (Chong, 2009). Similarly, experiences with index insurance products being offered in India seem to confirm the notion that households have little demand for catastrophic insurance coverage (Giné, Townsend, and Vickery, 2008). In addition, low demand for insurance products can be attributed to the lack of familiarity with insurance and misconceptions about how it works. For example, in many countries where there is not a culture of insurance, there is a commonly encountered sentiment among potential consumers that there should be a tangible, and frequent, return on premium paid.

As noted earlier, when pricing insurance products that protect against low-frequency, catastrophic events, insurers compensate for limited data by adding an ambiguity load to their estimate of the pure premium rate. This, combined with generally low household demand for such insurance coverage, can create a wedge between the price that insurance providers are willing to accept and the price that households are willing to pay. This price wedge may diminish over time if potential buyers are educated about their catastrophic risk exposure. Also, ambiguity loads may be reduced over time as insurance providers obtain more experience with the insurance product. Nevertheless, these various factors that limit demand for catastrophic insurance can be a significant challenge for scalability and sustainability.

This underscores the importance of consumer education for increasing the understanding of the role and benefits of insurance and improving the capacity of potential consumers to evaluate an index insurance product relative to their own risk exposure. Product design strongly influences demand through the value it demonstrates to the target market, however consumers' confidence and trust in the insurance provider will also affect their perceptions of and demand for the product.

A major message of this document is that it will take time for index insurance markets to mature. Although demand has been low for many pilot programs there has also been

encouraging growth in others. For example, the Index-based Livestock Insurance Program in Mongolia has demonstrated been steady growth in participation rates and in the sum insured over the past five years in the original pilot areas as herders gain experience and awareness of the product. Thus, while low uptake may be attributable to many different reasons we believe that supporting the broader market development process is a key to stimulating the demand for index insurance in the long term.

Chapter 5 Feasibility Assessment

A feasibility assessment identifies both what is needed and what is possible in terms of index insurance for weather risks. The preliminary assessment determines the feasibility of proceeding with product and market development given the opportunities and constraints that have been identified. Once preliminary feasibility has been established, a deeper analysis can inform on how to proceed, guiding product design and market development within the contextual constraints that exist.

The preliminary feasibility assessment evaluates the presence of certain basic conditions of an enabling environment that are needed to justify and support an index insurance market. These include:

- Presence of significant correlated weather risk;
- Local capacity exists/can be developed;
- Existence of enabling legal, regulatory, and political environment;
- Sufficient data exist to support the product; and
- Preliminary risk modeling indicates feasibility.

These criteria provide insight into the potential need for index insurance and whether an enabling environment exists to support a sustainable index insurance market. While correlated risk is considered to be a necessary condition for an index insurance product, deficiencies in the other criteria do not necessarily preclude product development. Constraints must be considered in aggregate to determine if there is a sufficient foundation to build on and whether weaknesses can be addressed through specific investments or alternative approaches. However, if many elements are weak or lacking, the development of a sustainable index insurance market will be extremely difficult.

If the basic preconditions exist, a more rigorous feasibility analysis involving risk assessment, market research, and an assessment of the institutional environment should follow. Evaluation of critical product design and market development factors begins as part of the feasibility assessment but continues throughout the life of the project.

A request for a feasibility assessment of an index insurance project often is based on some notion of the type of product being proposed and a target market (e.g drought insurance for smallholder farmers) based on previous activity or projects in the region. However, the information gained during the feasibility assessment may reveal limitations to the originally envisioned product that can direct product design towards a more workable and sustainable

approach. The process of feasibility assessment may lead to reprioritizing investments in other risk management measures based on the needs and constraints identified.

5.1 Risk Assessment

A risk assessment identifies the major weather risks and their impact in a geographic region to assess risk management needs and opportunities for the development of index insurance. A risk assessment provides an indication of the feasibility of insuring against a specific weather risk given, inter alia, the frequency and severity of the risk, the availability of historic data, the ability to measure a risk event, and the dependence between the index variable and a policyholder's losses. The process involves both quantitative and qualitative assessment of the weather risk itself as well as, vulnerability, and exposure to the risk. This information generates a risk profile that characterizes the occurrence of a specific risk and its socio-economic consequences, recognizing that vulnerability and exposure to weather risk are influenced by many factors, e.g, geography, weather patterns, livelihood strategies, population dynamics, industry growth, cultural values, etc.

Estimating the direct and indirect losses caused by the risk is a first step in assessing risk exposure and identifying a potential role for index insurance. Direct losses occur when a catastrophic event destroys assets, reduces revenue, or increases costs; however, indirect losses are also incurred due to the presence of catastrophic risk. For example, a bank may ration credit in regions exposed to flood risk, or a household may avoid investing in higher-return production strategies because it deems drought risk to be too great. A risk assessment identifies where existing risk management strategies are ineffective and/or inefficient for catastrophic risk, and where index insurance or other solutions might be appropriate. As an understanding of risk in the local context is developed, themes emerge that can guide priorities in product development. For example, understanding which weather risks have the gravest consequences and how the target market is affected establishes some of the parameters for product design.

5.2 Data Availability

Historical data corresponding to the frequency and severity of the underlying weather risk are necessary to determine the pure premium rate for an index insurance product. Rate-making begins by estimating the parameters of the probability distribution for the targeted weather risk. In practice, however, sufficient data to estimate the parameters of the probability distribution are frequently not available. A commonly used rule of thumb in statistical analysis is that a sample size of at least 30 observations is required to estimate the central tendency (mean) and variance of a probability distribution. Catastrophic insurance products are designed for low-frequency, high-severity events, however, which occur in the tails of the probability distribution. In a sample of 30 years, such an extreme event may have taken place only once. But does this mean that the probability of that event occurring again is 1 in 30? Perhaps the available 30 years of data represent an unusually auspicious period and the real probability of an extreme event is 1-in-10 years. Or perhaps the real probability of the extreme event is only 1-in-80 years and an event just happened to occur during the 30-year period for which data are available. Accurately estimating the tails of the distribution requires extensive historical data (ideally hundreds of years) but in lower income countries it is not common to have access to even 30 years of high-quality weather data. When insufficient data are available to accurately

estimate the frequency and severity of loss, insurers will either refuse to offer the insurance or load premium rates to account for the uncertainty. Thus, a feasibility assessment must account for limitations in the availability of historical data on the underlying weather variable.

A feasibility assessment must also address the spatial availability of the underlying weather variable. Sufficient temporal observations may be available but only for a few limited geographic locations. Limited spatial availability of data on the underlying weather variable restricts the potential for scale up. In some contexts, it may be possible to utilize data sources other than weather stations — such as data collected from satellite platforms (GlobalAgRisk, 2010b).

To measure the potential for basis risk, one would also like to have access to quantitative data on losses caused by the underlying weather variable. However, loss data are even more difficult to obtain in lower income countries. Qualitative data on losses that are carefully elicited from local experts can be used to at least partially offset the lack of quantitative loss data and provide a general assessment of potential basis risk (GlobalAgRisk, 2010b).

5.3 Market Research

Preliminary market research is another component of feasibility assessment. Market research examines demand and supply conditions and the suitability of the broader market environment for supporting a sustainable index insurance market.

5.3.1 Demand Assessment

A demand assessment is useful for evaluating whether there is sufficient interest to support and sustain a market for index insurance. A demand assessment considers who would benefit from the insurance (i.e., the target market) and whether they would be willing and able to purchase such a product. The information gained provides insight into the scale of the potential market and also guides product design by revealing the needs and preferences of the target market. Again, some aspects of feasibility assessment may need to be revisited as product development advances. The target market may express an early interest in having access to a weather insurance product, but until the structure and pricing can be demonstrated, it can be difficult to obtain an indication of their true interest in the product.

Unfamiliarity with the general concept of insurance, as is often the case among the rural poor in lower income countries, makes it difficult to elicit whether people will actually purchase the insurance. Willingness-to-pay studies have been used to assess demand for insurance products. However, the value of the results from this method is unclear given the difficulties in asking people to value a product about which they have little knowledge and no experience.

There are several impediments for new financial products which are difficult to evaluate and address without an actual market test. If decision makers within the target market have no experience with insurance and little (or possibly poor) experience with other financial service providers, they may be understandably reluctant to participate in a market test. As with other new technologies, social pressures can also influence the adoption of a new financial product. An endorsement from a respected member of the community can have a strong influence on others' interest in the product. Demand for the product may increase or decrease following a triggering event due to perceptions about the probability of a repeat event, particularly if there is a cyclical nature to the insured risk, such as El Niño.

A demand assessment must attempt to account for these issues to the extent possible to estimate the potential impact on uptake and market growth and whether the impediments can be addressed. Thus, from a demand perspective, the sustainability and scalability of a product depends on the level of interest expressed by the target market, but also on the ability to stimulate demand through responsive product design, education, and marketing. For example, designing products that have added value such as linkages to other services or benefits and that address the needs and preferences expressed by the target market will generally enhance demand.

A combination of approaches may be required to assess consumer demand. Among these are focus groups and interviews with members of the target market as well as consultations with local experts. Focus groups allow participants to engage in discussions of which risks they are most concerned about and how the risks affect their lives. These activities provide the opportunity to elicit information about potential demand while also providing an interactive forum for stakeholder education and feedback on proposed designs. Risk simulation exercises have been implemented in the design phase of many projects for the primary purposes of testing concepts and eliciting feedback. Simulation exercises create risk scenarios for participants to demonstrate possible outcomes with and without insurance. In addition to informing product design, they also educate potential consumers about how a proposed insurance product would work so they can better assess its value. Thus, these exercises have potential to both assessing demand and simultaneously encouraging it, though to date there has been little evaluation of the effectiveness of such exercises on participant comprehension of the actual product or the influence on product uptake.

Ultimately, the only true test of demand is to offer the product on a pilot basis and use the pilot as a platform for learning and product refinement. Investing in a limited-scale pilot tests the demand for the product and allows for modifications to enhance the sustainability and scalability of the insurance program before making larger investments in wide-spread implementation.

5.3.2 Supply Assessment

A feasibility assessment must also assess the market development interest, capacity, and commitment of the potential insurance providers. As with demand, this can be difficult to gauge without a true market test. Most insurers will have little prior knowledge of index insurance products but capacity building and education will occur as part of the market development process leading up to and including pilot implementation. However the investment in, and amount of time required for, capacity building is often underestimated.

An assessment of the existing insurance sector can identify capacity building needs. A small insurance sector may mean that time and financial investment in training and education will be quite high. The engagement and capacity of insurance companies and delivery agents is critical to ensuring the continuity and local ownership of these markets after donor involvement fades away. While they may not initially have the necessary technical capacity for developing an index insurance product, their level of engagement and commitment to market development is a major determinant of future market growth and sustainability.

The assessment should also seek to identify existing risk management mechanisms and insurance products that may conflict with or complement the proposed index insurance. A goal of product design should be to improve the use and effectiveness of risk management strategies for all levels of risk, and avoid crowding out other effective strategies whether formal or informal.

5.3.3 Institutional Assessment

The institutional environment also influences the sustainability and scalability of index insurance markets. An institutional assessment takes account of risks in the institutional environment, e.g., legal risks, regulatory risks, risks associated with government policies, institutional risks such as a lack of sufficient judicial capacity for effective contract enforcement, etc., that may adversely affect the implementation and growth of an index insurance program. These factors are sometimes discounted or disregarded during the pilot stage due to the small size of the market and the uncertain future of a pilot program. However this should not be the case since these are fundamental determinants of the long-run sustainability, and scalability of an index insurance product.

Government policies may be inconsistent with objectives for market-based insurance. Thus, an institutional assessment examines how index insurance would fit within the existing institutional environment, and whether there is support for the product among government stakeholders such as policymakers and insurance regulators. Again, product design and capacity building can account for some weakness in the institutional environment, however, corruption, political instability, or diverging policy objectives diminish the feasibility of proceeding with market development and compromise the development of a sustainable index insurance market.

Similarly, the existing legal and regulatory frameworks may impose limitations on product design. This begins with a determination of whether index insurance is expressly recognized as a form of insurance within the jurisdiction and, if not, whether it will fit into any existing legal classifications of insurance. It is also necessary to consider any restrictions on how index insurance can be used and sold. For example, if the law requires that the policyholder has an insurable interest, how the Courts and insurance regulators are likely to interpret this requirement will determine who is eligible to purchase the insurance. Too often, product developers do not recognize legal and regulatory risks until a product has gained enough scale and experience to be challenged or receive a thorough review by insurance regulators (GlobalAgRisk, 2010a).

While it may be difficult to foresee the legal challenges that could arise, particularly during the feasibility stage when the product is not fully conceptualized, a thorough review of relevant legislation and regulations by a local legal expert can address basic questions that will have an important bearing on product design such as:

- Under existing law, can index insurance contracts be regarded as insurance or will they instead be classified as financial derivatives or even gaming contracts?
- If index contracts can be considered as insurance, into which category of insurance contract do they fall?

- Are there any legal implications that should be taken into account in designing an index insurance product?

How an index insurance product is categorized is also dependent upon the perspective and interpretation of insurance regulators. Thus, it is important to initiate discussions during the feasibility assessment stage and maintain interactions with regulators throughout the product development and pilot test stages.

5.4 Drawing Conclusions from the Feasibility Assessment

A feasibility assessment provides important, first insights into the potential for developing a scalable and sustainable index insurance market by illuminating the specific challenges that must be addressed, if possible, in product design and market development activities.

Major decisions about whether and how to proceed with product development are largely determined by the outcomes of the feasibility assessment, however concepts and ideas are refined and adjusted during the product design process as more detailed information and stakeholder feedback is obtained. Product design is shaped by the consideration of the factors that contribute to sustainability and scalability in addition to the context-specific parameters identified during the feasibility assessment.

Preconceived ideas about the intended product design may be challenged by limitations uncovered during the feasibility assessment. Whether the original plans are modified or dropped depends upon the severity of the constraints and whether the larger objectives of product development can be achieved through a different product design. For example, the index-based flood insurance currently under pilot development in Vietnam was initially investigated with the vision to develop a flood insurance product for rice farmers. Yield data was available which could have supported an area-yield index insurance, however, because flood management decisions could influence the yields there were concerns about the potential for moral hazard. Thus, the decision was made to use up-stream river levels as an indicator of flooding, though using this data for an index is better suited for a risk aggregator product due to high basis risk in relation to farm yields. Thus, the product that was subsequently developed is for the state agricultural bank to protect its portfolio from default risk when early flooding damages borrowers' rice production. While this product would not directly benefit rice farmers, the farmers should benefit from improved access to financial services (Hartell and Skees, 2009b).

Nevertheless, the feasibility assessment may reveal limitations that would preclude development of an index insurance product. Such prohibitive constraints most often relate to data limitations, such as the availability of data or finding a suitable correlation between the data representing the risk and actual losses. For example, a 2009 feasibility study in Mali investigated the potential for index-based drought insurance in the southern Sikasso region (Hartell and Skees, 2009a). Drought was the major concern expressed by stakeholders; however, available data from two weather stations in the major cereal production areas exhibited weak correlation between rainfall shortfalls and yield shortfalls for maize, sorghum, and millet. The weak correlation, combined with poor weather data infrastructure in the country presented serious obstacles to developing a viable index insurance product.

Such hurdles may become less problematic in the future as new data technologies and methodologies are developed that can improve the quantity and quality of data, though the complexity of such approaches creates other challenges, particularly for index insurance products targeted to households.

Whether or not a feasibility assessment leads to product development, the information gained from the assessment allows project stakeholders to weigh the potential benefits and development costs with the opportunity costs of investments in other high priority needs. The information can be used to inform policy makers on how public sector interventions can be designed to address market failures and provide an enabling environment for insurance markets. If the assessment indicates that index insurance is not feasible the process will likely have illuminated other issues or solutions that merit further attention. The information gained can be used for building risk awareness in the community, guiding policy decisions, and promoting and strengthening a holistic approach to risk management.

Chapter 6 Evaluation

Impact evaluation of development projects is currently of considerable interest, particularly for the application of rigorous methods to support evidence-based policy making in all areas of social and economic development. The evaluation function in general is a natural path of inquiry when choosing among projects or pilot activities that appear sustainable and display potential for scalability and where one wants to know something more about the intervention's impact. To be sure, evidence of sustainability and scalability does not automatically guarantee that a project is meeting the intended development goals and objectives. And since formal market based weather risk transfer is but one of many possible interventions designed to address the constraints to poverty reduction, donors need some assessment of which interventions are likely to generate the greatest marginal contribution to poverty reduction per dollar spent.

Many weather index insurance projects have been initiated but at this time few have developed beyond the pilot stage and few have been subject to formal impact or efficiency evaluations. The lack of evaluation is due, in part, to the relatively short experience with an innovative financial product whose benefits are expected to develop fully only in the long term and whose short term performance has provided little empirical insight into eventual impact. Even with the longer experience of microfinance, there has been limited investigation of the impact of that financial innovation in achieving its intended socioeconomic outcomes (Armendáriz and Morduch, 2005). However, the challenges of conducting impact evaluation may be even greater for index insurance than for microfinance.

This chapter is not a manual on recommended evaluation methods. Practices are well established and many excellent resources exist to provide guidance on different overall strategies and means of estimation. Rather, the general aim of this chapter is to put impact evaluation in the context of overall evaluation practice for investigating if, and how, index insurance brings about change. That is to say, the results of impact evaluation cannot be viewed in isolation when used to consider, for example, the desirability of scaling a project activity. The chapter will also frame some of the major constraints associated with implementing an impact

assessment of index insurance, where a major defining characteristic is voluntary market participation.

6.1 Meaning and Purpose of Project Evaluation

Evaluation is a set of inter-related activities ideally taking place over the course of the project cycle that, on the whole, are meant to inform about the performance and the effectiveness of development interventions and to provide guidance to stakeholders and institutions regarding the improvement of current action and the direction of future policy. Evaluation research provides a systematic and thoughtful framework, grounded in social science research methods, to accomplish and communicate such an analysis.

The major contribution of evaluation to project improvement and policy is often expressed in terms of discovering "what works" in achieving certain development goals and objectives. That is a simplified way of considering causality, or attribution, of an intervention (i.e., the cause that results in an intended effect). In fact, there are multiple dimensions to identifying and understanding the factors and circumstances that contribute to the success, or failure, of an individual or set of related development efforts, and how these might be applied to improving project design and implementation. Estimating project impact, whether it achieves its objectives and to what extent, is a single dimension which by itself is insufficient to determine what works from the perspective of informing policy action. The context and temporality of the intervention must also be well understood before it is possible to identify the critical lessons and mechanisms that can be extrapolated to similar or distant circumstances. In this formulation, causality and context must be considered together.

Another purpose of evaluation is to provide accountability in an environment of scarce resources. This pertains not only to the appropriate and designated use of funds, of meeting stated indicators of implementation performance and outcome that can be attributed to the intervention, but also pertains to the comparison of the scale of benefits with the costs. Estimating project effectiveness thus provides one means of choosing which interventions among many to support. In a similar vein, accountability can also relate to the proportion of resources devoted to the evaluation of a development activity. Evaluation can become enormously expensive relative to the overall budgets of some pilot projects that are already to a great extent a test of concept. Therefore, decisions have to be made about the value of additional evaluation and additional project inputs. The scope and scale of evaluation must be tailored to the project circumstances in a way that generates useful insights in proportion to the project and in such a way that it does not impair the project.

Finally, evaluation contributes to the base of practical and academic knowledge about effective mechanisms and solutions to social and economic problems. Particularly within the scope of assessing project impact, it is possible to pose and test well-defined hypotheses, and estimate model parameters, of economic behavior and outcomes derived from theory. The accumulation of diverse experience structured through evaluation practices, and greater scientific comprehension of cause-and-effect mechanisms embedded in development interventions feeds into improved practices and new innovation. In this sense evaluation is an important investment beyond a single project, one that demands that resource use be planned and judiciously

employed to support the most rigorous feasible evaluation appropriate to the project and anticipated outcomes.

6.1.1 Scalability and Sustainability

Scaling a particular project or project concept is an investment that, explicitly or implicitly, comes at the cost of fewer other interventions. Results from an evaluation are one of the decision tools that can be used to support or detract from efforts to scale a project. But development policy and action, like that of any public policy, is subject to the political economy of decision-making such that project expansion or termination may have little to do with actual project outcomes. Still, many public sector donor agencies and private foundations are reemphasizing the role of methodologically rigorous evaluation for "evidence based" decision-making and attempting to inject greater accountability into funding decisions (e.g., USAID, 2011). That is, to direct funds toward development activities capable of demonstrating attributable performance.

From the perspective of technical assistance practitioners and donors, whether an intervention could be expanded or scaled to a larger area or to another location is substantially an evaluation question. Without thorough evaluation, interventions might be scaled that do not meet the intended development objectives or which, if they do, also produce significant negative unintended consequences.

When considering if a project activity should be scaled, the first item to consider is if the project was, as implemented, able to deliver or generate the quality and quantity of the intended benefits in the time frame envisioned. Benefit is used broadly here to encompass the possible indicators that the objectives have been achieved and are contributing to the goal of poverty reduction. Referring to index insurance, this might include demonstrated improved access to financial services and at more favorable terms, increased use of savings, additional productivity investments, and similar behavioral changes relating to financial market development. One also must be confident that it was the project intervention that produced, or caused, the result and not some other event exogenous to the inputs and activities of the project. It is also important to specify the time frame over which measurable results can be expected since a decision to scale a project may need to take place before the intervention has had an opportunity to work through the pathways of impact. This will determine which indicators of performance should be considered, some of which are intermediate but indicative of the expected and desired change of conditions.

Measuring and attributing outcomes to a project is what is generally understood to encompass much of impact evaluation. The second part of considering scalability, however, is to consider if the innovation is largely transferrable in its current form or if substantive modifications will need to be made in either the structure of the intervention (such as of the specific product) or in its implementation to fit the new environment. The idea of generalization to other contexts or circumstances is what lies behind the notion of external validity of an impact assessment (Imbens, 2010). Project scaling, or transferability, hence requires a deeper understanding of why and how an intervention has achieved its planned result in its current context for the targeted audience in order to speculate about its performance elsewhere or in an expanded form. Understanding why and how a particular intervention works is aided by the articulation of an

underlying causal model and other tools to help capture or visualize the pathways of development impact.

Evaluation also has a partial counterpart to the question of sustainability. An efficiency evaluation explicitly considers the total measured benefits of an intervention to the costs of implementation. Again, timing of such an analysis is important in order to fully capture the expected benefits that arrive over time. An impact assessment is a component of an efficiency evaluation. However, an efficiency evaluation focuses on the economic efficiency or cost effectiveness of an intervention rather than its sustainability in the sense defined earlier in this document. For index insurance, the development intervention is meant to initiate a market activity that eventually perpetuates without ongoing donor technical assistance or product subsidies. From a cost effectiveness perspective, a project might be considered unsustainable if the only decision criterion is net positive benefits.

6.1.2 Planning for Rigor

The increased emphasis on evaluation for project improvement and decision-making has been accompanied by a push for greater rigor in evaluation practice. This is particularly true for specific methodologies used to assess project impact such as randomized field experiments (RFEs).

For something to be rigorous in scientific research means that there is confidence, statistically expressed or otherwise, in the findings and conclusions of the analysis. Means of ensuring the internal validity of estimates — that what is being measured about the intervention is actually the case — is therefore needed for credible evaluation (Duflo, Glennerster, and Kremer, 2006). Part of being able to draw reliable conclusions also involves carefully considering and communicating the context and pathways of change when examining the effects of a development intervention (Maredia, 2009). Methodological prescription alone is insufficient. Rigor is a product of sound and transparent planning, clearly defining the evaluation questions and hypotheses, the underlying logic of the evaluation design, the use of appropriate statistical techniques and qualitative methods, and strong execution (Rosenbaum, 2010). Early planning for evaluation, preferably in conjunction with the project planning stage, creates the greatest opportunity to choose among the full spectrum of available evaluation designs sufficient and appropriate for the task.

While rigor is always desirable, it is not always necessary that an evaluation be the most comprehensive possible or employ the most technically demanding assessment methodologies. The scope of an evaluation exercise is a decision based on the scale and type of the project intervention, timing and degree of anticipated outcomes, the audience and evaluation questions being asked, and available resources. Evaluations are to be tailored to meet the objectives and the circumstances of the project in a way that provides for the information and decision-making needs of the project and other stakeholders. Sometimes evaluation can be methodologically parsimonious with the results communicated in quite general ways while other times the circumstances call for, or present an opportunity for, much greater precision.

6.2 Evaluating Impact

Impact evaluation or assessment seeks to identify and estimate the contribution of a project or other intervention to the improvement in conditions that it was designed to address (Rossi, Lipsey, and Freeman, 2004). Sometimes called program effect, the goal is to measure the effects of the intervention between two points in time, and against the desired outcomes (Weiss, 1972). However, impact assessment is also concerned with identifying and explicitly isolating and testing cause-and-effect hypotheses of a project intervention; that is, to attribute the project outputs to the outcome. Central to the idea of causality is that the estimate of the change in an outcome indicator is of net effects, having removed the influence of other sources that might have also contributed to a change in the conditions being targeted (Rossi, Freeman and Lipsey, 2004). For example, macro-economic trends, the influences of other development efforts or changes in government policy may have contributed to changes in outcomes. It is necessary to parse out or control for these other influences since they can either overstate or diminish the estimated impact of the project. Consequently, simple before and after comparisons will likely not be accurate depictions of impact.

The potential outcomes framework formalizes the concept of a counterfactual and that of net effects (Angrist and Pischke, 2009). It says that for any given individual there are two potential outcomes, one where the individual receives the intervention or treatment, and one where the individual does not receive, or does not chose to receive, the treatment. This raises the "problem of causal inference" since any given individual, or other unit of observation, can only either experience or not experience the intervention, never both (Imbens and Wooldridge, 2009; Duflo, Glennerster, and Kremer, 2006). The problem is that those receiving the treatment may have had different outcomes even if they had not received the treatment. Since it is impossible to observe both treated and untreated outcomes for the same individual, the counterfactual is constructed from a control group that is withheld the intervention. The control group is then compared to the treatment group that experiences the intervention. Using treatment and control groups makes it possible to attribute and estimate an average impact of an intervention. Such a method of comparison is only valid, however, if the method of assigning individuals into the treatment and control group is unrelated to potential outcomes, that is, if there is no selection bias. Selection bias results from situations where the assignment mechanism of individuals into treatment and control groups is due to some process that is not fully observed and where selection is related to potential outcomes. When the evaluator has control over the selection mechanism of individuals into the control and treatment group, randomization is the preferred method. Random assignment implies that the only difference between outcomes of the two groups is whether or not treatment was received and therefore selection bias is zero (Duflo, Glennerster, and Kremer, 2006).

Under ideal conditions, randomization is usually considered the performance benchmark for attributing and estimating the mean impact of an intervention with minimal assumptions. There are instances, however, where randomization is difficult to implement whether due to budget constraints, project implementation peculiarities, or ethical objections to withholding a "treatment." When randomization is not possible and evaluation must be conducted using observational data, there are a variety of quasi-experimental methods, instrumental variable methods, and methods of analysis of repeated observations that attempt to duplicate randomized assignment in the creation of a valid counterfactual for causal inference (Morgan

and Winship, 2007). Each of these has their strengths and limitations related to mostly non-testable maintained assumptions for identification. For example, the potential existence of unobservable and therefore omitted characteristics of individuals that influence selection into treatment cast irresolvable doubt on the internal validity of quasi-experimental methods. The recent popularity of RFEs, as well as non-experimental methods, to attribute impact and test hypotheses of development economics is not without criticism. While emphasizing strong internal validity of project effects estimates, it cannot be assumed that the results of most RFEs are generalizable to other circumstances or populations unless strongly guided by sufficiently full causal theory (Deaton, 2010). Implementation of RFEs can be easily compromised by events outside the control of the evaluator and introduce bias into the estimate of average effect (Morgan and Winship, 2007; Bamberger and White, 2007). On the other hand, successful randomization of individuals into treatment groups may obscure important information about context and characteristics (sub-group heterogeneity) that result in certain outcomes and which provides information about the transferability of intervention mechanisms (Pawson and Tilly, 1997).

6.2.1 Challenges to Impact Estimation of Index Insurance

There are a number of characteristics of index insurance projects that cause difficulty in performing an impact evaluation and no one method of estimation has special abilities over the others to surmount these challenges. The relative scarcity of case examples demonstrates the extent to which these characteristics are a barrier to analysis. It is not necessarily the case that any single factor creates problems for evaluation; it is the combination of several factors together that creates an interesting implementation challenge.

Selection Mechanism. In any evaluation of project impact, understanding and describing the selection or treatment allocation mechanism is critical for estimating and attributing effects with minimal selection bias. This will remain a difficult hurdle for analyzing market interventions such as index insurance where participation is usually wholly voluntary and where there are likely to be non-trivial and difficult to observe differences between individuals who choose to purchase insurance and those who do not. The many possible motivations behind an insurance purchase decision are very likely confounded with potential outcomes that inject bias into estimates. For example, producers possessing higher 'ability' may be more likely to purchase insurance, and would have better outcomes even without insurance, which would result in the benefits of insurance being overstated. Further, insurance purchase is one usually made on a recurring basis and so depends not only on often-unobservable characteristics of the individual but also depends on future expectations formed on prior experience (Morgan and Winship, 2007). Randomization in the presence of voluntary compliance is difficult to achieve even using randomization techniques specific to those circumstances because of diluted average effects or other concurrent limiting factors. Similarly, while non-experimental methods may attempt to explicitly model this self-selection attribute, they too are confronted with implementation hurdles.

Innovation Uptake and Statistical Power. Uptake is often low for new financial instruments such as index insurance (Cole et al., 2008). This is to be expected because insurance is costly and because it takes time for people to experiment and learn about a product and different means of risk management (Boucher and Mullally, 2010). In addition to low numbers of policies sold,

the amount of insurance purchased, the sum insured, is also generally quite low which further suppresses the potential effect size. The difficulty for evaluation purposes is in obtaining sufficient observations for a desired level of statistical power in a survey design that also attempts to control for selection bias. The number of observations needed to achieve a predetermined statistical power is related to the anticipated effect size to be detected. For small effects the greater must be the power and the larger the sample size. It can easily occur that the desired sample size is as great as or greater than the initial observations of insurance uptake. This greatly complicates survey design efforts and the need to collect relevant baseline information before an intervention, i.e., before an insurance purchase. Until markets are mature enough to generate sufficient observations, it may be difficult to investigate in detail the causal linkages and effects of interest. This observation applies to the effects of index insurance products targeted to households. The investigation of risk aggregator interventions also involves relatively few observations but complete and repeated sampling of the population is reasonably feasible.

Temporality. Client education and the full impact of index insurance market development can involve a lengthy time horizon since the events being insured are relatively infrequent, with typical probabilities of no more than one event in seven years. If the full effect of the insurance is assumed to only be shown by direct experience, and not involving instantaneous adjustments or predictable changes in behavior, then any impact assessment design will need to accommodate the possibility of temporal delay. However, it becomes increasingly difficult to maintain a valid counterfactual if impact is expected to be realized mostly in the long term. Temporal delay in outcomes combined with repeated intervals of self-selection creates considerable challenges for the standard estimation strategies. This situation highlights the need for a well-articulated theory that clearly delineates the causal pathways to identify and measure leading indicators of hypothesized behavioral changes and outcomes that occur in the longer term.

Market Setting. Virtually all index insurance initiatives include the participation of private insurance companies and commissioned distribution channels. As pointed out by Boucher and Mullally (2010), while this provides an opportunity to directly gain insight into contracts and markets, it also presents an evaluation design challenge. Often a desired experimental methodology used to fix a selection mechanism will be at odds with the interests of the insurer and distribution channel who may not wish to restrict access to a product by potential clients, for example. Project service expansion may be driven by political considerations that preclude a randomized phase in approach. Evaluators and project personnel also have less control over implementation decisions that could result in delay, thus requiring surveying activity to be rescheduled to less desirable time frames, or even implementation failure. Early planning for evaluation with the insurers and distribution channel as partners and beneficiaries of the results may help lessen these types of potential conflicts.

6.3 Program Theory and Monitoring

While the estimation of impact and hypothesis testing is the focus of much academic interest, other evaluation functions are important either in their own right for the strengthening and improvement of an intervention or for providing support and context to the impact assessment.

The types of evaluation that can be conducted correspond to the different stages of the project cycle including an analysis of the need for a project, the design, implementation, and delivery, impact or outcomes, and project efficiency (Rossi, Lipsey, and Freeman, 2004). Other typologies exist and it is not necessarily the case that all areas will or should receive equal weight in performing an evaluation. Choices about the type of evaluation and the extent of the evaluation will be based on the information needs of the stakeholders, including the desired precision of estimates to support conclusions, the type of project, and the evaluation budget. The sequence is important however and it is rare that a specific evaluation could be conducted in isolation as information from lower levels feed into higher. In particular, successful impact assessment depends on equally rigorous attention to program theory and monitoring. These two evaluation areas become even more important when considering project performance and scalability in those situations where impact assessment is especially challenging or omitted altogether.

6.3.1 Program Theory

There exist several methods that can be used by evaluators to systematically elicit and describe a development project's impact and process theory. The program theory comprises impact and process theory and lays out how the project is proposing to generate the intended benefits and achieve its objectives and goals. While listed as an evaluation function, a thorough description of the program theory properly belongs to project formulation and planning, and evaluators present during this stage of the project cycle can help ensure that it is accomplished.

Impact theory is an articulation of the sequence of inputs, mechanisms, and pathways of the intervention that necessarily leads to the intended change in behavior, practices, or other outcomes over time. It is a statement or hypothesis about cause-and-effect relationships derived from theory that underlie and legitimize the entire project activity. An example of this logic is given in Chapter Three, that links improvement in the development goal of poverty reduction to the availability and use of insurance against correlated weather risk for individuals and firms. In this formulation of the causal pathway, insurance releases constraints in the credit market that facilitates access to capital for productivity enhancing investments and the development of more resilient up and downstream market access. Some researchers might emphasize other factors, such as the causal pathways of adoption or have more/less complexity and depth depending on the needs of the analysis.

However, for many development projects the causal process is implicit and generalized and would benefit from a greater degree of specification and formality. The level of evaluation complexity might depend on the needs of the audience but it is generally preferred that an investigation provide a test of the casual mechanisms of a theory of change rather than only estimate the amount of change suggested by a theory. The former asks for greater complexity in a causal explanation of change (Morgan and Winship, 2007).

Impact theory, implicit or formalized, is used to determine what key indicators must be measured in order to later assess and attribute impact. It should be developed in advance of project implementation and assessment of outcomes to avoid the temptation to fit a model to the data. Should the project be successfully implemented but fail to generate the intended outcomes, the impact theory will be analyzed for theory failure. Impact theory is necessary to begin establishing the external validity of a project beyond its immediate location through demonstrating the applicability of general principles and modeled outcomes.

Economists are particularly well equipped and accustomed to providing mathematical models of causality based on theory and assumptions of economic behavior. These models can provide explicit testable hypothesis related to the observed outcomes and can be useful incremental contributions even if there is not yet a fully developed structural system in place. Other techniques can also be used in conjunction to illuminate the causal pathways and mechanisms that invoke change. For example, logic models, or logical framework models, have a long been used to diagram and operationalize the basic elements of an impact theory by delineating the resources, activities, outputs, outcomes, impacts, indicators and risk. The logic model can also incorporate additional information such as critical assumptions, other contextual factors, and a time dimension over which impacts may be expected to occur. Causal relationships can also be depicted using graph theory and provides an additional means to identify mediating indicators and conditioning variables to guide the appropriate choice of estimation methods (Morgan and Winship, 2007).

Particularly for index-based risk transfer market development, the ultimate impact or benefits of a project may only be apparent after some time has passed. For this reason, it is important for the description of the impact theory to identify mediating or intervening steps in the causal pathway. For example, the diffusion and adoption process of new knowledge about index insurance may take time and whose benefits only become apparent after an infrequent exogenous shock provides a demonstration and learning event. However, in order to understand if the project is having an effect before such an event, it is important to identify those mediating steps, short-term indicators of behavioral change, which can serve as an indicator of long-term impact. Identifying meaningful intermediate indicators of long-term outcomes is probably the most challenging aspect of formulating the impact theory and evaluation design for index-based financial innovation and may help explain why there are few examples of subsequent impact assessment.

6.3.2 Process Evaluation and Monitoring

Process evaluation, or implementation assessment, is conducted to document and determine if the project is delivering or has delivered its planned outputs in the manner prescribed to the intended target. Ongoing monitoring that uses a strong design, appropriate management information systems, and valid measures of risks, activities, outputs, and outcomes, tracks and helps detect problems with implementation and allows for timely corrective action. Documenting implantation changes is important particularly as it relates to the underlying logic of the impact theory and how it might change the appropriateness of any identified mediating indicators. This information can be used to help distinguish between theory failure and implementation failure should the project not generate the intended outcomes. The process evaluation and monitoring activity should also attempt to record any significant contextual changes that might have an effect on observed outcomes or the efficacy of implementation efforts. The appearance of any unintended consequences, positive or otherwise, should also be recorded and if necessary incorporated into ongoing surveillance. In the absence of any other evaluation, project process evaluation provides the only record of accountability and project performance from which insights can be drawn. In addition, a valid description of actual implementation is needed to help correctly attribute a particular project output to an outcome.

6.4 Examples: Impact Assessment of Index Insurance

We are aware of only three recent examples of index insurance impact evaluations, all of which make use of a randomized design in the selection mechanism. Two examples are concerned primarily with identifying demand determinants of the intervention while the third attempts to investigate welfare effects.

Cole et al. (2010) seek explanations for low uptake of index-based rainfall insurance in India and estimate the price elasticity of demand for the insurance using experiments and non-experimental corroborative evidence. They find that household liquidity constraints, lack of trust in the insurance provider, and limited financial experience depress insurance demand. As expected, demand is significantly price-elastic. Giné and Yang (2009) investigate uptake determinants for hybrid seed production loans bundled with index-based rainfall insurance in Malawi. They find that uptake of the bundled product is lower relative to an unbundled loan product, opposite of what was anticipated. However, uptake of the insured loan was positively related to producer education, income and wealth while no such relationship was associated with those who chose the unbundled production loan. They suggest this finding is related to efforts by better off producers to protect their higher wealth position from default costs while for less well-off producers the additional cost of the insurance had limited value given that the unbundled loan product already had an element of embedded limited liability. Boucher and Mullally (2010) designed a randomized encouragement experiment to study the welfare effects of the introduction of area-yield insurance for cotton farmers in Peru. Acknowledging that impact on welfare measures may take time to be fully realized, they focus on hypothesized intermediate indicators of behavior change including the effect of insurance on credit rationing and input use intensity. Unfortunately, for many of the reasons given previously, participation in the insurance during the initial sales season was too low to enable inference.

6.5 Evaluation Summary

It is sometimes tempting to view evaluation as mostly consisting of impact assessment, where the strongly preferred empirical method is a randomized field experiment to generate an internally valid counterfactual from which to easily assess outcomes of the intervention. A more comprehensive and perhaps traditional perspective encompasses the broad range of evaluation activities and mixed methods of assessment and reporting. From this perspective, impact assessment is not a substitute for, but a complement to, an overall and rigorous evaluation. This was clearly seen during a recent meeting on microfinance impact attended by one of the authors of this study. At that meeting one participant was almost apologetic in asking for something more, perhaps case studies, to round out and provide context to the growing number of randomized experiments (Microfinance Impact and Innovation Conference 2010, New York).

Evaluation is meant to inform stakeholders about an intervention's performance, attribute and measure its results, assess effectiveness and provide insight to its transferability. Still, impact assessment of index insurance interventions as the culmination of an overall evaluation effort is not routine due to cost and a number of logistical and analytical challenges.

These costs and challenges often justify foregoing impact evaluation particularly for small demonstration projects (Shadish, Cook, and Leviton, 1991). “If” and “when” to evaluate are important questions particularly for donors who are seeking information on what types of

interventions in which to invest. Donors can be potentially frustrated when outcomes are expected to arrive primarily in the long term but their decision-making has a shorter time horizon and when intervention outcomes are obscured by 'black-box' mechanisms of impact. For effective evaluation, project organizers will need to explicitly include donors as beneficiaries of evaluation efforts in order to secure a long-term commitment. Ensuring the donor has a good understanding of the evaluation plan and the logic model of the particular index insurance intervention, including the mechanisms, linkages, and intermediate indicators of longer-term impact, facilitates commitment. Similarly, insurance and delivery channel participants are more likely to assist in evaluation when the assessment also includes useful information about demand characteristics and price response, and when the evaluation effort is sensitive to their underlying profit and political economy motives.

Evaluation planning concurrent with the project is critical to take full advantage of available methods and to make clear the means of achieving overall development goals and objectives. Strong program theory and process evaluation are necessary components regardless of whether impact assessment is included and help provide important contextual information for interpreting impact results. Impact assessment is more likely to be appropriate for more mature interventions with a well-structured logic model and proven implementation. Even so, impact assessment will need to be planned in conjunction with the project to satisfy information needs depending on the evaluation strategy. That is, evaluation must be tailored to the circumstances and the information needs of the project and other stakeholders.

Chapter 7 Market Development

Market development is about creating conditions that enable index insurance markets to take hold, develop, and grow. In most lower income countries, this typically involves governments and/or donors helping to provide public goods that would otherwise be missing. Governments play an important role in establishing legal and regulatory frameworks that are conducive to index insurance and supporting the meteorological services so that weather data are of good quality and easily accessible. Donors often fund the design and development costs of index insurance products, provide technical assistance and support capacity building efforts that strengthen local financial institutions, raise insurance awareness and financial literacy among consumers, fund impact evaluation studies, and support forums for exchanging information and experiences (Hellmuth et al., 2009). In some cases, donors have also funded the installation of new weather stations or invested in research and development on alternative data generating technologies. Because market development expenditures have public good characteristics, an insurance provider will generally be unwilling to bear all the cost of these large, up-front, investments. Once an index insurance product has been developed for a particular location it can easily be copied by competitors in that region who have not had to incur any of the start-up costs.

Investments in market development are likely to create long lasting benefits that extend beyond just an emerging market for a specific index insurance product. Regions that could reap the greatest benefits from index insurance also tend to suffer from weak and underdeveloped insurance markets. Index insurance can "crowd in" other market-based risk transfer instruments. Index insurance is used to transfer the economic consequences of the most

catastrophic, spatially covariate weather risk out of the local area. With that risk removed, it is more likely that other market-based risk transfer instruments will emerge to protect against residual risks that are far less catastrophic and spatially covariate.

Experience has repeatedly shown that breaking the index insurance market can be quite challenging. At the same time, limited resources and the threat of donor fatigue require making strategic choices regarding the sequencing of investments in insurance products. Products that can reach scale quickly as well as withstand the test of time, given all the operational hurdles that bedevil index insurance projects in the developing world, have the potential to spur the market as well as promote an inflow of additional resources. Such products are well positioned as starting points for market development, and they merit serious consideration even if the benefits to the poorest segments of society are indirect or not immediately apparent (as with some risk aggregator products).

Since weak or failed pilots discourage future investments and dampen demand, we theorize that product sequence matters in the process of market development. Specifically, we propose that risk aggregator products should be introduced first. An initial focus on risk aggregators may be necessary for two reasons. First, these products tend to face fewer challenges than household products; and second, risk aggregator products are more likely to generate sufficient volume to attract the attention of commercial insurers who must make investment decisions based on the bottom line. It is conceivable that, once the market has been penetrated and the foundations of an enabling environment have been laid, it will be easier to extend the product to individual households. Still, household products may simply not be feasible in many regions of the developing world. Therefore, we are careful to note that our reasoning, while highly plausible, is not meant to be interpreted in a deterministic fashion. Thus, a central focus of this chapter has been on the steps in the market development process that are both absolutely essential, and auspiciously for project developers, replicable.

7.1 Promoting Enabling Legal and Regulatory Environments

As insurers and reinsurers prepare to take index insurance beyond small tests toward commercial products that aim to reach large numbers of clients, it is becoming increasingly evident that attention to legal concerns is vital to scale up efforts. One of the most critical, and certainly most overlooked, aspect of developing new markets for index insurance is ensuring that enabling legal and regulatory frameworks exist that can support these products.

As any other financial services product, it is essential for market confidence that index insurance contracts are generally accepted as legally enforceable. If there are doubts as to the enforceability of index insurance contracts, insurers will not be prepared to develop and sell them, market intermediaries will not be prepared to recommend or sell them and consumers will not be interested in purchasing them. Therefore, index insurance requires legal and regulatory frameworks that support the product either explicitly or at least implicitly through laws and regulations that are not inconsistent with the use of index based risk transfer contracts as insurance. Further, because experience with weather insurance markets – or insurance markets in general, for that matter – is typically limited in lower income countries, the introduction of index insurance raises a unique set of legal, regulatory, and supervisory

challenges. It is important that product designers consult insurance regulators and other relevant regulatory authorities to ensure that products meet regulatory requirements. In addition, regulators must understand that, because of the exposure to spatially correlated losses, index insurance has unique risk financing needs that require access to global reinsurance markets and that may require special provisioning rules. These challenges must be addressed from the very beginning of product development for a pilot to reach meaningful scale.

In practice, however, legal and regulatory issues tend to receive only nominal attention. The general trend has been to approve products on a pilot basis and postpone any substantial legal and regulatory considerations until after the technical aspects are put in place and the products demonstrate potential for scale up. This simplifies product introduction and frees time and resources for other needs. Donor organizations have encouraged this approach in the past, while regulatory authorities and development practitioners have been generally acquiescent — the former likely constrained by limited resources that can be devoted to the task; the latter perhaps concerned that donors will become discouraged by the substantial amounts of time required to obtain necessary approvals or by the many hurdles inherent in the political process should changes to laws be necessary.

Index insurance for managing adverse weather and natural disaster risk is primarily targeted to countries with nascent or non-existent insurance markets. Accordingly, legal institutions governing insurance also tend to be in early stages of development. Even countries with relatively advanced insurance markets are unlikely to have promulgated legislation that applies directly to index insurance.[8] Likewise, supervisory and regulatory authorities usually have only cursory familiarity with this new class of insurance. In addition, guidelines from the International Association of Insurance Supervisors (IAIS), although fully applicable, come in a general rather than explicit form. The IAIS has not issued international standards or guidance on the regulation and supervision of index insurance. The lack of specific standards and guidelines, limited exposure to index insurance, and a backdrop of weak insurance markets, can create considerable legal and regulatory risks. Overlooked or postponed, legal and regulatory risks pose one of the biggest obstacles to creating index insurance markets that can be sustained in the long run. A brief overview of typical legal and regulatory risks faced in the development of index insurance is provided below. For more details, see the Legal SKR, 2010 and Carpenter and Skees, 2010.

7.1.1 Legal Risk

Perhaps the most obvious example of legal risk is the risk that a contract will not be legally enforceable. However, legal risk is generally considered to have a wider meaning. For example, Ciro (2004) describes legal risk as the risk that a failure in the legal framework, documentation, or counterparty will result in the increased probability of risk and loss.

[8] There are a number of exceptions. For example, the government of the Philippines recently promulgated a regulatory framework and national strategy for microinsurance that incorporates index insurance and the government of Malawi, is currently updating its legal framework to better accommodate index insurance as part of the Agricultural Development Support Project (ADP-SP).

Legal risk can be either generic or entity, or contract, specific. Generic legal risk describes risks associated with index insurance as a product, within a country's legal system and framework. For example, the characteristics of index insurance may prevent it from being recognized as insurance under a country's insurance or other laws.

Clearly, it is likely to be much more costly if incompatibility with the legal framework is not discovered until after the product has been developed and widely marketed and sold. Entity specific legal risks are related to a party's capacity to contract and contract specific risks may arise from a failure to properly execute the contract. For example, in order to comply with the law of a particular country, it may be necessary for an index insurance contract to be drafted so as to explicitly include a requirement for insurable interest. The contract may adequately provide for this, but there is remains a risk that a contract will be purchased by a person who does not actually have an insurable interest. In some countries, this would leave the contract unenforceable. One of the consequences of a failure in the legal framework, documentation or counterparty will be damage to the credibility of index insurance as a product.

7.1.1.1 Contract Design

The essential characteristics of index insurance, i.e., payment against the value of an index rather than as compensation for measurable actual losses, is likely to result in an increased level of generic legal risk, particularly in a country where the legal framework does not expressly recognize index contracts as a form of insurance. For example, there is a risk that an index contract will be regarded as a derivative or perhaps even a gaming contract, rather than as an insurance contract.

It may be possible to mitigate generic legal risk through appropriate contract design. For example, most countries recognize types of non-indemnity insurance.[9] Generic legal risk may be reduced if an index insurance contract can be designed so as to fall within the category of a non-indemnity insurance contract, where permitted by the legal framework of a country. We explore this in detail in our Legal SKR.

We also argue in the Legal SKR that it may be possible to position an aggregate loss index contract as a form of valued policy. A valued policy is an insurance contract where the parties agree in advance on the value to be placed on the insured property in the event of its total loss. In the absence of fraud or a manifestly excessive valuation, the parties are bound by this valuation. In the event of a partial loss, the insured is entitled to recover that percentage of the total loss value that is equal to the percentage loss of the property insured.

This is a complex area and, as yet, there are no tested precedents for either approach. We therefore recommend considerable caution.

However, if an index contract can be successfully designed as a form of non-indemnity insurance, this carries considerable additional advantages arising out of the fact that the amount of the insurance payment depends upon the premium paid and the index value, rather than the policyholder's actual loss. The policyholder therefore has the flexibility of selecting an insured value at the inception of the contract based on his own assessment of his risk exposure and likely losses.

[9] Often termed either "contingency insurance" or "fixed sum" insurance

7.1.1.2 MITIGATING LEGAL RISK

Very few index insurance pilots have paid sufficient attention to the legal framework. Instead of commissioning a legal assessment, most index insurance projects have relied solely on the opinions of regulators, even for issues that belong to the legal rather than the regulatory domain (e.g., insurable interest). We emphasize strongly that this approach is extremely imprudent, as the principle legal risks associated with index insurance arise out of the legal framework and the contract documentation. Although regulators may have discretion to classify a contract as an insurance contract, and possibly to extend the definition of insurance, any disputes between the parties to a contract will ultimately be resolved through the Courts. Therefore, it is not possible to conduct a thorough assessment of legal risk without undertaking a thorough analysis of the country's relevant laws. Preferably, this review should be conducted by, or with the assistance of, a qualified local professional who understands the legal framework and can point to potential issues and pitfalls. As with regulatory risk, it is not possible to entirely obviate legal risk. Even a full legal review does not guarantee that a contract will not be challenged in court at a future time.

Developing legal and regulatory frameworks that can support index insurance requires time. Often it takes years for legislation to be enacted and for the necessary regulatory rules and regulations to be put in place. Postponing this work until the pilot is ready for commercial expansion can have severe consequences for individual insurance products and foil market development efforts. Obviously, being unable to launch a product following significant investments in product development or pulling it from the market after all the investments have been made is both embarrassing and wasteful. In addition, legal risk and regulatory risk can compromise product credibility, thus alienating clients whose trust may be difficult to regain in the future. Finally, encountering unresolved legal and regulatory issues can cause significant delays in scaling up. This time lag may cost the program its momentum, causing donors and local stakeholders to lose interest.

7.1.2 Regulatory Risk

Regulatory risks are the risks associated with the regulatory framework and its implementation by the insurance regulator and other regulators. The insurance regulatory framework of a country always applies to insurers and usually to insurance intermediaries, including agents and brokers. Regulatory risk is the risk that the implementation of the regulatory framework by the regulator, or future changes to the regulatory framework, will result in the product being categorized as other than insurance, or will have some other significant impact on the ability of the product to achieve its objectives. Regulatory risk is particularly relevant to index insurance, since its novelty makes it susceptible to potential misconceptions on the part of the regulator, who often has a certain degree of discretion to decide how regulated financial products should be classified.

The foremost regulatory risk is that the regulator will classify the product as a financial product other than insurance, such as a derivative, or even as a non-financial product, such as a gaming contract. If this occurs after the product is already being sold, the insurer may suddenly find itself in serious breach of other financial services legislation or the gaming laws. Although we are not aware that this has occurred anywhere to date, caution is warranted given that regulators

are increasingly moving toward a principles-based system of regulation and supervision and away from product-specific approval. Such a principles-based system clearly carries the risk that the supervisory authority will reclassify the product after it enters the marketplace, thus throwing into doubt the status of the product sold as well as the legal compliance of the insurer. Other examples of regulatory risk include the regulator:

- Determining that the index insurance product falls in a class of insurance business for which the insurer is not licensed or authorized;
- Limiting the types of clients to whom the insurance can be sold;
- Limiting the types of delivery channels that can be used for the product; and
- Imposing additional requirements on the insurer providing the product which burden the insurer with extra costs.

7.1.2.1 Mitigating Regulatory Risk

Regulatory risk can be mitigated by involving the relevant regulator from the beginning of the product development process and maintaining an ongoing dialogue with the regulator throughout. Given that regulators are unlikely to have the kind of in-depth familiarity required for the effective supervision of index insurance products, it is particularly important for the product developer to educate the regulator on how the product works. The intensity of effort and investments required will depend on the knowledge and sophistication of the regulator. When engaged from the outset and well informed, regulators are positioned to provide input on how existing laws and regulations apply, what conditions they may impose, and whether any modifications to the proposed product are necessary. Sometimes, the regulatory framework may need to be altered and new regulations implemented to accommodate index insurance. An alliance with a supportive regulator increases the likelihood that such changes can be obtained in time for the market test.

Another important benefit related to mitigating regulatory risk is that engaging the regulator in product development from the beginning builds the regulator's technical capacity. This is critical for maintaining a sustainable index insurance market. Regulators must be sufficiently familiar with the technical aspects of index insurance to offer guidance if modifications are necessary to the product, or if the legal and regulatory frameworks undergo changes that have implications for the product. In addition, increased sophistication among regulators facilitates the introduction of new products and market growth, since well-informed regulators are also more likely to be flexible and open to innovation (see example below).

Although steps can be taken to mitigate regulatory risk, it cannot be fully eliminated. Ultimately, regulators are free to decide how to apply regulations, and often to change the regulatory framework. In addition, the regulatory framework is affected by factors that are outside the regulator's control. For instance, regulations are influenced by domestic legislation and international standards, each of which may change over time.

In sum, the adverse consequences of failing to address legal and regulatory issues early on -- from compromising otherwise deserving projects, to thwarting future initiatives, to missing out on valuable opportunities to build regulatory capacity — should not be taken lightly. Developers

of index insurance programs are therefore encouraged to pay close attention to the local legal and regulatory environment and address all relevant issues from the beginning of the process. First and foremost, this entails conducting an in-depth assessment of applicable laws as part of feasibility work to ensure that the product can achieve its objectives within the existing framework, as well as engaging relevant regulators throughout the product development process to minimize the risk that the product will not satisfy regulatory requirements. Promoting an enabling legal and regulatory environment from the start is a critical step to building scalable and sustainable index insurance markets.

7.1.2.2 El Niño Insurance and Regulatory Support for Innovation

GlobalAgRisk's experience with El Niño insurance in Peru demonstrates that the involvement of the national regulator is critical to the development of innovative insurance products and increases potential for long-term sustainability. The national banking and insurance regulator (SBS), has been consulted throughout the product development process, leading to valuable product guidance and precedent-setting regulatory approval for innovative product features.

El Niño insurance was initially envisioned as a derivative product to be sold exclusively to banks and MFIs that are versed in handling sophisticated financial instruments. However, early discussions with the SBS indicated that the product should instead be structured as insurance. This guidance from the regulator consequently opened the door to a wider, less financially sophisticated market that would have been excluded had the product been classified as a derivative, including firms in the agricultural value chain, farmer's associations, and local and regional governments.

Continuous dialogue with the SBS has also lead to the approval of new product features, thus placing El Niño insurance at the forefront of index insurance innovation. These innovations carry significant legal and regulatory implications for the development of index insurance.

Initially, the insurance was approved as a valued policy. However, as indicated above, the classification of an index contract as a valued policy is more appropriate for aggregate loss indexes, such as area yield and livestock mortality. El Niño insurance, on the other hand, uses the ENSO signal, which is an indirect loss index. As a result, in the second year, the insurance was developed as a contingency insurance contract which, as indicated above, is a form of non-indemnity insurance.

The El Niño insurance was initially described as a business interruption policy. However, it soon became clear that the uses of El Niño insurance extend beyond covering business interruption costs and losses to include a broad range of consequential losses. This delimiting label was therefore removed.

Given that, under a contingency insurance contract, there is no requirement for the policyholder to prove actual loss, the issue of whether the policyholder has an insurable interest is a matter of significant importance. Although there may be many types of potential insurable interest, it was decided to restrict the sale of the policy to persons who are exposed either: 1) to losses sustained, or additional costs, due to extreme flooding in the northern coastal region of Peru as a consequence of the occurrence of an extreme El Niño; or 2) to losses sustained, or additional costs, due to adverse changes in the fishery off the coast of Peru due to high sea surface temperatures caused by the occurrence of an extreme El Niño. In relation to the fishery, a high

sea surface temperature results in reductions in the fish catch and in increased fishery costs. This restriction was imposed for practical reasons as it would be more difficult for the insurer to satisfy itself that other persons that may wish to purchase the product actually have a real insurable interest.

El Niño insurance is therefore now being written as an insurance policy that can potentially be used by any legal entity (or individual) in Peru exposed to the losses and additional costs set out in the paragraph above, due to catastrophic flooding as predicted by extreme November and December ENSO 1.2 measures. The payment under the insurance contract is not "earmarked" for specific types of losses and the policy can therefore be purchased to protect against loss of revenue or extra costs that occur as a result of the insured event. For example, the cajas can use the insurance payment to fund the extra costs of finding capital during or after the catastrophic event, the costs of managing liquidity shortfalls during a crisis, losses incurred from restructuring loans, and ultimately, extra costs associated with restructured or defaulted loans. Assessing consequential losses is extremely difficult and expensive. El Niño insurance, which as payment is made against a published index requires no loss adjustment, has been accepted by regulators in place of traditional indemnity based products which require cumbersome loss assessment processes for consequential losses, including business interruption costs (e.g., estimating business revenue losses).

Another significant innovation that distinguishes El Niño insurance concerns the timing of the indemnity payment. Since the payment is based on November and December sea surface temperatures, which are a predictor of the occurrence of floods in February–April period, El Niño is a form of forecast insurance, i.e., it pays before the losses have been sustained. To our knowledge, this is the first "forecast index insurance" product to receive regulatory approval.

7.2 Building Capacity Among Local Implementation Stakeholders

Index insurance is a unique and sophisticated financial instrument that is typically introduced in an environment of missing public goods (e.g., limited access to quality weather data, inadequate legal and regulatory environment, and limited insurance culture). As a result, significant investments in institutional capacity building – the transfer of knowledge and skills to the local implementation stakeholders through education and technical assistance initiatives – are central to laying the foundation for sustainable index insurance markets. One critical component of capacity building is helping local partners develop project ownership, which is an important motivator for maintaining initiative and long-term commitment. This is often a slow process, requiring patience and fortitude on the part of the outside agent conducting these efforts. A local insurance company, for example, that is naturally positioned to take the leadership role, may be cautious and slow to commit at first due to the risks inherent in simultaneously investing in a new line of products while building expertise.

Nevertheless, the ultimate goal is to hand off the product to local "champions" who are equipped with relevant skills and have the necessary incentives to realize market growth on their own or with minimal outside assistance. Ideally, institutional capacity building also empowers local stakeholders to create effective risk management solutions that fit the local context and are not necessarily limited to index insurance.

Due to the high up-front costs and risks involved, capacity building efforts tend to be facilitated through donor-supported investments and carried out by qualified practitioners. The practitioners perform roles such as conducting the feasibility assessment, finding workable solutions for missing public goods (e.g., increasing access to quality weather data, advising on the improvement of the legal and regulatory environment, providing consumer education), designing the product, preparing the pilot, and engaging international reinsurers. The donor may also function as a facilitator, bringing together various local and national actors to initiate collaboration and begin the process of knowledge transfer.

The first stage of capacity building typically involves educational outreach to a diverse group of public and private actors (policy makers, government officials, insurance and financial service regulators, insurance companies, financial institutions, farmer's organizations, farmers, etc.) about index insurance – what it is, how it can be used, and how to regulate this unique class of insurance. Workshops bring local players together and often provide them with a new way of looking at the effects of weather risk and the use of insurance in the local economy. One particularly effective method is to collect quantitative estimates (even if crude) of the direct and indirect economic impacts of the weather risk, which are subsequently shared with workshops participants. Placing a monetary value on the cost of risk can be sobering. It also serves to emphasize that losses are inevitably absorbed somewhere in the economy and probes thinking about who actually pays for losses when they occur and whether these costs can be reduced. This activity not only highlights the importance of insurance solutions in some settings, but also may lead to reevaluation of policies or practices that result in poor risk management in general.

Importantly, during these initial awareness-building campaigns, practitioners identify local leaders, including a commercial insurer, insurance regulators, and any intermediaries that may be involved in product delivery, who are committed and demonstrate a willingness to invest in the success of the project. These local champions receive more focused one-on-one training related to developing and implementing the actual product.

Various skills are needed to develop an index insurance product and take it beyond the pilot stage. Contract design, for example, requires specialized risk assessment and actuarial skills. Brokers and delivery agents must possess marketing and insurance selling skills including being able to explain the insurance product to clients; insurers need expertise in negotiating with global reinsurers; etc.

Building the institutional capacity of the insurance and regulatory sectors plays a particularly important role in developing new markets for index insurance. Because it protects against spatially correlated risk, index insurance requires special financing arrangements, including provisioning and access to global reinsurance markets. To stay solvent in years of very high losses, private insurers and regulators must understand how to establish appropriate financial provisions needed for making large payouts. In addition, maintaining financial viability often requires selling part of the risk to global reinsurers. At this point, the reinsurance market is still limited, with few international players and somewhat lackluster interest in investing in these emergent markets. This makes it all the more important for local insurers to gain the trust of reinsurers by conforming to accepted business operating practices. Regulators play an important role in helping insurers improve their access to global markets, by incorporating international operating standards into the local regulatory framework.

Fostering commitment among local leaders is also an important aspect of capacity building. Local players must take ownership of the project to see to its advancement, particularly when complications arise. The resolve required of overcoming hurdles that are part and parcel of product development and piloting can come only from partners who are committed to the effort and who exhibit strong leadership skills.

In addition, local leaders can play a critical role in overcoming initial set-up challenges and catalyzing market development. In Nicaragua, for example, the leadership of the national insurer, Instituto Nicaragüense de Seguros (INSER), was instrumental in building a promising index insurance market. In 2005, CRMG partnered with INSER to lay the groundwork for an index insurance pilot that protects groundnut farmers against drought risk. Over the course of two years, INSER took the lead in reaching out to various implementation stakeholders to facilitate the transfer of technical skills and capacity. The product was successfully launched in 2007 and continues to grow (Hazell et al., 2010).

Because building local capacity is a time intensive process, it must start from the beginning of product development and continue through implementation and evaluation. Making these investments early on ensures that local partners will develop skills and a strong knowledge base in time for scale up. In addition, since feasibility of expansion depends in part on creating capacity to deliver cost effective products, local partners must learn to review and refine products in response to feedback from market participants. Therefore, it is critical that outside consultants strive to transfer responsibilities to local partners as soon as possible.

The investments required for institutional capacity building depend, of course, on insurance awareness and the strength of the local financial sector, which vary tremendously across countries and regions. Mongolia, for example, has an underdeveloped insurance sector so intensive institutional capacity building activities, particularly in the regulatory domain, were required to launch the livestock mortality index insurance pilot (Mongolia IBLI). El Niño insurance in Peru, on the other hand, did not require such heavy investments in institutional capacity building, since the country has a relatively sophisticated insurance market.

7.3 Educating Consumers

Consumer education is pivotal to the success or failure of index insurance programs: a product, no matter how well designed, cannot succeed if potential clients are unaware that it is offered; fail to perceive its value; or have unrealistic expectations about its benefits. Consumer education therefore carries the dual purpose of helping vulnerable households and the businesses that support their livelihoods (e.g., agricultural lenders, firms in the value chain, farmer's associations, and other risk aggregators) make sound risk management decisions on the one hand, and stimulating demand for index insurance products on the other. Essentially, the goal of consumer education is to create a strong insurance culture, which in turn underpins sustainable insurance markets.

Consumer education content and delivery may differ considerably depending on the target market. Preparing effective educational materials for risk aggregators will likely require a detailed knowledge of the industry (e.g., banking) and a thorough understanding of how weather risk affects specific firms in that industry. Campaigns targeting households will necessarily be both broader and more general. El Niño insurance in Peru is a case in point.

GlobalAgRisk has been involved in educational outreach to cajas through individual meetings with managers and credit analysts for each caja. Since caja managers must balance the current cost of insurance premiums with the benefit of improving resilience to extreme El Niño events, the challenge of educational outreach has been to help caja managers recognize the value of El Niño Insurance, particularly during non-El Niño, or "normal", years. For example, El Niño Insurance could allow cajas to increase their lending presence in vulnerable economic sectors that experience higher risk but also yield higher returns. To demonstrate some of these benefits, the GlobalAgRisk team has developed a basic banking model that allows for preliminary quantification of the long terms costs of unmanaged El Niño risk. While crude, this analysis can motivate caja managers to invest in more thorough cost/benefit analyses of purchasing insurance, which may have been otherwise unlikely.

In rural settings of lower income countries, there will be a vast financial literacy gap between risk aggregators, particularly lending institutions such as banks and MFI's, and poor households. Households are unlikely to have had previous experience with any form of insurance and will thus require an introduction to the very concept. As a result, educational campaigns geared toward households will need to be much broader in their scope. The Microinsurance Network's Insurance Education Working Group has compiled a set of best practices in consumer education content and delivery design based on preliminary evidence from the field (Dror, Dalal, and Matul, 2010). One key finding is that consumer education must be nestled in broader awareness building efforts. This is particularly important for campaigns targeting households, which, at the very least, must focus on risk management and insurance, but should, if resources are available, also include basic financial literacy activities such as budgeting (Dror, Dalal, and Matul, 2010).

The Insurance Education Group defines consumer education, as applied to microinsurance (but also pertinent to index insurance whose end users are households), as: "a systematic effort to teach risk management strategies and the role of insurance in order to promote better risk management practices amongst low-income households. The goal of consumer education is to provide households with knowledge and skills that enable them to make the best financial decision for themselves" (Dror, Dalal, and Matul, 2010, p. 1). Characteristically for an industry still in its infancy, however, what may often pass for education are industry-driven campaigns that market the benefits of a specific product. This has been a common experience with microinsurance. Although product marketing is important, it is neither a substitute for, nor the starting point of, consumer education. Compared to financial transactions that entail exchanges of tangible goods, insurance can be quite abstract. Households need to understand not only the general concept of insurance but also be able to compare the benefits and costs of a specific index insurance product. Ultimately, only informed consumers can be expected to effectively utilize available financial risk management tools.

Consumer education should be related to previous loss experiences. This is particularly salient for index insurance, since it works best for catastrophic risks, which occur infrequently and are thus likely to be ignored by many of those who are at risk (Hogarth and Kunreuther, 1989). Because this cognitive failure may lead to undervaluing of index insurance and consequently to under-consumption, consumer education programs should remind clients about past catastrophic weather events that adversely affected their communities. Vivid imagery of the high price of unmanaged weather risk has a powerful psychological impact. A particularly compelling exercise is to demonstrate the financial value of an index insurance product by

having figures on hand that show how much a client with coverage could receive following a catastrophic loss event. For example, Weather Risk Management, which provides index-based risk transfer products in India, uses historical data on crop failures to remind farmers of past losses and demonstrate the value of purchasing the insurance policy (Dror, Dalal, and Matul, 2010).

The Insurance Education Working Group's findings regarding consumer education delivery highlight the need for continuity, repetition, and the use of a variety of channels and tools. Evidence shows that one time, *ad hoc* activities fail to achieve intended results. Rather, education programs need to be ongoing facilitation efforts. Messages also need to be consistent and reiterated periodically to improve information retention. Mass media channels such as radio and TV can be used to raise broader awareness, while workshop and classroom training allows for greater participation and interaction, which increases learning.

A variety of tools can be employed to deliver information, including brochures, flip charts, games, and cartoons. Programs that have the best results are learner centric, engaging the clients and encouraging active participation. And, of course, since the ultimate goal is to create informed communities that have the knowledge and skills to make best use of the available formal risk management tools, client education needs to be linked to specific products and contain product relevant information (Dror, Dalal, and Matul, 2010).

Educational campaigns geared toward households will need to be more intensive in terms of repetition and require a broader mix of tools and delivery methods compared to educational outreach targeted to more sophisticated users. Training for risk aggregators can be delivered in a workshop setting or conducted as focused meetings with key participants.

Educational outreach must also consider consumer protection issues. Since sustainability of low value financial transactions targeting smallholders depends on keeping costs to a minimum, providers continue to experiment with different business models in an attempt to attain ever-higher levels of efficiency. Innovations mainly center on efficient delivery channels, such as the use of existing intermediaries and technology-enabled devices such as mobile phones. However, these innovations also carry risks to less educated and inexperienced customers. Research reveals, for example, that, in Kenya, some clients of the mobile payment provider M-PESA – a rapidly expanding branchless banking service serving low income clients – were revealing their passwords to agents (Morawczynski and Pickens, 2009). The Kilimo Salama pilot uses M-PESA as an efficient interface for selling contracts, registering clients, and transferring payouts (Feroni, 2010).

Customer protection issues are best addressed through the regulation and supervision of providers. However, an effective consumer protection framework can accomplish its objectives only insofar as the end users understand the financial services and the associated redress and complaint mechanisms. Educational initiatives that improve client's awareness regarding rights and how to file complaints supplement regulatory action and serve an important function in reducing risks for customers (Dias and McKee, 2010).

Investments in broader consumer education and outreach are particularly important when index insurance is provided using existing delivery channels such as retailers or financial service providers to ensure that the proper information is being conveyed to consumers. Relying on

individuals who have little experience with insurance to adequately explain the concept of index insurance or important aspects of the product to uninformed farmers, presents a risk. Thus, investments in financial literacy and product education of the individuals involved in product marketing and sales are also critically important for the scalability and sustainability of the market.

Delivering comprehensive and continuous educational campaigns is costly. At the same time, the proportionately high transaction costs associated with low value transactions pressures insurers to maintain lean operations. This raises the question of whether insurance providers can sustain broad and long-term educational initiatives. More fundamentally, given that financial literacy is essentially a public good that can benefit a variety of institutions, an insurer may not have sufficient economic incentives to incur the financial burden of providing educational programs. It is more likely that comprehensive consumer education will come through a coordinated effort of insurers and other financial service providers, the government, NGOs, and donors.

To curtail costs, whenever possible, providers should investigate linking product marketing to existing initiatives, such as government financial education and consumer protection programs (Dror, Dalal, and Matul, 2010). Likewise, the responsibility among stakeholders should also be partitioned to maximize efficiency. For example, an NGO that maintains a local presence is better positioned to provide continuous consumer education than a practitioner headquartered on a different continent. In addition, monitoring and evaluation of consumer education activities must be incorporated from project inception to reveal which strategies generate desired results at lowest costs (Dror, Dalal, and Matul, 2010).

Chapter 8 Product Design

It is never easy to initiate an insurance product in a new market. This is particularly true when designing innovative index insurance products for lower income countries. The product design must account for all the needs, opportunities, and constraints identified by the feasibility assessment. Obstacles revealed during the feasibility assessment may also stall index insurance product development completely but spur other innovations and creative new approaches to managing identified risks.

Index insurance products have typically been designed with the intention to protect against crop yield losses due to adverse weather events. However, due to increased recognition of the limitations of this approach along with new understandings about the direct and indirect consequences of catastrophic weather risk, other designs are beginning to emerge such as contracts that protect a household's livelihood portfolio more generally from the consequences of a catastrophic weather event. Limitations experienced with offering index insurance to households as a stand-alone product have also led to new ideas for reaching poor households with index insurance. Among these are innovative delivery systems, linkages to other services, and targeting index insurance products to the institutions and businesses that provide valuable services to households.

This chapter considers which product design features may be most effective for introducing index insurance products into rural areas of lower income countries. We focus on two general

classes of products that have been developed for market-based index insurance programs: those designed for risk aggregators and those designed for households.

8.1 Index Insurance for Risk Aggregators

Index insurance products designed for risk aggregators are intended to protect the solvency of a firm and improve access to the firm's services by low-income households. Thus, the direct beneficiary of the insurance is the insured firm, however, is it expected that the firm's improved resiliency to catastrophic weather risk will lead to indirect benefits for households through improved accessibility and continuity of services. For example, given the spatially correlated nature of drought risk, lenders are affected by the drought exposure of their agricultural borrowers. If a drought occurs, many borrowers could be expected to experience repayment difficulties concurrently. The threat of such risks and the potential consequences for the local economy may cause banks to restrict or ration their services as a way to reduce their exposure. Evidence of this behavior was seen in Peru following the severe 1997-1998 El Niño. Some of the banks in the affected regions suffered increased default rates and other liquidity problems for years afterward. Following that experience, banks reduced the size of their agricultural lending portfolios, leaving some farmers without the ability to access credit and limiting the banks' profitability from a productive sector.

Likewise, other firms in the value chain (e.g., processors or exporters) may experience disruptions to their business, such as a sharp reduction in the supply or quality of a commodity, or limited access to transportation, due to the widespread effects of a catastrophic weather event. Lost revenue may then threaten a firm's capacity to keep laborers employed or fulfill contract obligations.

Relaxing some of these value chain constraints can create significant benefits for rural households if it leads to improved access to and continuity of local services. The insurance can strengthen the ability of a firm to withstand weather-induced shocks, making them more competitive in the marketplace but this should also enable them to offer better terms of service, such as reducing some of the risk loading that is embedded in interest rates. With access to insurance, a company would have flexibility in using an insurance payout for the highest priority need, e.g., to cover fixed costs, to keep people employed, or to invest in recovery/reconstruction or risk adaptation.

Due to the challenges of developing index insurance products targeted to households, a greater focus on product development for financial institutions and value chain enterprises is emerging (Skees, 2010; GlobalAgRisk, 2010b; Hazell et al., 2010; Arce, 2010; Skees et al., 2007). The data constraints can be considerably less as risk aggregator products require lower spatial specificity of the data that underlie the index. If weather stations are relatively sparse, basis risk will be higher for household products that require point-specific assessments than for risk aggregator products that can rely on assessments conducted at the community or regional level (GlobalAgRisk, 2010b).

Many supply-side constraints to implementation are also greatly reduced with a risk aggregator product. By targeting the aggregate portfolio of a financial institution or a firm in the value chain, administrative and product delivery costs will be substantially lower than for insurance targeted to households. In addition to the efficiency gains from dealing with many fewer policies

of larger value, the contract structure for a risk aggregator product can also be more easily customized to the specific needs of each firm. Educational efforts are also more targeted and less extensive than what is required for household index insurance products. Firms and financial institutions are also more likely than households to have previous experience with insurance or other risk transfer mechanisms. Thus, they are better equipped to evaluate index insurance products.

As mentioned earlier, the introduction of a product for a risk aggregator does not preclude the development of, or need for, household applications of index insurance and other forms of insurance. The development of risk aggregator index insurance products will build capacity among insurance suppliers and regulators, facilitating the possible development of household products at some point in the future (Skees and Barnett, 2006; Skees, 2008; GlobalAgRisk, 2010b).

Targeting initial product offerings to risk aggregators may generate the volume needed to engage insurers and reinsurers in developing and growing the market. However, creating index insurance products for risk aggregators is not without challenges. For example, while there are many operational advantages that make risk aggregator products more feasible and cost-effective for insurance companies and product developers, questions remain about risk aggregators' demand for index insurance.

Some of the same problems that stifle demand for household index insurance products also exist for products targeted to risk aggregators. Although risk aggregators likely have more experience with insurance than low-income households, most will not be familiar with index insurance and many will not have explicitly considered their exposure to weather risk. When we present product concepts to risk aggregators, they are always most concerned about the cost of the insurance. However, the cost is somewhat irrelevant until there is fuller understanding of what the product offers and how much sum insured is needed. We work with potential policyholders to redirect this question to an evaluation of how the product functions and an assessment of their optimal level of sum insured to obtain a truer idea of the cost of the insurance in comparison to the benefit provided by smoothing losses after a catastrophe.

Businesses may prefer that their customers be individually insured, thereby shifting the cost of the insurance to their clients. However, risk aggregator and household products are not complete substitutes. Recent research by GlobalAgRisk in Peru is demonstrating that a bank whose agricultural borrowers are insured may still face exposure to weather-induced defaults from other borrowers or liquidity problems when affected households withdraw savings deposits (Collier and Skees, 2010; Cavanaugh, Collier, and Skees, 2010). As with a household product, an index insurance product targeted to risk aggregators should account for the various ways that the business may be affected by catastrophic weather risk. The most direct effects will be the most obvious, e.g., borrowers defaulting on loans following a natural disaster. However a deeper analysis can help quantify other consequences including the costs and benefits of existing risk management strategies that the firm may be utilizing (e.g., restricting lending to a particular sector to reduce exposure to weather risk).

Risk aggregators that have received government or donor support following past catastrophes may be less inclined to purchase insurance if they expect similar financial support in the future. For example, some financial institutions have at least implicit recapitalization guarantees from

governments or donors. Private sector firms who cannot count on government support during a catastrophe may have more demand for a weather insurance product as long as the benefit of the insurance on their bottom line can be clearly demonstrated. One-on-one analyses and risk modeling can be done with each potential insured to examine their long-term variability of returns with and without insurance. Such a detailed analysis would not be feasible for any household product given the large number of potential customers.

From an operational standpoint, the decision to purchase index insurance can also be subject to a convoluted or bureaucratic process, depending on the institutional structure of the firm. It is important to identify early the channels and personnel involved in the decision making process as well as the time required to obtain approval and budget allocation for the payment of premium. For government agencies or private firms governed by a board of directors, funds to pay insurance premiums may need to be first approved for inclusion into the annual budget. For example, in Peru the idea of offering index insurance to water users' associations was considered. Such insurance would enable the associations to implement disaster prevention and recovery activities surrounding El Nino events. However, the associations' governance procedures are such that the decision to purchase insurance would require a unanimous vote by all of the members, which would be near impossible.

Lastly, it cannot be guaranteed that an insured risk aggregator will adjust their practices to offer improved access to services or other benefits to poor households. Such objectives cannot be mandated but they are more likely to occur if a competitive market exists for the services offered by the risk aggregator. If product development is supported by a public-private partnership comprising government stakeholders or international agencies, their involvement and the integration of the project into a larger public policy dialogue can provide the influence to ensure that development objectives are also being advanced (Rohregger and Rompel, 2010). Educational efforts can also emphasize the potential business advantages of offering better services, such as attracting and retaining customers in a competitive market.

Many of the challenges described above may be addressed through careful market development efforts including consumer education, capacity building with the insurance supervisor, and risk analysis to demonstrate the benefits of insuring against weather risks. In some cases, rating agencies or government regulators may provide added incentives for insurance purchasing. For example, in Peru we have worked with banks, credit rating agencies, and the banking and insurance regulator to understand factors that influence bank reserving requirements and how index insurance purchasing could possibly relax these requirements and/or improve credit ratings.

Though we and others make a conceptual case for initially targeting index insurance products to risk aggregators there is as yet little empirical experience to support this view. However, several risk aggregator products are in advanced stages of development so we are likely to learn much more about the possibilities and constraints of developing index insurance products for risk aggregators in the next few years.

In 2007 the Malawi rainfall index insurance pilot program shifted to a risk aggregator focus by insuring the portfolios of banks that lend to growers of tobacco and other commodities with highly organized supply chain. This decision came after two years of pilot sales to groundnut farmers in which insured farmers who had borrowed from banks engaged in side-selling of their

output and failed to repay their loans. Opportunity International Bank of Malawi (OIBM) and Alliance One, a tobacco trader, used the rainfall insurance to insure a portion of their lending portfolio. Part of the cost of the insurance was passed on to individual borrowers as part of the loan package, though no explicit arrangement was in place to inform borrowers of the insurance or to pass on any benefit from a payout. Tobacco production was targeted since the tobacco sector in Malawi is vertically integrated through contract farming and auction sales, allowing more opportunity to recover loans. Since it is a crop that has higher input requirements than groundnuts, the larger sum insured also enabled the product to obtain reinsurance coverage in the international market for the first time (Bryla and Syroka, 2009).

In the Philippines, Munich Re, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), and a local insurance company, Coop Life Insurance and Mutual Benefit Services (CLIMBS), recently developed an index insurance product to insure the portfolios of lending cooperatives against severe typhoons. The product is based on wind and rainfall triggers measured by satellite. The intent is to protect the financial stability of the cooperatives and their lending portfolio, and to provide a benefit to individual members of the cooperatives by structuring an insurance mechanism for both the cooperatives and their clients. The product has a tiered payout structure in which, depending on the severity of the event, the cooperatives would receive a payment of 5, 10 or 20 percent of their loan portfolio. It is intended that these funds would be passed on to benefit individual borrowers in need, either through emergency loans or to finance premiums for microinsurance cover (MunichRe, 2010).

8.1.1 Weather Insurance for Businesses

GlobalAgRisk is involved in the development of risk aggregator products in Peru and Vietnam. Research conducted on these projects has given us a much stronger vision for how index insurance can strengthen risk aggregators and improve their ability to serve low income clients.

8.1.1.1 INDEX-BASED FLOOD INSURANCE IN VIETNAM

In Vietnam, early onset flood business interruption insurance was designed to address the additional costs encountered by the Vietnam Bank for Agriculture and Rural Development (VBARD) when certain river level events adversely affect the ability of its clients to service their working capital rice production loans.[10]

In the Mekong River Delta province of Dong Thap, annual single-pulse river flooding beginning in mid-June and lasting until February is a natural occurrence around which two rice producing seasons are structured. The second season rice crop is usually harvested in June/July and can face significant disruption and losses when the flood advances earlier and more strongly than usual. Stakeholder consultation and Mekong River flood modeling identified the Tan Chau river level gauge as a good indicator of downstream and overland flooding in Dong Thap. A river level of 280 centimeters or above was found to constitute disruptive inundation when occurring between June 20 and July 15. A flood water level of this magnitude in later periods is considered normal and usually occurs after the rice harvest is completed.

[10] The material in this section is adapted from Hartell and Skees, 2009.

The early onset flood contract is structured as a linear payment function per cm of the maximum three-day moving average of daily water level measured at the Tan Chau station during the harvest vulnerability period. An index threshold value of 280 centimeters is empirically shown to result in a payment approximately 1-in-7 years, sufficiently infrequent to be insurable. The maximum payment occurs at 350 cm, which corresponds to a 1-in-100 year flood event.

Flood is a difficult peril to insure--not only is it spatially covariate but flood control management decisions can have a profound influence on who experiences flooding and when. In Dong Thap, extensive flood control infrastructure is used to selectively and progressively direct the flood in its early stages, and leaves open the possibility of opportunistic flood management. This makes it very difficult to rate and underwrite the risk at the individual level even if flood modeling can in principle categorize different levels of flood risk among individuals. Consequently the decision was made to first focus on the big risk exposure of VBARD, the main risk aggregator in Dong Thap and the dominant lender to agricultural producers.

VBARD acts as a *de facto* agricultural insurer through its lending practices which include: 1) application of nearly uniform interest rates throughout the country, thus VBARD pools risk nationally; and 2) in the event of a natural disaster that affects loan repayment ability, VBARD performs a loss assessment to determine if loans should be rescheduled. In the past, the government periodically recapitalized the bank for loan forgiveness and other additional expenses, but the practice of debt forgiveness has been discontinued as the government moves to shape VBARD into a more accountable commercial enterprise. Nevertheless, the Government is still a source of capital in the event of shortfalls. Loan rescheduling and some amount of commune-level loss adjustment take place if the borrower qualifies. And like an insurer, VBARD maintains local reserves to protect against losses created when debt is rescheduled. The recent regulatory changes towards commercialization are serving as an important catalyst for VBARD to consider innovative options to cover its lending exposure from natural disaster risk.

One approach for the risk aggregator is to develop insurance contracts that are tied to the expectation of loan default of clients resulting from an early onset flood event. While intuitively appealing, in the context of Vietnam, there are a number of difficulties with the approach from a legal perspective. Current banking practices rarely move non-performing debt off the institution's accounting books, even though there are loans considered to be in default. Not having clear procedures to do so causes problems establishing insurable interest as required for insurance. A second problem is that, even thought the insurance would act as protection to the bank's overall lending portfolio from expected default during early onset flood events and does not directly identify individual borrowers, a pathway is open for subrogation under the Civil Code of Vietnam when the insurance is characterized as credit default insurance, a form of property insurance. Subrogation allows the insurance company to claim on the assets of defaulting clients when an insurance payout is made to the bank. While it is unlikely that claims of subrogation by an insurance company would be cost effective — such claims would be essentially unworkable under an index insurance contract — the possibility still exists. Finally, tying insurance only to loan default ignores the substantial costs associated with loan servicing and rescheduling.

An alternative approach is to consider only the direct and indirect opportunity costs and consequential losses accruing to VBARD when there is an increase in loan rescheduling needs caused by the early onset flood event — a type of business interruption cost associated with an insurable event. These costs arise because current VBARD lending practices do not include additional penalties or interest for rescheduling of loans. An index insurance product characterized as business interruption insurance avoids encumbering a contract with subrogation claims because it is not insurance for the individual loan default risk of farmers or even the portfolio credit risk of VBARD. It may be possible to position a business interruption policy as a type of valued policy[11] where the parties to the insurance contract agree in advance on the value of the insured loss given certain events that will cause a loss.

VBARD would have considerable flexibility in the use of the insurance payment. One approach for the use of a business interruption insurance payment would be to use it as a substitute for some portion of the reserving requirements imposed by banking regulators. The goal of blending the two risk management instruments, insurance and cash reserves, is to reduce the overall cost of being able to meet financial obligations while considering the many sources of risk to the banking enterprise. It was felt that this type of dynamic and innovative risk management would be needed as VBARD continues to make the transition to more commercial principles.

The regulatory approval of the index-based business interruption insurance by the Vietnam Department of Insurance in 2008 was a milestone in being the first such contract formally approved for an agricultural context. A fully priced and reinsured contract of USD 1 million cover was offered to VBARD by a domestic insurance partner in 2008 and 2009. VBARD's exposure for business interruption from early onset flood in Dong Thap was estimated at VND 120 billion (~ USD 7.5 million), which represents its maximum insurable sum and an *ex ante* genuine pre-estimate of loss.

VBARD did not purchase the contract in either year and ultimately opted to purchase provincial level area-yield insurance for rice production in 2011 to insure part of its agricultural lending portfolio. This insurance was offered through its captive insurance company, Agricultural Bank Insurance Company (ABIC), which removes the threat of subrogation.

8.1.1.2 Index-based El Niño Insurance in Peru

In Peru, the risk of concern is El Niño, which can bring catastrophic rainfall and flooding to the coastal regions of Peru, particularly in the north. The past two severe El Niño events resulted in rainfall more than 40 times the normal amount for January through April. The initiative to develop weather index insurance in Peru began with a focus on protecting microfinance institutions from the risk of loan defaults and other problems resulting from extreme El Niño events, with the goal of stimulating an increase in agricultural lending to smallholder farmers. Feasibility work identified El Niño as the driver of catastrophic rainfall and flooding in the province of Piura, and found a strong correlation between these catastrophic events and sea surface temperatures (SSTs) in the Pacific, which are indicators of El Niño Southern Oscillation (ENSO) cycles. As a result, an El Niño index insurance product has been developed based on the

[11] See paragraph 7.1.1 above.

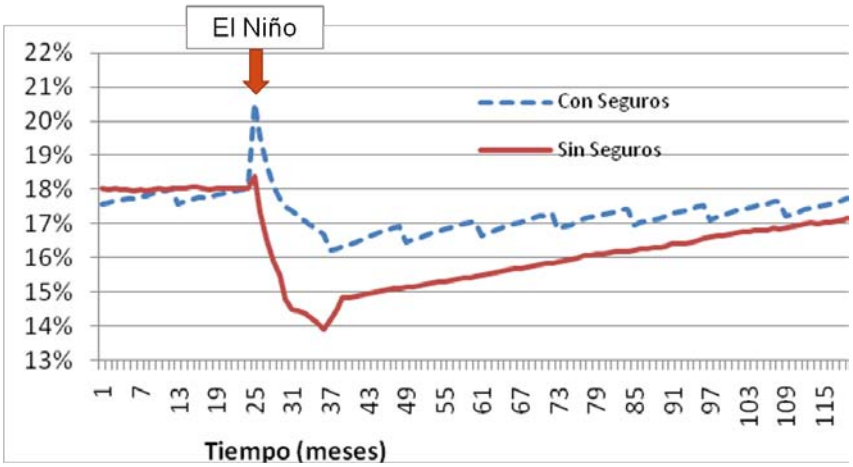
average November and December SST for ENSO region 1.2 measured by the U.S. National Oceanic and Atmospheric Administration (NOAA).

During product development the initial focus expanded beyond insuring the agricultural lending portfolio of lenders in recognition of the different ways financial institutions and other enterprises are affected by catastrophic El Niño events. Extreme rainfall and flooding from past events has resulted in many significant problems in Piura — lost or damaged crops and fruit trees, erosion of soils and riverbanks, a breakdown in transportation due to damaged roads and bridges, increased incidences of disease (e.g., malaria), and disruptions in commerce. When individuals and local markets suffer in this fashion, it is expected that many in the agricultural value chain and other sectors will also suffer. For example, by early 1998 there was a clear indication that a strong El Niño was coming and thus, many farmers simply did not plant their crops which resulted in a 27 percent drop in fertilizer sales in northern Peru (Skees, 2010). These insights led us to position El Niño Insurance differently to account for the variety of ways that risk aggregators in the region may suffer from El Niño risk.

The El Niño Insurance product was presented to the Peruvian regulator as a form of contingency insurance designed to pay for consequential losses that are linked to catastrophic flooding caused by severe El Niño events. Furthermore, given that high ENSO measures in November and December are such a strong signal of catastrophic rainfall to come between February and April, the regulator also accepted that exposed firms would be incurring additional expenses even before the onset of the disaster (Skees, 2010). Thus, the design of the El Niño Insurance enables the policyholder to receive a payout as early as January, allowing time to use the funds to implement disaster preparation activities if possible or to have funds available in the immediate aftermath of the disaster.

For microfinance institutions in the region, an insurance payout would be treated as new equity on their balance sheets, bolstering their capital adequacy ratio during a time when it would otherwise be reduced by delinquent or defaulted loans and savings withdrawals (Collier and Skees, 2010). Figure 1 illustrates a model of the effects of an El Niño disaster on the capital adequacy ratio for a microfinance institution (MFI) both with insurance (con seguros) and without insurance (sin seguros). The horizontal axis is time measured in months. As the figure shows, an insured institution would be in a stronger position following El Niño to make new loans and investments for years afterwards in comparison to an institution without insurance. The spike for the insured institution is a result of the insurance payout with a decline afterwards representing capital outflows in the form of new loans. To achieve this buffer against capital losses, the MFI need only insure a portion of their lending portfolio to offset some of their risk exposure. In the risk assessment model used to support the results presented in Figure 1, the optimal sum insured was in the range of 5 percent of the value of the lending portfolio (Collier and Skees, 2010).

Figure 1 Effects of El Niño on Capital Adequacy Ratio with and without Insurance



Source: Collier and Skees, 2010

The analysis presented in Figure 1 resulted from one-on-one risk assessments with some of the MFIs in Piura to gain a clearer understanding of the different ways in which El Niño affects their operations and to help them evaluate an optimal level of sum insured to support resiliency and return to normal operations after a catastrophic event. The analysis gives credence to the idea of El Niño insurance by illustrating how insurance can be used to offset the long term consequences of catastrophic weather risk. The concepts are relevant to other financial institutions and businesses that experience problems from El Niño even though their exposure and needs may be different. For example, a fair trade fruit export association that contracts with farmers in Peru immediately saw value to the El Niño Insurance. This exporter envisions using insurance payouts to hire farmers whose crops were damaged by El Niño to assist with flood risk mitigation and/or recovery activities. This would allow the association to maintain relationships with the farmers and support a swift return to full production.

8.2 Index Insurance for Households

Index insurance targeted to households remains appealing to donors and practitioners working to improve the livelihoods of the poor because there is a direct benefit to households. However, the challenges of developing index insurance are most acute for household products. Household insurance products must be relevant, affordable, and accessible to low-income markets but costs must also be kept low to ensure solvency and sustainability. Efficiency is a key factor for household index insurance products though it can be difficult to minimize transaction costs and achieve sufficient volume of low-value transactions to attract and maintain the interest of commercial insurers and reinsurers. In this section we examine some of the major product design components for index insurance targeted to households.

8.2.1 Product Distribution and Delivery Models

The delivery, or distribution, channel is the component of product design that determines how the product will be sold. In lower income markets, having efficient delivery channels is

important due to small market volume and the pressure to minimize costs to maintain as low a premium as possible. Costs and inefficiencies in product delivery can impede the performance and affordability of the product.

In finding an effective and efficient delivery channel, insurers must navigate the tradeoff between investing in accessibility and keeping costs low. At one end of the spectrum is a full-service model in which a representative of the insurance company visits each potential client. A benefit of the full-service model is that the person selling the insurance should have specialized training, and ideally, can help clients assess their exposure, answer any questions about the insurance product, and serve as a conduit through which the client can contact the insurer directly if needed. However, when households are located in remote or difficult to reach areas, the transaction costs associated with the full-service model can become prohibitive relative to the small sums insured. Thus, this model is typically not feasible for index insurance targeted to households in rural areas of lower income countries.

At the other end of the spectrum is a delivery channel with low client contact and low transaction costs. Examples include automated services such as automatic teller machines (ATMs) or mobile phones. In recent years, automated service technologies have greatly advanced in many lower income countries and have been used to increase access to banking services. Such technologies could, in principle, deliver index insurance as well. The Consultative Group to Assist the Poor (CGAP) recently examined the growing use of branchless banking in the financial sector of lower income countries and found the use of mobile technology enabled more rapid scale up and lower transaction costs though applications are still largely limited to payment transfers (McKay and Pickens, 2010). Insurance transactions are more complex, requiring more exchange of information, though software platforms are beginning to emerge that can facilitate such transactions. Using automated services is likely most feasible where index insurance sales could “piggyback” on the existing automated services of a local financial institution. It is important to note however that financial regulations are not advancing as rapidly as delivery technologies. Thus, mobile phone based insurance transactions may not have proper regulatory oversight or existing regulations may prohibit such transactions.

Partner-agent models fall in the middle of the spectrum by lowering transaction costs through the use of a delivery intermediary while still providing face to face interaction with the consumer. In this model, the insurance company partners with an intermediary, typically a lender or other business that already offers services to the target market. This delivery channel is less costly than the traditional insurance agent model since it utilizes existing distribution networks. For a partner-agent model, the delivery cost will likely include some commission that compensates the intermediary for their role in the sale and administration of the product.

The intermediary may only serve as an access point for the insurance or there may be a formal linkage between the insurance and the other services offered by the intermediary as a “bundled” product. Index insurance programs targeted to households in Ethiopia and Brazil utilize existing government social programs as a distribution and marketing channel for reaching low-income households (Hazell, et al., 2010; Oxfam America, 2010). In Vietnam, an index insurance product for coffee farmers is being sold via a network of agricultural extension agents (Hartell and Skees, 2009b). The agricultural extension service is trusted by farmers and also provides the opportunity to integrate insurance education into broader agricultural

management training. In these examples, the insurance is sold as an independent product, though it certainly may complement the primary services offered by the intermediary.

Integration of index insurance with other services in the value chain can convey and reinforce the role of insurance as part of a holistic approach to risk management. The Indian insurance company ICICI Lombard began selling an index insurance product for potato farmers in 2007 that is offered as part of a package of services provided through contract-farming arrangements with global agribusiness, PepsiCo. Insurance coverage is voluntary, but uptake has been high (more than 80 percent in the first two years). The upfront production costs for PepsiCo's processing potatoes are significantly greater than for staple crops grown in the region, but potatoes produced for PepsiCo are also significantly more profitable. Thus, the insurance reduces some of the risk to farmers of making the investment in this high-return activity. For PepsiCo, the insurance, in conjunction with the other services they provide, helps manage their supply risk by improving the quantity and quality of production. For this reason, as an added incentive, PepsiCo offers a price premium on potatoes sold by insured farmers (Hazell et al., 2010).

8.2.1.1 Bundled Insurance Products

Bundling index insurance with another product or service can help satisfy additional development objectives such as improving access to financial services by low-income households or incentivizing the adoption of new technologies. Index insurance has been most commonly bundled with agricultural credit, where the loan and the insurance are obtained together as part of a single transaction through the lending institution. However bundling index insurance with savings, technical assistance services, or products such as agricultural inputs is also possible.

An index-based rainfall insurance product in Kenya utilizes a novel approach to product delivery incorporating the efficiency of mobile phone technology and the accessibility and incentive of linking the insurance to agricultural inputs. The Kilimo Salama program, introduced in 2009, utilizes an existing network of trained and certified agro-retailers to sell the insurance to farmers. Farmers are able to insure the value of the inputs (e.g., seed, fertilizer) they purchase and the expected value of their crop (Syngenta Foundation, 2011). Part of the premium is paid by the supplier. The farmer's portion of the premium cost is simply added to the cost of the inputs. A mobile phone application enables the sales person to register the transaction with the farmer's information including their selected reference weather station, and the consumer receives a receipt via text message. Payments are transferred using the M-Pesa wireless banking system. In the initial pilot year in 2009, 200 farmers, in an area covered by 2 weather stations, purchased the insurance. In the second year, the inclusion of 30 more weather stations and more than 40 distribution points enabled rapid expansion to new areas and the sale of nearly 12,000 polices. (Syngenta Foundation, 2010).

Kenya's Kilimo Salama program has demonstrated the capacity for scalability using an easily expandable delivery channel. However, expansion still relies on having adequate data infrastructure to support insurance coverage in new areas. For this type of approach it is also important to appreciate the need for transparency, consumer education, and appropriate oversight to ensure all interests are protected. A legal and regulatory review would be needed to ensure mobile transactions have legal effect and that consumers have access to all the

information they require to make purchase decisions. Nevertheless, technological innovations such as this will play an important role in the scalability of future index insurance programs.

Because of the risk reduction created by insurance purchasing, bundling index insurance can also lead to better terms for insured clients on the services offered by the intermediary. For example, in Pisco, Peru, loan officers for a local bank, Caja Señor de Luren, sell an area-yield index insurance to cotton growers. To promote insurance purchase and recognize the risk management efforts of clients covered by this insurance, the bank lowered the interest rate for farmers purchasing the insurance from 3.25 percent per month to 3.00 percent per month. That is roughly a 3 percent interest rate reduction in annual terms (Carter, 2008). When insurance is bundled with another product or service in this way it can increase both supply and demand for the combined services through risk reduction and added value, provided the right incentives are in place for both the lender and the borrower.

Bundling insurance to credit, while common, may not always be feasible. For instance, if the lending cycle does not align with the insurance cycle it may not be practical to link the two. GlobalAgRisk encountered this problem in Peru with efforts to bundle El Niño Insurance with credit for smallholder households. The problem occurs due to the long period of time between the insurance sales closing date and the onset of insurance coverage. Premium must be paid nearly a year in advance of the coverage period to avoid intertemporal adverse selection problems based on early El Niño forecasts. This has two profound implications for bundling household El Niño insurance with credit. First and foremost, the insurance sales season ends in January, an awkward point in the local cropping cycle, before many families (depending on their crop mix) are looking for loans to cover their productions costs for the upcoming planting season. If clients are not buying insurance and taking out loans at the same time, then it is far less efficient to bundle the two products and offer them through local financial institutions.

The second problem is that most production loans have a term of less than a year while the El Niño insurance has almost a one year lag between the time of insurance purchase and the onset of coverage. A production loan taken out at the time of insurance purchase would typically have to be repaid before the insurance coverage takes effect. Furthermore, local lenders use leading El Niño indicators to limit their risk exposure by reigning in short term lending if an El Niño looks likely. This means that the bank selling the insurance will not have risk exposure on the loan they make at the time of insurance purchase and will not extend another loan if early indicators suggest an upcoming El Niño event. Thus, there is little incentive for the bank to offer any concessions for a client's insurance purchase through preferential interest rates or cost-sharing of the insurance premium. This second issue has led GlobalAgRisk to focus on offering the insurance to clients with multi-year loans, which cannot be recalled if El Niño looks likely and thus continue to represent a credit risk to local banks.

Additionally, if credit constraints are not a significant problem, or demand for credit is low, then bundling the services may have less value for the consumer. Institutional or operational weaknesses can also challenge the feasibility of offering a bundled product. Recalling the Malawi example, bundling index insurance with credit via local MFIs was initially the preferred delivery channel as it provided groundnut farmers with access to credit for productive inputs that they did not have before. Even though farmers exhibited strong demand for the bundled insurance product and the access to credit it provided, the inability of the lenders to recover the

loans eventually caused them to limit access to producers of commodities with an integrated supply chain where loan recovery was easier (Bryla and Syroka, 2009).

In cases where bundling index insurance with credit or other services is not feasible or desirable, there could be value in bundling insurance with savings. Due to the high cost and financial risk associated with credit, there is growing emphasis in the development community on encouraging savings as a first priority over the promotion of microcredit. However, for poor households, the opportunity cost of savings can also be quite high. The accumulation of savings also requires discipline and trust in the financial institution that holds the deposits.

To our knowledge, there are no index insurance products explicitly linked to savings at this time. However, there are examples based on microinsurance products that can provide some insights into the demand for a composite insurance-savings product. The TAMADERA microinsurance product introduced by Allianz Indonesia in 2010 is one such example. TAMADERA combines a savings component with insurance coverage for illness, hospitalization, or death. The primary objective of the product is to mobilize savings for the education expenses of low-income households which is one of the foremost concerns expressed by the target market. Interest on the savings is used to finance the insurance coverage and consumers who consistently pay the premium for five years receive a full refund of the premium after a 5 year maturity period (Allianz, 2010).

Similar structures could be incorporated into index insurance products as well. Consumers have an expressed preference for insurance products that cover lower-intensity, higher-frequency risks. However, from an economic standpoint, those risks would be better managed through savings or credit. Combining savings with index insurance could provide a way to appeal to those demand preferences while maintaining the integrity and affordability of index insurance. GlobalAgRisk is currently exploring how a savings component could be incorporated into index insurance products. The savings would provide a reserve that would be accessible for moderate losses while index insurance would protect against catastrophic events.

GlobalAgRisk is currently researching alternative ways to design such a product for the IBLI in Mongolia. The product starts payments when the mortality rate exceeds 6 percent in the soum (Mongolian county). IBLI payments for mortality rates between 6 and 10 percent would be paid either wholly or in part from the savings component. Payments for losses in excess of 10 percent would be paid completely by the insurance component. Since it is primarily paid for by savings, the layer of losses between 6 and 10 percent would not carry an insurance load. If there are no payouts over the 3 year contract, the herder would receive the savings back as a premium rebate or they could use the savings to purchase the IBLI in the fourth year. These types of innovations can satisfy the apparent demand to be paid for more frequent and small losses without the added cost of insurance for these layers. Importantly, these types of products may also be useful in getting insureds to continue purchasing the insurance even though they have not received a payment in previous years as they will understand that they can get their premium rebate at the end of the 3 year contract.

Significant questions remain about how to structure such a product. There are important legal and regulatory considerations. Additionally, combining savings with index insurance is complicated by the issue of basis risk, especially for moderate losses where basis risk is likely higher than it would be for catastrophic events. Savings held independent of an index insurance

contract could, in theory, be used to help the policyholder manage basis risk if their loss exceeds the insurance payout. However, due to the high opportunity cost, poor households often have little incentive to save. In principle, linking insurance to savings could increase the incentive to save, but if the household's ability to withdraw from savings is tied to a triggering event based on the same index as the insurance product, then access to the savings is subject to the same basis risk as the associated index insurance.

8.2.1.2 Considerations for Partner-Agent Models

Partner-agent models can have many advantages over other delivery models for the provision of index insurance products targeted to households. Among these advantages are reduced transaction costs, added value for consumers, improved accessibility to both insurance and the intermediary's services, and a ready channel for marketing and education. However, if partner-agent models are pursued there are important considerations that must be taken into account.

Market performance will depend on the capacity of the partner intermediary to deliver and administer the index insurance product. The intermediary's knowledge of, and commitment to, the product, and the intermediary's reputation among those in the target market will greatly influence consumer interest in the product. A significant limitation of partner-agent models (especially in the early stages of an insurance market) is that the insurance sales are a supplementary transaction to the primary reason the client is visiting the intermediary (e.g., for a loan). As a result, the person selling the insurance tends to be specialized in a field other than insurance sales and, therefore, may be less equipped to assist the potential client in the insurance purchase decision. This also raises regulatory concerns about opportunities for agent conflicts of interest, particularly if the consumer does not have full information about the insurance product. In index insurance programs in India and Malawi where the insurance was linked to credit, evidence suggested that borrowers did not understand the terms of the insurance, or in some cases, were not even aware they had insurance, even though they were paying the premium as part of their loan or as an additional fee (Giné and Yang, 2009). To minimize these problems it is important to ensure full transparency so that the consumer has clarity about the terms of coverage and their rights.

The Peruvian banking and insurance regulator, Superintendencia de Banca , Seguros y AFP (SBS), has recently identified a number of insurance sales practices associated with some new microinsurance products, that they believe are insufficiently transparent. Their regulations, aimed at increasing transparency, have implications for bank-based sales of insurance products. In particular, some Peruvian MFIs require borrowers to purchase life or property insurance (for which the MFIs receive commissions) as a condition for obtaining a loan. This, in itself, is not unusual. However, the cost of this insurance is not charged as a separate premium or reflected in higher interest rates because the premium is added to the principle of the loan. Given that the clients taking these bundled loans are not making an explicit decision about managing their risks using insurance, this may simply be a means of increasing bank revenue without raising advertised interest rates. To combat this practice, SBS has issued regulations stating that premiums for some types of insurance required as a condition of granting a loan must be included as interest rate costs (SBS, 2009; SBS, 2005). This type of regulation will become increasingly common as national regulators begin to scrutinize microcredit interest rates and the practices that are used to add premiums into principle of loans, a trend that is clearly on the rise

after the recent upheavals in microcredit markets in Nicaragua, Bosnia, and India. Thus, product developers would do well to consider possible unintended consequences of any such arrangement before committing to this type of linkage.

In Mongolia, the potential for conflicts of interest on the part of intermediaries has hampered efforts to sell index-based livestock insurance through rural financial institutions. Currently, the Index-based Livestock Insurance (IBLI) program utilizes a full service model, where commission-based insurance agents make direct transactions with herders.[12] However, this approach has been costly and inefficient given the expenses agents must incur in reaching disperse herder households without the guarantee of making a sale. In preparation for nationwide implementation of the program, additional delivery models are being investigated to identify more efficient and easily accessible options for the insurance transactions. There are approximately 1,000 points of access to banking services for herders in rural areas and the use of credit is high among herder households, suggesting that the network of rural financial institutions would be a logical distribution channel. However, the existing regulatory framework does not provide sufficient oversight to protect against potential conflicts of interest for lenders who may also be selling insurance. Under current regulation, banks as institutions cannot be designated as insurance agents. Until recently, insurance policies could only be sold by individual bank staff as agents of the insurance company. This reduces the ability of the bank to impose and enforce a code of conduct for insurance sales. Thus, a loan officer who earns commission from both the loan and the insurance sale may use his/her position to influence a customer to purchase insurance that they do not want or need. However, banks may now be authorized as insurance brokers. This will enable a bank to act as an intermediary in the sale of IBLI insurance contracts, albeit not as an insurance agent. Although this is not entirely satisfactory, given that a broker acts for the insured, it is more satisfactory that using bank officers to sell insurance in an individual capacity.

In addition to potential conflicts of interest on the part of the intermediary, there is also a risk that consumers will engage in short-sighted, opportunistic, behavior. As an example, if a bank client receives a preferential interest rate when they buy the insurance to cover the outstanding value of their loan, they may be tempted to purchase the minimum insurance value required to receive this additional benefit, without necessarily recognizing the broader context in which the insurance has value. This additional incentive could distract households from making a purchasing decision based on their actual risk exposure.

To protect the interests of all stakeholders and support the growth of the market, the delivery channel must be permissible under the insurance law and there must be proper regulatory oversight in place to discourage market misconduct. Insurance legislation may impose restrictions on who can legally sell insurance and therefore could limit delivery options. Thus there are important legal and regulatory considerations in selecting an appropriate delivery channel that must be addressed even at the initial pilot stage.[13]

[12] Though the IBLI program in Mongolia uses an aggregate-loss index rather than a weather index, aspects of the product design are relevant to other weather index insurance products.

[13] A more detailed discussion of legal and regulatory issues associated with bundled insurance products can be found in GlobalAgRisk, 2010a.

8.2.2 Index Insurance for Consequential Losses of Weather Risk

Efficient, cost-effective delivery systems are important for reducing costs; however, scalability and sustainability also depend on a product's appeal and perceived value to the consumer, aspects that must be accounted for in product design and consumer education. With concerns primarily about the scalability of index insurance targeted to households, a stronger emphasis on demand-driven products is emerging with the goal of increasing uptake and market size (Hazell et al., 2010; Oxfam America, 2009; Goslinga, 2010; Carter, 2009).

It is important that consumer education efforts emphasize the unique role of index insurance as a mechanism for insuring against spatially correlated, catastrophic risks. Consumer education efforts should also emphasize that index insurance can protect against more than just crop losses. Though early designs were conceived as an alternative to traditional loss-based crop insurance, index insurance can protect against various consequences of a catastrophic weather event. Promoting index insurance as a form of crop insurance led to a focus on the development of complex contracts designed to closely estimate crop yield performance. These products deny access to rural households that are not engaged in agriculture or those that produce crops other than the crop targeted by the index insurance product. The complexity of these approaches also restricts the market by creating an additional educational barrier for potential policyholders. In addition, by confining coverage to a specific crop, these products reduce a household's ability to modify production strategies to manage risk based on real-time information.

Rural households are often engaged in both agricultural and non-agricultural activities and are affected by the impacts of catastrophic events on the broader rural economy. Index insurance will have broader appeal and value to the target market, and likely be simpler and more transparent, if it is designed to insure against the wide array of losses that can occur as a result of a catastrophic weather event. If one considers the widespread immediate destruction of a natural disaster and the different ways that can affect a community in the weeks and months following the event, then a much larger potential market for index insurance emerges. Catastrophic rainfall or flooding can cause damage to a community that extends well beyond the agricultural sector. There may be damage to homes, businesses, and infrastructure, in addition to injuries or health problems that may occur. For example, in 1983 the northern Peruvian department of Piura experienced torrential rainfall and catastrophic flooding from a severe El Niño that washed out crops, irrigation infrastructure, bridges and roadways. Due to the damaged roadways, some communities were isolated for months without access to food or medicine. The condition of the roads limited commercial trade until roads and bridges could be cleared and repaired. These factors had a devastating effect on households and the local economy.

Broadening the potential market for index insurance should improve the resiliency of the local economy following a catastrophic event. These designs are also consistent with recent microinsurance initiatives that seek to provide comprehensive insurance packages that protect against multiple risks to the livelihoods of the poor. For example CARE India partnered with the Indian insurer Bajai Allianz to develop a microinsurance package of insurance products for life, accident and property insurance, including coverage for natural hazards (Sundararajan and Devabalan, 2009). In Haiti, Mercy Corps is supporting an initiative by the Haitian MFI FONKOZE to develop a microinsurance product for multiple natural hazards, including earthquakes and

hurricanes. This product would pay off the remaining balance of small business loans held by the policyholder and provide additional cash payment for recovery needs (Sossouvi, 2010). These initiatives, though not all index-based, are responding to the needs of the clients they serve whose livelihoods are exposed to multiple sources of risk.

Hill and Robles (2010), recognizing the limitations of crop-based index insurance, urge more generic index-based weather securities in Ethiopia, noting that exposure to weather risk is not defined entirely by crop choice, and that the effects of weather risk can be heterogeneous, even for farmers growing the same crop. Similar concepts have motivated the approach to product design taken by GlobalAgRisk in recent work in Vietnam and Peru which involves assessing the direct and indirect, as well as short- and long-term, consequences of a catastrophic risk to design a product that has value to a broader, diverse market and the flexibility to allow policyholders to best manage their risk exposure. Index insurance products in both countries were positioned as a form of "contingent insurance" for consequential losses (Skees, 2010; GlobalAgRisk, 2010a). Provided that this possible under the insurance law, and if necessary permitted by the insurance regulator, this eases the need to demonstrate the index as a proxy for a specific loss (e.g., a crop yield loss) and thereby allows policyholders to make assessments of how the indexed risk corresponds to their individual risk exposures. This requires additional investment in education to assist consumers in making informed purchase decisions, yet it also makes weather insurance more flexible and relevant to a broader market. In Vietnam, for example, GlobalAgRisk has designed index insurance for coffee farmers that is designed to insure against consequential losses from drought risk in the early coffee season. While the product is marketed to coffee growers in Dak Lak province, the index is not designed to insure against poor yields specifically since this would fail to capture the variety of losses and expenditures that farmers incur as a result of drought (Hartell and Skees, 2009b). In this case, farmers incur extra costs associated with additional irrigation when early rainfall is well below normal.

8.3 Contract Structure

Components of an index insurance contract, e.g., the payout structure and the period of coverage, have bearing on both sustainability and demand for the product. Demand side preferences for greater coverage and frequent payouts must be balanced with concerns regarding affordability and minimizing basis risk. These considerations help determine the threshold and limit values of the index and the period of coverage.

8.3.1 Payout Structure

The payout structure is the rate of payout between the threshold trigger and the limit of the contract (Martin, Barnett, and Coble, 2001). A linear payout structure is commonly used to illustrate examples of index insurance. However, there are other options that may more effectively correspond to demand-side preferences or to how the policyholder is affected by events of increasing severity. The payout structure can be adjusted to capture more or fewer events with higher or lower payouts; however the price of the insurance must adjust accordingly to reflect the probability and magnitude of payouts.

Carter (2009) suggests that consumer confidence in the product and the insurance market may be strengthened by structuring non-linear contracts that provide small payments, for less severe

events with larger payouts for more extreme events. This may appeal to the preference of consumers for more frequent payouts while increasing their experience and comfort with the product (Carter, 2009; Giné and Yang, 2009).

However, there are problems with increasing the frequency of payouts which can undermine the longer term sustainability of an index insurance market. First, at a fundamental level, as the probability of an insured event increases, so does the price of the insurance. This makes it more difficult to offer a market-based product due to the financial limitations of the targeted market. If consumers pay a higher premium rate for a more frequent payout, the sum insured they can afford will likely be reduced, leaving them underinsured in the event of a major catastrophe.

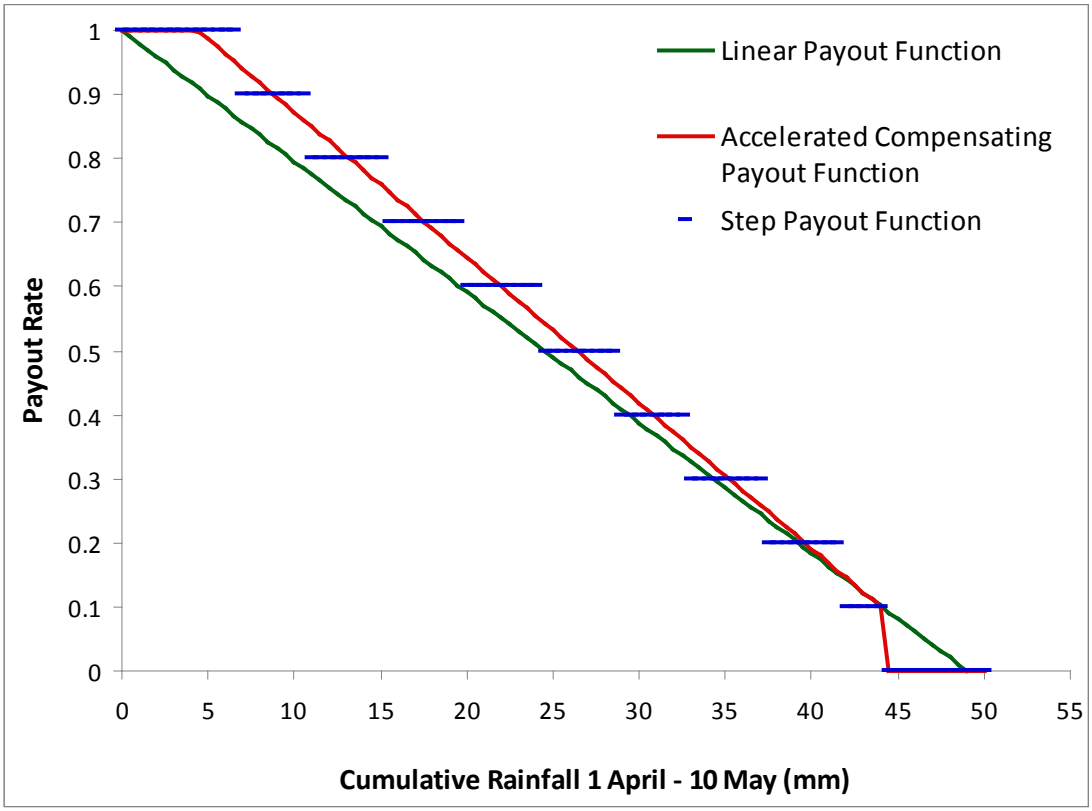
Second, as we have argued in this document and elsewhere (GlobalAgRisk, 2010b; GlobalAgRisk, 2009; Skees, 2008), index insurance is best suited for low-probability, catastrophic risks. Due to the high transaction costs of insurance, savings and credit are generally more cost effective means of smoothing consumption for low severity events. Additionally, it is expected that for less severe events, basis risk will be more pronounced as there will be greater heterogeneity in how individuals are affected by the insured event (GlobalAgRisk, 2010b). This can lead to dissatisfaction with the product if it does not effectively transfer the policyholder's risk exposure.

While there is clearly demand for insurance which pays out more frequently, index insurance product design should focus on creating innovative structures that provide a sense of value to the policyholder and instill confidence in the product, while still offering sufficient coverage against catastrophic risks to which policyholders are most vulnerable. Here again, however, the role of education in developing a culture of insurance and providing perspectives on long-term approaches to managing risk is a critical complement to sound product design.

The payout structures designed by GlobalAgRisk for index insurance products in Peru and Vietnam have a minimum payment for lower severity events that then follow a linear schedule up to the limit. Figure 2 compares three possible payout structures for an index-based drought insurance product in Vietnam. For each structure, payouts are triggered by cumulative rainfall over the period April 1 - May 10 of less than 45 millimeters. For the simple linear structure, the maximum payout does not occur unless realized rainfall over the period is zero. The payout for each millimeter of realized rainfall less than the 45 millimeter trigger is calculated by simply dividing the sum insured by 45 millimeters. The accelerated compensating payout structure begins with a minimum payment of 10 percent which prevents policyholders from receiving a miniscule payment if the cumulative rainfall threshold is barely crossed. Furthermore, the maximum payout is reached at 5 millimeters of realized rainfall over the period (in contrast to zero millimeters for the simple linear structure). This increases the percentage of sum insured that is paid out for rainfall realizations between 5 and 45 millimeters which will increase the price of the insurance. A step payout structure is another alternative that was proposed in order to provide greater transparency and simpler presentation of the range of payments to farmers who would be buying the product. A step structure converts a continuous linear payout structure into a discontinuous structure composed of several discrete payout steps. In figure 2, a step payout structure is shown as a variation of the accelerated compensating payout structure. This step structure provides a 10 percent increase in the payment rate for every few mm of rainfall deficit relative to the threshold. The pricing is essentially the same as for the accelerated

compensating payout function, yet there are advantages in how the product is perceived. A step enables all the possible payout rates to be neatly printed on the policy so that both the insured and the insurer are clear on the payout that is due. A disadvantage of a step payout function is that very small differences in the realized value of the index can lead to significant differences in payouts.

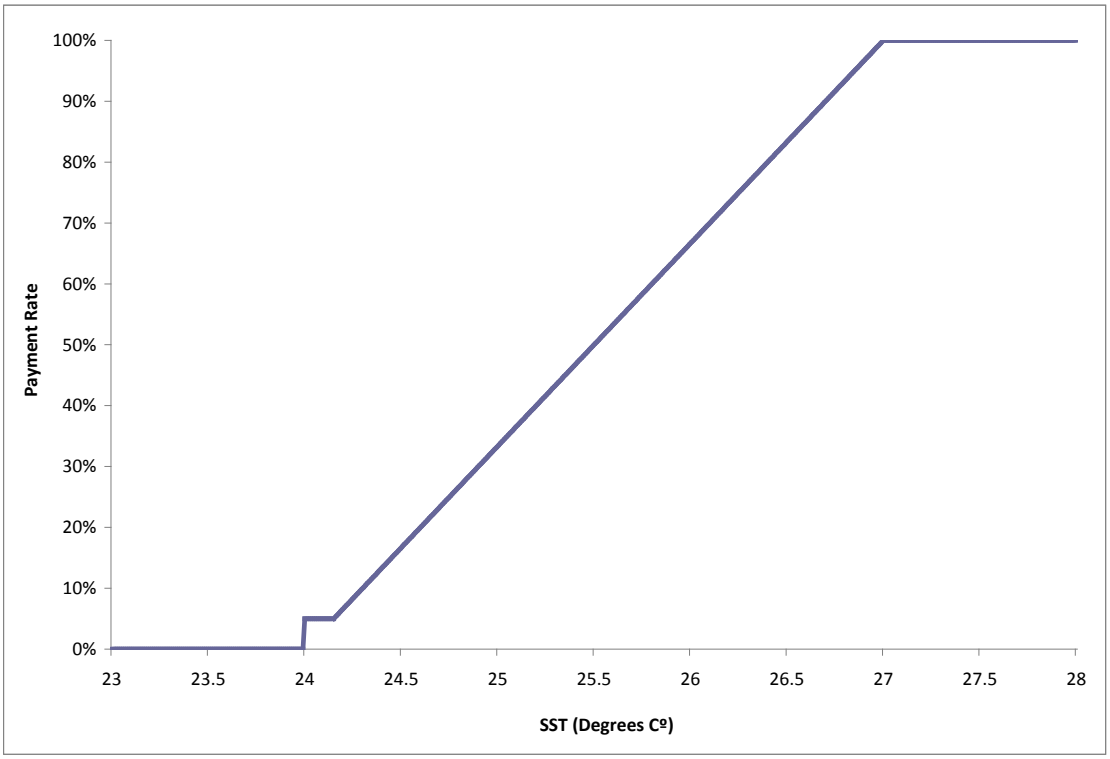
Figure 2 Three Possible Payout Structures: Index-based Drought Insurance in Vietnam



Source: GlobalAgRisk, 2010

Figure 3 illustrates a payout structure being used for the El Niño Insurance product in Peru. Payouts are made when the average SST value for November and December is greater than the trigger value of 24° C. The contract is structured to provide a minimum payment of 5 percent of the sum insured when the index just exceeds the trigger. A linear payout rate is followed after 24.15° C, with the maximum payout achieved when index values reach the limit of 27° C.

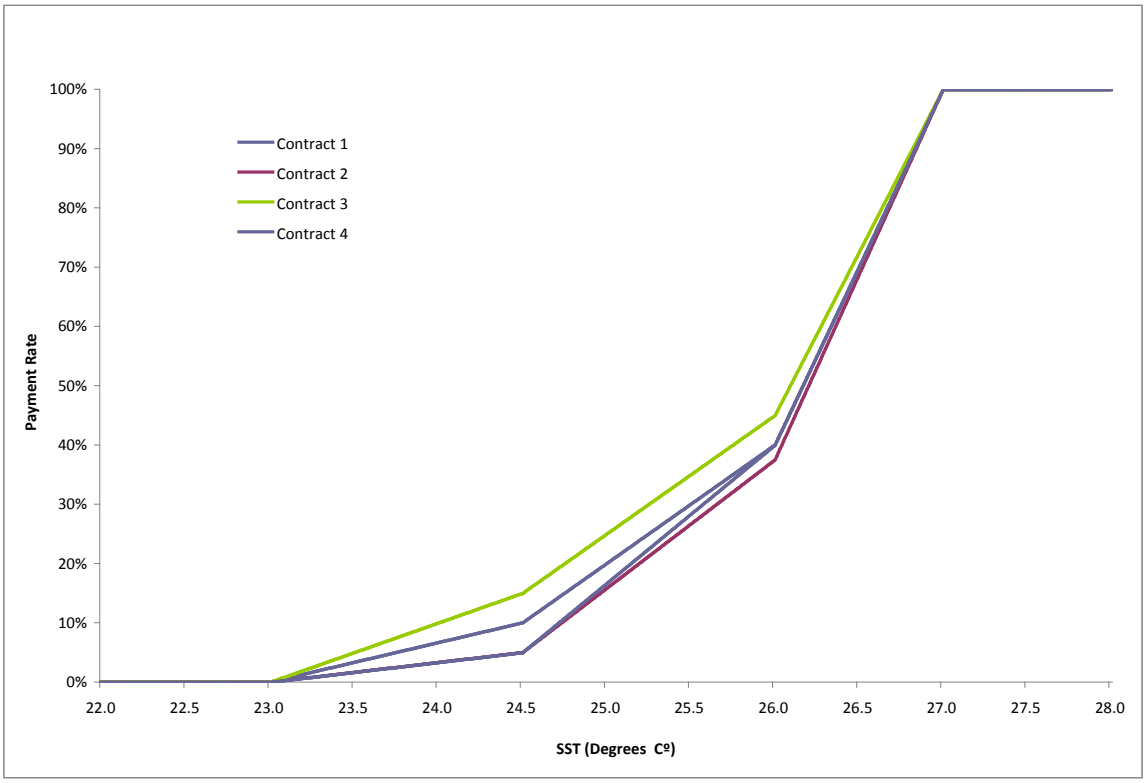
Figure 3 Sample Payout Structure for El Niño Insurance in Peru



Source: GlobalAgRisk, 2010

In Peru, the base design of the El Niño Insurance is being used to offer different types of contract structures to different target markets. Because these contracts are targeting risk aggregators, and therefore these are single, larger volume policies, it is more feasible to tailor the payout structure to the preferences of each. For example, one potential buyer was interested in an accelerated payout structure, with smaller payments starting at a lower temperature threshold, and larger payments for the more severe events. Figure 4 shows four variations of such a structure with different payout rates.

Figure 4 Example of an Accelerated Payout Structure for El Niño Insurance



Source: GlobalAgRisk, 2010

Hill and Robles propose the use of index-based weather securities rather than insurance contracts to provide fixed unit contracts with a zero-one payout structure. [14] Thus, if rainfall falls below the defined threshold, the full payout is made. The simplicity and flexibility of this approach have advantages in that they are easy for the consumer to understand, and they could be utilized by others whose livelihoods are vulnerable to the weather risk (Hill and Robles, 2010). The disadvantage of zero-one payout structures is that very small differences in the realized value of the index can be the difference between receiving a full payout or no payout. This encourages possible tampering with instruments used to measure rainfall. It also increases the likelihood of dissatisfaction from buyers and reputational risk for those entities underwriting such contracts.

Education is an important complement to product design in improving stakeholders' understanding of insurance and their ability to evaluate the benefits and costs of a particular product. The more complicated the contract structure the more investment that will be needed to convey contract details to the target market.

[14] A discussion of the use of non-insurance risk transfer products for weather risks in lower income countries is outside the scope of this document. For a discussion of the advantages and disadvantages of using weather derivatives versus insurance see Carpenter and Skees (2005).

8.3.2 Coverage Period

The period of cover is another aspect of the contract structure that depends upon several factors including the onset and duration of the insured event. The coverage period should be long enough to capture the most significant events that affect the target market, yet short enough to allow the policyholder to receive the payout as soon as possible after the occurrence of a triggering event. If the insurance is targeted to a heterogeneous market, e.g., farmers growing a diverse array of crops, then the period of coverage must also account for variation in how and when different households or firms are affected by the weather risk.

When index insurance is used to insure agricultural production, the window of coverage typically aligns with the major growing season. However, the coverage period may also be structured around critical points in the growing season. For example, MicroEnsure has utilized a dry day index in the development of several drought insurance products which reduces the period of cover from the entire season to a window for potential consecutive days without rain. This restricts the period of coverage to focus on the dimensions of drought risk that are of most concern to the farmers. In these cases the concern is less about cumulative rainfall deficits during the entire season and more about windows of dryness that deplete soil moisture during critical periods (MicroEnsure, 2010).

A similar approach has been utilized with other rainfall index insurance programs that structure the coverage period around phases of a crop growth cycle. The water requirements during critical periods (e.g., sowing, flowering, and harvest) are identified and the limits of coverage are set for each phase. In areas where planting dates are highly variable, the contracts may also include a dynamic start date so that the period of cover begins once there has been sufficient rainfall for sowing (Mapfumo, 2008).

A variation on a phased approach was tested in a recent pilot in southern Ethiopia that provided greater flexibility in coverage periods and the target market. The pilot offered two levels of drought insurance coverage for four one-month periods spanning the rainy season (June through September). This provided eight generic contract options from which consumers could select to create a self-customized insurance package (Hill and Robles, 2010). While this approach offers more flexible coverage, it also requires that the consumer be able to evaluate how his/her risk exposure correlates to the various insurance options.

The period of highest risk exposure may be difficult to narrow to a short time frame. For insurance products that are designed to insure against the broader consequential losses of catastrophic weather risk, the start and end to the agricultural season may not be the most relevant time period for the insurance product. The period of exposure will depend on the seasonality of the risk. Obviously the period of coverage will be much shorter for a rapid-onset event such as a hurricane than for a slow-onset event such as drought which results from prolonged, cumulative conditions. However the period of cover should be as short as possible to enable payouts to be settled expediently after a triggering event.

The IBLI program in Mongolia insures against high livestock mortality that can occur throughout the winter or spring, though it is not impossible for large losses to occur late in the year. The livestock census that provides data for indexing livestock losses is only conducted annually, in December. Thus having a 12 month period of coverage and relying solely on the annual census would mean that herders could suffer severe losses in the early part of the year and not receive

a payout until more than a year later. Analysis of historical data revealed that the vast majority of losses, particularly in high loss years, occur between January and May. The decision was made to implement a mid-year estimate of livestock mortality in the areas where IBLI is being offered, to shorten the window of coverage to the most critical months (January through May) and thereby enable prompter payouts to herders when there are triggering losses.

The period of coverage for the El Niño Insurance product in Peru is not tied to agricultural production but rather the regular timing of the El Niño phenomenon which occurs near the end of the year and persists into the first months of the next year. Thus, for the El Niño Insurance product, the period of cover spans November and December, two months where the SST used for the index have an extremely high correlation to rainfall in the region in subsequent months. In this case, the period of cover was easily defined by a relatively short period in which there is a strong indicator of an impending natural disaster. This design enables the insured to receive a payout in January before the most intense period of rainfall begins. If the contract had been based on rainfall levels, the period of coverage would have been much longer, possibly January through April, to obtain a measure of cumulative rainfall over the duration of the event. Such a design would have meant that the policyholder would not receive a payout until months after losses had been incurred.

8.3.3 Sales Period

The sales period is the window of time in which an insurance policy may be purchased. There is great variance in the timing and length of the sales periods for index insurance products. Generally the sales period is set to coincide with unique conditions of the delivery channel and the target market. For example, if the insurance is bundled with credit, the sales period will need to correspond to lending cycles. However, the major concern is that the timing of the sales period must mitigate opportunities for inter-temporal adverse selection.

Inter-temporal adverse selection occurs when consumers can make insurance purchase decisions based on information that was not available to the insurer at the time that policy provisions (including premium rates) were established. If the information indicates an increased likelihood of a triggering event, then sales will be higher. If the information indicates a reduced likelihood of a triggering event, then sales will be lower.

Inter-temporal adverse selection can eventually destroy the long-run viability of an insurance product. For this reason, the sales period must end before reliable forecasts about the insured risk can be made. Nevertheless, the IBLI experience in Mongolia has shown that herders will delay purchase decisions until the last possible moment so they can have the most information possible about pasture and livestock conditions and winter weather forecasts before making their insurance purchase decision.

It seems safe to assume that, all other things being the same, a longer lag between sales closing and the onset of coverage will reduce demand for the insurance product. However, the magnitude of this effect has not been sufficiently explored. As weather forecast technologies improve and information technologies make such forecasts more accessible, it will become even more important to carefully consider the timing of index insurance sales periods. In Peru, for example, ENSO signals are constantly monitored for signs of an emerging El Niño pattern. The earliest forecasting begins as much as nine months in advance, though early forecasts have not

been very reliable. Nevertheless, to avoid problems with inter-temporal adverse selection the sales closing date for El Niño Insurance was initially set for March, to cover the occurrence of a severe El Niño in the following January through April. However, ENSO monitoring technology is rapidly improving and the sales closing date was pushed back to January, nearly a full year before the onset of coverage. During the January 2011 sales season some firms that were interested in purchasing El Niño index insurance eventually decided not to purchase the insurance based on early El Niño forecasts which suggested that 2012 would not be an El Niño year. This occurred despite the fact that such early forecasts have a high degree of uncertainty.

In general, issues regarding sales periods are more problematic when insuring against events tied to climatic cycles such as ENSO or slow onset events such as drought. For fast onset events, such as earthquakes or extreme wind speeds, the lag between the end of the sales period and the beginning of the insurance coverage need not be so long.[15]

8.4 Pricing and Affordability

Establishing the price (premium) is an important aspect of insurance product design. To be sustainable in a commercial market, insurance products must be sold at a price that creates value for both suppliers (insurers) and demanders (potential insurance purchasers). This section describes both supply and demand influences on index insurance pricing.

8.4.1 Supply Factors

As stated previously, a financially sustainable commercial insurance product will have a premium sufficient to cover all costs and provide a return on investment that is competitive with alternative investments of a similar risk level. If this is not the case, suppliers will cease offering the insurance product and focus instead on other opportunities.

The costs of supplying insurance can be divided into two categories: pure premium and operational costs. Pure premium is the expected payouts that will be made to policyholders. It is typically described as the expected payouts per dollar of sum insured — the pure premium rate. For example, if the insurer expects to make $5,000 in payouts for every $100,000 of sum insured, the pure premium rate is 5 percent. For an index insurance product, the pure premium will be higher the closer the trigger is to the expected value of the underlying variable. For example, consider an index insurance product that protects against insufficient rainfall measured at a weather station with expected rainfall over a given period of 500 mm. If payouts are triggered when rainfall is less than 400 mm the pure premium will be significantly higher than if payouts are triggered only when rainfall is less than 300 mm.

Operational costs include all of the expenses that the insurer incurs to supply the insurance product to the market. Examples include costs associated with marketing, underwriting, sales and delivery; management, data collection and processing; accounting; legal services; and

[15] An idea currently being considered for El Niño insurance would have the policyholder pay the premium in two installments. The first payment would be some percentage of the total premium cost (e.g., 20 percent). The second installment would be due at a later date. Should the policyholder fail to pay the second installment, the contract would be cancelled with no return of the first installment to the policyholder. This idea has not yet been presented to a national insurance regulator so it is unclear what legal or regulatory concerns it might create.

claims adjustment. Index insurance products generally have lower operational costs than traditional loss-based insurance products. This is primarily because index insurance products do not require individualized underwriting and claims adjustment. Innovations such as the use of partner-agents (e.g., input suppliers and loan officers) or automated service technologies (e.g., ATMs or mobile phones) to sell index insurance policies have been motivated by efforts to further reduce operational costs.

If the pure premium for a particular insurance product is 5 percent of sum insured and the operational costs are 7 percent of sum insured, then the breakeven premium rate (the premium rate that generates zero return to equity) is 12 percent. On top of this, insurance company investors will expect some return on equity from their investment. If the return on equity adds 1 percent of sum insured to the premium (for this example, we assume that as a result of purchasing reinsurance the insurance company has only limited capital at risk), the total premium would be 13 percent.

Thus far, this example has been based on an assumption that operational costs as a percentage of sum insured are the same for every policy sold; however, this is often not the case. Many operational costs have a fixed component. For example, there is often little difference in delivery costs for a small insurance policy and a large insurance policy of the same type. The same is generally true for data processing and accounting costs. This implies that as a percentage of the sum insured, the operational costs of small insurance policies are higher than those of large insurance policies — so breakeven premium rates are higher for smaller policies. This is a difficult challenge for the financial sustainability of insurance products targeted to smallholder households or small businesses that tend to purchase small-valued policies. Higher operational costs imply that commercial insurers must charge higher premium rates to smallholders, or else accept lower rates of return on equity. The challenge is even greater for insurance products targeted to rural areas, since in many lower income countries poor transportation and communications infrastructure greatly increase the costs of selling and servicing insurance. Firms in the value chain and other risk aggregators, on the other hand, tend to purchase higher-valued policies that are operationally less costly (as a percentage of sum insured) relative to products targeted to smallholders.

8.4.2 Demand Factors

If an insurance product is to be sustainable it must also be perceived by potential buyers as creating value in excess of the price. In other words, buyers must, at least in principal, be *willing* to pay an amount for the insurance coverage that is at least as great as the premium. This is a necessary, but not sufficient, condition for sustainable market demand. The sufficient condition is that potential buyers must be *able* to pay the premium. Buyers might be willing to purchase a policy but be unable to do so, in which case there is no effective demand for the product.

As was discussed in chapter 4, willingness to pay for catastrophic insurance coverage is generally low. People tend to underestimate the likelihood of catastrophic natural events and thus undervalue insurance that protects against losses caused by such events. Startup investments in consumer education can increase willingness to pay for index insurance by providing accurate information about the likelihood of catastrophic events. However, investments in consumer education may also have to be continued well beyond the startup phase. It is common for policyholders to gradually opt out of index insurance purchasing; especially if a catastrophic

event that triggers a payout does not occur within a few years after startup. Thus, continuing investments in consumer education will likely be required.

Some donor-funded projects have used premium subsidies to increase demand for new index insurance products. Typically, these subsidies are rationalized by arguing that they support development objectives and will last for only a few years until consumers have become accustomed to purchasing the products. The use of premium subsidies has been further encouraged by a recent trend toward designing index insurance products to protect against frequent, moderate losses. One reason for insuring against moderate losses is to address the problem of consumers underestimating the likelihood of catastrophic events. However, when index insurance is designed to protect against increasingly moderate losses, the price of the insurance is higher compared to a catastrophic policy. As a result of the higher price, product designers may be compelled to seek higher levels of premium subsidy.

While the intentions may be good, direct premium subsidies create several problems. Risk that is accurately priced provides information for economic agents on which to base activity decisions, such as whether it is valuable to invest in risk mitigation, to expand activity, or exit. Since premium subsidies lower the cost of the insurance, policyholders do not receive accurate price signals regarding the magnitude of their actual risk exposure and thus, make economically inefficient decisions. When premium subsidies are eventually removed, demand for these insurance products tends to collapse. Premium subsidies also distort markets by "crowding out" alternative risk transfer or risk mitigation strategies. This is a particular concern where index insurance is presented as a tool for managing climate change as insurance in itself does not reduce the threat and premium subsidies mute important signals that encourage adaptation and mitigation. In addition, premium subsidies make it difficult to assess scalability and sustainability. Donors may be willing to fund premium subsidies for small pilot projects but are not likely to provide the large amounts of funding required to subsidize scaled-up insurance programs — and to do so on a continual basis. Perhaps the greatest concern is that promoting premium subsidies sets a precedent difficult to reverse and threatens the commercial viability of index insurance before the nascent concept is even put to a true market test. For these reasons, anyone who is seriously concerned about scalability, sustainability, and economic efficiency must think carefully before utilizing premium subsidies for index insurance products.

An alternative to direct premium subsidies is demonstrated by an Oxfam USA project that supports the development of a rainfall index insurance product for smallholder farmers in Ethiopia. The Horn of Africa Risk Transfer for Adaptation (HARITA) project has attempted to make insurance more accessible to the poorest households by linking the insurance to the Ethiopian government's cash-for-work program rather than through a direct premium subsidy. Individuals who are eligible to participate in the safety net program can work additional days to pay for the insurance premium. The majority of policies were "bought" in this way, with Oxfam providing the funds to cover premium costs. The HARITA project has rapidly expanded from its initial pilot year in 2009 with good participation (20-30%) in the villages where it is offered. Two contract options were offered in 2010 based on farmer preferences with expected payouts of approximately 1-in-5 or 1-in-3 years (Chen et al., 2010). While the frequent payout rate and ties to the safety net program have likely encouraged uptake and expansion of the product, questions remain about the program's long run sustainability. In a project, such as this, which is targeted at those living in poverty, the distinction between providing social support and

developing a commercial insurance market can become blurred. Maintaining a clear distinction is important for developing sustainable commercial insurance markets.

In Mongolia, the IBLI program combines social support with a commercial insurance product by subsidizing the catastrophic layer of risk, e.g., when total livestock losses in a county exceed 30 percent. Thus, the commercial product is priced for livestock mortality from 6-30 percent though insured herders are insured for losses of up to 100 percent. This places a subsidy at a layer of risk that is typically subject to cognitive failure and reduces the price of the commercial product without employing a direct premium subsidy for all layers of risk.

Governments are prone to change their support for insurance products. With the IBLI design, there is a clear separation between the commercial layer and the catastrophic layer. If, at some time in the future, the government were to decide that it cannot continue supporting the catastrophic layer of risk, there is an increased probability that herders, who have been purchasing an unsubsidized commercial layer of risk protection, will continue to purchase insurance for that risk layer.

8.5 Areas for Further Research

The technical design of index insurance products has advanced greatly over the past decade, yet there are still hurdles to overcome if index insurance markets are to be scalable and sustainable.

As new ideas and approaches are tested, continued evaluation and research is needed to shed light on the following questions.

- What innovations in product structure can improve the sustainability and scalability of index insurance?
- How can new technologies be used to improve the efficiency and accessibility of index insurance? What are the limitations of technology for market development?
- What are we learning about the demand for weather insurance by risk aggregators and the factors that influence their uptake of insurance?
- As more risk aggregator products emerge, what will be the effect on poor households?
- What are the challenges and opportunities for bundling index insurance with savings?

Chapter 9 Recommendations

This report builds on the preceding two reports on data issues and legal and regulatory considerations by focusing on the elements that influence the sustainability and scalability of index insurance products. Experience to date has very clearly demonstrated that it is not easy to develop index insurance markets. Long-term investments are required and expectations and approaches must recognize this reality. This chapter provides recommendations for developing viable index insurance markets. The recommendations incorporate conclusions from the preceding reports in this series.

9.1 Evaluation

Recommendation – From the outset, projects supporting index insurance must formulate evaluation strategies related to targeted development objectives. When derived from a clearly defined theory of change, these strategies can aid decisions about expansion and continued investment.

Sustainability and scalability are irrelevant unless the product is also achieving its development objective. Evaluation research is the set of inter-related activities conducted over the lifetime of the project that is meant to inform about the performance and effectiveness of index insurance interventions and to provide guidance to stakeholders and institutions regarding the improvement of current actions and the direction of future policy.

9.1.1 Evaluation Informs Scalability

Scalability refers to the transferability of the project concept to other contexts or circumstances. An assessment of scalability is preceded by at least three evaluation functions. The project's underlying theory of change must be well articulated and sufficiently complex to communicate the mechanisms and pathways of change that the project intervention is expected to produce in pursuit of the overall development objective. This framework is necessary to identify credible indicators among the targeted population which measure the outcomes the project is expected to produce. The time horizon of the desired outcomes or changes must also be carefully considered. Indicators, based on short-run outcomes, should be identified that reflect on the realization of longer term hypothesized outcomes. The project must also be monitored for implementation success or failure with includes attention to any special local characteristics that affect the performance of the project. Finally, impact assessment attempts to attribute and measure the project's contribution to the desired outcomes.

While impact assessment strives for internal validity in order to be confident that the measured outcomes are correctly attributed to the intervention, its external validity is based on being able to generalize the result to other contexts. This requires a deeper understanding of why and how an intervention has achieved its planned result in its current context for the targeted audience in order to speculate about its performance elsewhere or in an expanded form. Understanding why and how a particular intervention is successful is aided by the specification of an underlying causal model and other tools to help capture or visualize the pathways of development impact.

9.1.2 Impact Evaluation of Index Insurance must Overcome Unique Challenges

Despite the ever-growing number of index insurance pilot activities, there are only a few examples of published evaluation assessments related to demand or impact. This may be due to the interaction of several characteristics of index insurance interventions that make it difficult to design and execute an evaluation plan. Chief among these is the voluntary nature of insurance purchasing. This makes isolating the selection mechanism difficult, particularly in conjunction with typically low uptake rates. The frequently long time horizon for development results to be observed requires examining pathways and intermediate indicators of change. Project implementation through private market entities requires special consideration when planning evaluation. Their cooperation, as with donors, can be facilitated by identifying how they can benefit from the evaluation.

9.1.3 Plan Evaluation in Conjunction with the Project

If impact evaluation will be conducted for a project, which depends on the circumstances of the particular project and information needs of the stakeholders and donors, it should take place after implementation irregularities have been resolved. At the same time, the evaluation must be planned at the beginning of the project to take full advantage of the range of available estimation methods, to ensure that data requirements are met, and so that decisions about expansion and continued investment can be based on expectations and measured indications of achieving the desired development objectives. Consequently, program theory and process evaluation are necessary components of any project – regardless of whether impact assessment is included in the evaluation effort – to help ensure mindful consideration of the intended development objectives as market development and product design decisions are made.

9.2 Market Development

Recommendation – Rather than providing premium subsidies, donor and government funds should be used to invest in building local capacity and establishing the proper institutional frameworks that can support the development and growth of index insurance markets in lower income countries

Developing sustainable index insurance products requires that there is also a sustainable foundation for market development. This involves substantial time and investment to develop the knowledge and commitment of stakeholders and the supporting institutional frameworks that are needed to enable these markets to grow and adapt to the local context. With this longer-term vision, there is a critical role for donor and government support for market development which can have more broad and lasting benefits than premium subsidies.

9.2.1 Invest in capacity and stakeholder education

Building index insurance markets can be a daunting task. Practitioners often work in environments of missing public goods, against the background of underdeveloped financial and legal institutions, and with stakeholders who have limited exposure to formal risk management instruments. These local constraints and knowledge gaps must be addressed for markets to take root and develop. For this reason, concerted and lasting commitments to awareness campaigns and building the capacity of local stakeholders are absolutely essential. These activities serve to empower local decision makers: insurers and intermediaries are better able to create and successfully market viable products; consumers are well informed and are thus using index insurance effectively; and, insurance regulators can provide guidance about how index insurance fits within the country's legal and regulatory framework. Investments in stakeholder education and capacity building, in sum, provide the knowledge and institutional foundations without which long-term sustainability and scalability cannot be attained.

Governments and donors play an important role in facilitating the transfer of knowledge and skills to local stakeholders through the funding of education and technical assistance initiatives. Institutional capacity building and client education are long-term investments – they must start from the beginning of the market development process and continue through implementation and impact evaluation.

Institutional capacity building entails identifying local implementation partners who have a vision for how index insurance can work in the local context. These partners should be both committed to, and invested in, the success of the market. The end goal is to hand off the product to these local champions who are equipped with relevant skills and have the necessary incentives to realize market growth on their own or with minimal outside assistance.

Consumer education should create a strong insurance culture by helping vulnerable households and risk aggregators make sound risk management decisions, including being able to use index insurance effectively against catastrophic weather risk. Therefore, care must be taken not to confuse consumer education with product marketing, which has a narrow focus and is product specific. Because households in rural areas of lower income countries typically have limited exposure to risk transfer instruments, consumer education will have to be time- and resource-intensive, as well as encompass consumer protection issues. Providing educational outreach to risk aggregators, who tend to be more financially sophisticated, should not be as time-intensive but may require greater expertise.

9.2.2 Focus on Legal and Regulatory Issues from the Start

Legal and regulatory issues have almost certainly been the most overlooked aspect of index insurance product development. Most development practitioners have focused on other aspects such as selecting an index, identifying an appropriate delivery channel, consumer education, obtaining reinsurance, and constructing a pilot test of the proposed product. While all of these other aspects are important, a product can never scale up beyond the pilot stage and will never be sustainable unless an enabling legal and regulatory environment exists.

It is not surprising that this aspect of product development is often overlooked. It is difficult and occasionally frustrating work. Development practitioners are sometimes afraid that potential donors will be dissuaded by the challenges inherent in working with local policymakers and government officials or the amount of time required in obtaining necessary approvals. However, if one is seriously concerned about building scalable and sustainable index insurance markets, it is an important step that cannot be avoided and should not be postponed.

9.2.3 Replicate Processes not Products

Index insurance products cannot be easily replicated as product design is highly contextual. Products must be developed in a manner that is responsive to a host of geographically heterogeneous meteorological, cultural, political, legal, regulatory, economic, and institutional factors. Some aspects of product design may be applicable in multiple locations but a prototype insurance product that can be replicated as a whole across a variety of different local contexts is neither likely nor desirable.

What can be replicated is an effective process for developing index insurance products. In fact, product development and implementation should be informed by a model that emphasizes critical steps in the process. New products are developed by repeating the steps in the process rather than by simply replicating a previously developed product.

The implication of this is that large start-up costs for developing new index insurance products cannot be avoided. Incurring these costs is necessary both for designing products that are appropriate for the local context and for building the local capacity necessary to ensure that the

product effectively transitions from external facilitators to local implementers. Investments in building market foundations and strong local capacity will reduce the start-up costs of future index insurance ventures.

9.2.4 Provide Public Goods not Short-term Subsidies

Donor funding of feasibility studies, product design, capacity building, and other start up costs is necessary for the development of index insurance markets. These are all public goods that are unlikely to be funded by local insurance providers.

Premium subsidies, on the other hand, can crowd out other risk mitigation or risk transfer mechanisms. They also create a dependency on continual subsidies that is incompatible with an objective of creating scalable and sustainable index insurance markets. The dependency created by insurance premium subsidies has been consistently demonstrated by experience with products such as crop insurance and flood insurance in both developed and developing countries across the globe.

Supporters of premium subsidies for index insurance often employ reasoning that is vaguely reminiscent of the "infant industries" rationale for protecting domestic industries from the rigors of a globally competitive market. They argue that the subsidies are only for a short time – just a way to "prime the pump" until the market can mature and develop into a fully competitive market. But just like those infant industries, most subsidized insurance markets never quite seem to mature to the point where they are ready to give up their privileged status. Insurance providers and policyholders become intent on maintaining access to the economic rents that can be derived from the premium subsidies. When donors are no longer willing to continue providing premium subsidies, the local government is pressured to provide the subsidies (e.g., India). If the government is unable or unwilling to continue providing premium subsidies, the market is likely to collapse.

If governments or donors insist on subsidizing premiums, the subsidy should not be implemented as a percentage of the total premium cost. Instead the subsidy should be concentrated on providing coverage for an extremely rare but highly catastrophic layer of risk. Due to cognitive limitations in processing probabilistic information, decision makers tend to downplay or even ignore the potential for extremely rare events. As a result, they are often unwilling to pay for insurance protection against extremely rare, but highly catastrophic, events. By using subsidies to provide protection only against extremely rare and highly catastrophic events, the subsidies will be much less likely to crowd out commercial insurance markets for less extreme, but still potentially catastrophic, risk layers.

9.3 Product Design

Recommendation — To address the challenges of the market development process, product design should focus on four areas:

1. *Starting with products for risk aggregators;*
2. *Insuring against the broader economic consequences of weather risk, not just crop losses;*
3. *Insuring against low-frequency, catastrophic risks; and*
4. *Reducing costs and adding value through innovative design and delivery features.*

We maintain the argument that developing risk aggregator products may be a more feasible starting point for developing index insurance markets, however, we also recognize that risk aggregator products are not a substitute for individual insurance products and there will still be donor interest and demand for individual products as they offer different advantages. Regardless of the intended market, products must be relevant and have demonstrable value to the target market. More flexible designs (e.g., covering broader consequential losses, not crop-specific) can help compensate for other limitations of index insurance (e.g., basis risk). Products should capture the different way losses from a weather risk may be experienced, including short and long-term losses, direct and indirect sources of loss. Bundling products with other services can provide additional value and efficiency.

We have four recommendations regarding the types of index insurance products that should be developed in the future. Each of these recommendations challenges much current thinking about index insurance. The first three recommendations are repeated from the Data SKR. The fourth recommendation is based on ideas discussed earlier in this document.

9.3.1 Start with Risk Aggregator Products

Most index insurance products developed to date have been targeted to households. However, our experience has led us to conclude that when introducing index insurance into a new market environment the focus, in most instances, should first be on products targeted to risk aggregators. Risk aggregator products have important advantages relative to household products, including lower cost and generally greater feasibility potential. These products face fewer data constraints and costs associated with capacity building, administration and product delivery. In addition, policies sold to risk aggregators tend to be larger in value, resulting in improved financial viability for these insurance products. Financially sustainable insurance products, in turn, are more likely to attract commercial insurers and reinsurers, whose presence is essential in developing and growing a sustainable market.

Given all these reasons, in regions where intractable supply and demand side constraints preclude the development of micro-level products, risk aggregator products may be the only feasible mechanism for using index insurance to transfer catastrophic weather risk. It is also conceivable, that, in some regions, “breaking” the market with a commercially sustainable risk aggregator product will pave the way for household products, once capacity has been transferred and the institutional foundations have been laid. While we suggest that product sequence matters, we are careful to note that, until empirical evidence exists to support or refute this reasoning, it is highly plausible rather than deterministic. Thus, we theorize that, as a general rule, risk aggregator products are better positioned to initiate the process of market development; household products, if at all feasible, should be gradually introduced after market foundations are already in place.

Index insurance geared toward risk aggregators has been questioned on the grounds that it does not benefit poor households directly. We suggest that the indirect benefits that risk aggregator products may offer to households should not be underestimated. As noted in Chapter 3, unmanaged weather risk has important poverty implications: it leads to credit constraints and higher costs of borrowing, which reduce rates of asset accumulation for households and business that provide services to them. Risk aggregating firms limit the services they provide to the rural poor because they cannot manage the catastrophic weather risk associated with

serving these clients. For example, households may pay banks higher interest rates because the bank is unable to efficiently manage the catastrophic risk exposure in the region. Also, agricultural input suppliers, commodity processors, and lenders alike may limit their presence in regions where households are vulnerable to catastrophic risk because these risk aggregators are unable to manage this correlated risk themselves. Index insurance products for risk aggregators that enhance the ability of these firms to manage catastrophic risk can benefit households by increasing access to valuable services provided by these firms.

9.3.2 Think Beyond Protecting Against Yield Losses for a Single Crop

Most index insurance products developed to date have been designed to insure rural households against reduced yields for a single crop. However, yield losses are only one indicator of household well-being. Most households in lower income countries do not rely solely on income derived from a single crop. Instead, they plant a variety of crops and often have livelihood portfolios that are diversified across labor activities outside of farming. For these reasons, index insurance designed around yield variability for a single crop is likely not the best mechanism for protecting rural households from the financial effects of a catastrophic weather event.

This misplaced emphasis on yield losses for a single crop is obviously related to the misplaced emphasis on household products. Most risk aggregators clearly have weather risk exposure that extends well beyond their clients having reduced yields for a single crop. Thus, risk aggregator products are typically not designed around how catastrophic weather events affect a particular crop. They are more flexible and therefore, applicable to more heterogeneous purchasers. Because of this flexibility, risk aggregators can use their knowledge of how catastrophic weather events affect their businesses to tailor their index insurance protection to best fit their needs.

9.3.3 Focus on Catastrophic Events

While developers of index insurance products increasingly focus on insuring against moderate losses, the most effective and efficient use of index insurance is to protect against catastrophic events. The current focus on moderate losses is motivated by concerns that buyers with little or no previous experience with insurance will become discouraged and quit purchasing index insurance if they do not occasionally receive a payment. Again, the misplaced emphasis on household products has led to another problem – a misplaced emphasis on moderate losses.

Insurance is a relatively expensive risk management mechanism. For that reason, it should be used primarily to protect against low-probability, catastrophic risks that are difficult to manage using other means. It is almost always more economical to manage the financial consequences of more frequent but less devastating risks through savings, borrowing, diversification, risk mitigation, and various types of informal family and community reciprocity obligations.

Not only is insurance against moderate losses quite expensive, in the case of index insurance it is likely to have higher basis risk. The spatial covariance of many weather events increases with the severity of the event. For example, more severe droughts tend to be more widespread than less severe droughts. This suggests that the spatial specificity of data required for developing index insurance that protects against moderate loss events is greater than that required for developing index insurance that protects against catastrophic loss events. Said differently, for

any given spatial specificity of available weather data, the basis risk will be higher for index insurance that protects against moderate losses than for index insurance that protects against catastrophic losses.

It is likely also the case that the covariance of returns across different activities is greater for more extreme weather events. In other words, steps to diversify a portfolio by investing in several activities may be ineffective for protecting against extreme weather events. If so, this further supports the notion that index insurance should focus primarily on addressing the range of consequential losses that result from catastrophic weather events.

9.3.4 Reduce Costs and/or Add Value to Household Insurance Products

If index insurance products are targeted to smallholder households, the products must obtain a high level of efficiency and value to achieve viable scale. Technologies such as ATMs or mobile phones provide one mechanism for low cost delivery of index insurance products. Linking the insurance to other products or services can reduce costs by utilizing an existing delivery channel such as a lender or input supplier. Such linkages can also add value to the underlying insurance product and contribute to additional development objectives such as improving access to financial services or the adoption of new production technologies.

Despite the advantages of more cost effective methods to deliver insurance to smallholder households, caution is advised. For example, if insurance is sold through an existing delivery channel the insurance sale will be supplementary to the primary reason that the client is accessing the delivery channel. As a result the person selling the insurance may be quite knowledgeable regarding lending or agricultural inputs but not very knowledgeable about insurance. In addition, when the same market intermediary is selling both insurance and another product or service, the potential for conflicts of interest may exist. Finally, unique legal and regulatory challenges may exist when selling insurance via ATMs or mobile phones or through delivery channels other than direct sales by insurance agents. For example, consumers of insurance products should have an opportunity to see the contract. This issue can be resolved. However, it is the type of extra step that may get over looked as the desire to create efficient delivery overpowers other concerns.

References

Allianz. "Allianz Life Indonesia Expands in Microinsurance with a New Product Combines Protection and Savings Plan." Press release, Jakarta, Indonesia, October 6, 2010.

Angrist, J. D., and J.-S. Pischke. *Mostly Harmless Econometrics: An Empiricists Companion.* Princeton: Princeton University Press, 2009.

Arce, C. "Weather Index Insurance for Agriculture: Lessons Learnt." Presentation at the Symposium on Agriculture Risk Management, Antigua and Barbuda, June 16–19, 2010.

Armendáriz, B., and J. Morduch. *The Economics of Microfinance*. 2nd ed. Cambridge: MIT Press, 2010.

Bamberger, M., and H. White. "Using Strong Evaluation Designs in Developing Countries: Experience and Challenges." *Journal of Multidisciplinary Evaluation* 4(2007): 58–73.

Bardhan, P., S. Bowles, and H. Gintis. "Wealth Inequality, Credit Constraints, and Economic Performance." *Handbook of Income Distribution*. Atkinson, A., and F. Bourguignon, eds. Amsterdam: North-Holland, 2000.

Barnett, B. J., and O. Mahul. "Weather Index Insurance for Agriculture and Rural Areas in Lower income Countries." *American Journal of Agricultural Economics* 89(2007): 1241–1247.

Barnett, B. J., C. B. Barrett, and J. R. Skees. "Poverty Traps and Index–based Risk Transfer Products." *World Development* 36(2008): 1766–1785.

Barnett, B. J., J. R. Black, Y. Hu, and J. R. Skees. "Is Area-Yield Insurance Competitive with Farm-Yield Insurance?" *Journal of Agricultural and Resource Economics* 30(2005): 285–301.

Barrett, C. B., P. P. Marenya, J. McPeak, B. Minten, F. Murithi, W. Oluoch-Kosura, F. Place, J. C. Randrianarisoa, J. Rasambainarivo, and J. Wangila. "Welfare Dynamics in Rural Kenya and Madagascar." *Journal of Development Studies* 42(2006): 248–277.

Barrett, C. B., and B. M. Swallow. "Fractal Poverty Traps." *World Development* 34(2006): 1–15.

Besley, T. "Nonmarket Institutions for Credit and Risk Sharing in Low–Income Countries." *Journal of Economic Perspectives* 9(1995): 115–127.

Boucher, S., and C. Mullally. "Evaluating the Impact of Index Insurance on Cotton Farmers in Peru." Technical Notes IDB–TN–198, Designing Impact Evaluations for Agricultural Projects, Inter–American Development Bank (IDB), Washington, DC, December, 2010.

Bryla, E., and J. Syroka. "Micro- and Meso-Level Weather Risk Management: Deficit Rainfall in Malawi." Experiential Briefing Note, Commodity Risk Management Group, The World Bank, Washington, DC, January, 2009.

Carpenter, R. and J. R. Skees. "Index-Based Insurance Products — Regulatory and Legal Issues." Paper prepared for Commodity Risk Management Group, Agricultural and Rural Development Division, The World Bank, Washington, DC, September, 2005.

Carter, M. R. "Intelligent Design of Index Insurance for Smallholder Farmers and Pastoralists." 2020 Focus Brief: Innovations in Insuring the Poor, Focus 17, Brief 6, International Food Policy Research Institute (IFPRI), Washington, DC, December, 2009.

Carter, M. R. "Inducing Innovation: Risk instruments for Solving the Conundrum of Rural Finance." Keynote Paper Prepared for the 6th Annual Conference of the Agence Française de Développement (AFD) and The European Development Network (EUDN), Paris, France, November 12, 2008.

Carter, M. R., and C. B. Barrett. "The Economics of Poverty Traps and Persistent Poverty: An Asset-based Approach." *Journal of Development Studies* 42(2006): 178–199.

Carter, M. R., F. Galarza, and S. Boucher. "Underwriting Area-based Yield Insurance to Crowd-in Credit Demand and Supply." Paper Prepared for the International Conference on Rural Finance Research: Moving Results into Policies and Practice, FAO Headquarters, Rome, Italy, March 17–19, 2007.

Carter, M. R., P. D. Little, T. Mogues, and W. Negatu. "Poverty Traps and Natural Disasters in Ethiopia and Honduras." *World Development* 35(2006): 835–856.

Cavanaugh, G., B. Collier, and J. R. Skees. "Designing Credit-El Niño Insurance Products to Improve Resiliency of Households." GlobalAgRisk Project Report, Incorporating Weather Index Insurance with Territorial Approaches to Climate Change (TACC) in Northern Peru, United Nations Development Programme (UNDP), Washington, DC, September 30, 2010.

Chen, J., T. Dinku, E. Holthaus, B. Lyon, M. Madajewicz, C. Mullaly, M. Norton, D. Osgood, A. Pascualini, S. Pant, N. Peterson, R. Saavedra, J. Sharoff, K. E. Shirley, C. Small, S. Stiffel, and T-L. Teh. "HARITA IRI Report to Oxfam America: Final Report for IRI MIEL Planning and Technical Support for HARITA Micro-Insurance Pilot USA 536/09." IRI Technical Report 10–08, International Research Institute for Climate and Society (IRI), Palisades, NY, June, 2010.

Chong, C-Y. "Microcapital Story: Tensions in the Microinsurance Sector — Observations from Munich Re's Experience in Indonesia." MicroCapital.org online article, June 29, 2009; Accessed March 31, 2010. http://www.microcapital.org/microcapital-story-tensions-in-the-microinsurance-sector-observations-from-munich-res-experience-in-indonesia/

Ciro, T. Financial Derivatives and Legal Risk: Managing Uncertainty in Derivatives Transactions. London, UK: Euromoney, 2004.

Cole, S. A., X. Giné, J. Tobacman, P. B. Topalova, R. M. Townsend, and J. I. Vickery. "Barriers to Household Risk Management: Evidence from India." Finance Working Paper 09–116, Harvard Business School, Boston, MA, November 19, 2010.

Collier, B., and J. R. Skees." Analysis of El Niño Insurance to Protect the Caja Portfolio." Working paper, GlobalAgRisk, Lexington, KY, November, 2010.

Collier, B., J. R. Skees, and B. J. Barnett. "Weather Index Insurance and Climate Change: Opportunities and Challenges in Lower income Countries." *Geneva Papers on Risk and Insurance — Issues and Practice* 34(2009): 401–424.

Deaton, A. "Instruments, Randomization, and Learning About Development." *Journal of Economic Literature* 48(2010): 424–455.

Dercon, S., ed. *Insurance against Poverty*. Oxford: Oxford University Press, 2005.

Dercon, S. "Wealth, Risk, and Activity Choice: Cattle in Western Tanzania." *Journal of Development Economics* 55(1998): 1–42.

Dias, D., and K. McKee. "Protecting Branchless Banking Consumers: Policy Objectives and Regulatory Options." Focus Note 64, Consultative Group to Assist the Poor (CGAP), Washington, DC, September, 2010; Accessed March 28, 2011. http://www.cgap.org/gm/document-1.9.47443/FN_64_Rev.pdf

Dror, I., A. Dalal, and M. Matul. "Emerging Practices in Consumer Education on Risk Management and Insurance." Briefing Note 3, Microinsurance Innovation Facility, Social Finance Programme, International Labor Organization, Geneva, Switzerland, September 2010; Accessed March 28, 2011. http: //www. ilo. org/public/english/employment/mifacility/download/brnote3_en. pdf

Duflo, E. "Scaling Up and Evaluation." *ABCDE Annual World Bank Conference on Development Economics 2004: Accelerating Development*. Bourguignon, E., and B. Pleskovic, eds. Washington, DC, and New York, NY: World Bank and Oxford University Press, 2004.

Duflo, E., Glennerster, R., and M. Kremer. "Using Randomization in Development Economics Research: A Toolkit." CEPR Discussion Paper 6059, Centre for Economic Policy Research (CEPR), London, UK, January, 2007.

Eswaran, M., and A. Kotwal. "Credit as Insurance in Agrarian Economies." *Journal of Development Economics* 31(1989): 37–53.

Feroni, M. "Affordable 'Pay as You Plant' Index Insurance." Presentation at the Microinsurance Summit London 2010, London, UK, September 29–30, 2010.

Giné, X., R. M. Townsend, and J. I. Vickery. "Patterns of Rainfall Insurance Participation in Rural India." *World Bank Economic Review* 22(2008): 539–566.

Giné, X., and D. Yang. "Insurance, Credit, and Technology Adoption: Field Experimental Evidence from Malawi." *Journal of Development Economics* 89(2009): 1–11.

GlobalAgRisk. "State of Knowledge Report — Data Requirements for the Design of Weather Index Insurance." Project report, Innovation in Catastrophic Weather Insurance to Improve the Livelihoods of Rural Households, Bill and Melinda Gates Foundation, Seattle, WA, June 30, 2010b.

GlobalAgRisk. "Legal and Regulatory State of Knowledge Report." Project report, Innovation in Catastrophic Weather Insurance to Improve the Livelihoods of Rural Households, Bill and Melinda Gates Foundation, Seattle, WA, February 28, 2010a.

GlobalAgRisk. *Designing Agricultural Index Insurance in Developing Countries: A GlobalAgRisk Market Development Model Handbook for Policy and Decision Makers.* Lexington, KY: GlobalAgRisk, 2009; Accessed March 28, 2011. http: //www. globalagrisk. com/Pubs/2009_GlobalAgRisk_Market_Development_Model_Handbook. pdf

GlobalAgRisk. "Developing Agricultural Insurance in Vietnam: Post-Interim Report." Revised Interim Report, prepared under contract to World Perspectives, Inc., for Asian Development Bank Project ADB–TA 4480 VIE, Washington, DC, April, 2006.

Goslinga, R. "Practical Experiences in Improving Affordability and Delivery Channels of Weather Index Insurance for Kenyan Smallholder Farmers." *Microinsurance — An Innovative Tool for Risk and Disaster Management.* Morelli, E., and G. Amsicora Onnis, eds. Davos, Switzerland: GRF Davos, 2010.

Hartell, J., and J. R. Skees. "Handbook III: Applications of Risk Assessment and Product Development in Vietnam." *Developing Agricultural Insurance in Vietnam: Four Educational Handbooks*. Hanoi, Vietnam: AgroInfo, 2009b.

Hartell, J., and J. R. Skees. "Prefeasibility Analysis: Index-based Weather Risk Transfer in Mali." Report prepared for Save the Children Federation and the United States Agency for International Development (USAID), Washington, DC, February, 2009a.

Hazell, P., J. Anderson, N. Balzer, A. Hastrup Clemmensen, U. Hess, and F. Rispoli. "The Potential for Scale and Sustainability in Weather Index Insurance for Agriculture and Rural Livelihoods." Research paper, International Fund for Agricultural Development (IFAD) and World Food Programme (WFP) Rome, March, 2010.

Hellmuth, M. E., D. E. Osgood, U. Hess, A. Moorhead, and H. Bhojwani, eds. *Climate and Society Issue 2: Index Insurance and Climate Risk: Prospects for Development and Disaster Management*. New York, NY: International Research Institute for Climate and Society, Columbia University, 2009.

Hogarth, R. M., and H. Kunreuther. "Risk, Ambiguity, and Insurance." *Journal of Risk and Uncertainty* 2(1989), 5–35.

Hill, R. V., and M. Robles. "Flexible insurance for heterogeneous farmers: Results from a small scale pilot in Ethiopia" Research paper, International Food Policy Research Institute (IFPRI), Washington, DC, October, 2010.

Imbens, G. W. "Better LATE than Nothing: Some Comments on Deaton (2009) and Heckman and Urzua (2009)." *Journal of Economic Literature* 48(2010): 399–423.

Imbens, G. W., and J. M. Wooldridge. "Recent Developments in the Econometrics of Program Evaluation." *Journal of Economic Literature* 47(2009): 5–86.

Iturrioz, R. "Agricultural Insurance." Primer Series on Insurance, Issue 12, Non-Bank Financial Institutions Group (NBFI), The World Bank, Washington, DC, November, 2009.

Katchova, A., and P. Barry. "Credit Risk Models and Agricultural Lending." *American Journal of Agricultural Economics* 87(2005): 194–205.

Kunreuther, H. “Mitigating Disaster Losses through Insurance.” *Journal of Risk and Uncertainty* 12(1996): 171–187.

Kunreuther, H. “Limited Knowledge and Insurance Protection.” *Public Policy* 29(1976): 227–261.

Kunreuther, H., and P. Slovic. “Economics, Psychology, and Protective Behavior.” *American Economic Review* 68(1978): 64–69.

Mahul, O., and J. R. Skees. “Managing Agricultural Risk at the Country Level: The Case of Index-based Livestock Insurance in Mongolia.” Policy Research Working Paper WPS4325, The World Bank, Washington, DC, August 1, 2007.

Mapfumo, S. “Weather Index Insurance: Implementation, Product Design, Challenges and Successes — Lessons Learned In the Field. White paper, MicroEnsure, November, 2008; Accessed February 1, 2011. www.microensure.com/resources-publications.asp

Maredia, M. K. “Improving the Proof: Evolution of Emerging Trends in Impact Assessment Methods and Approaches in Agricultural Development.” IFPRI Discussion Paper 00929, International Food Policy Research Institute (IFPRI), Washington, DC, November, 2009.

Martin, S. W., B. J. Barnett, and K. H. Coble. “Developing and Pricing Precipitation Insurance.” *Journal of Agricultural and Resource Economics* 26(2001): 261–274.

McKay, C., and M. Pickens, M. “Branchless Banking 2010: Who’s Served? At What Prices? What’s Next?” Focus Note 66, Consultative Group to Assist the Poor (CGAP), Washington, DC, September, 2010; Accessed March 28, 2011. http://www.cgap.org/gm/document-1.9.47614/FN66_Rev1.pdf

McPeak, J. G., and C. B. Barrett. “Differential Risk Exposure and Stochastic Poverty Traps among East African Pastoralists.” *American Journal of Agricultural Economics* 26(2001): 674–679.

Mechler, R., J. Linnerooth-Bayer, J., and D. Peppiatt, D., 2006. "Disaster Insurance for the Poor? A Review of Microinsurance for Natural Disaster Risks in Developing Countries." ProVention/IIASA Study, Geneva, Switzerland, July, 2006; Accessed March 31, 2011. http://www.proventionconsortium.org/themes/default/pdfs/Microinsurance_study_July06.pdf

MicroEnsure. "Weather Index Crop Insurance." Webpage; Accessed March 31, 2011. http://www.microensure.com/products-weather.asp

Miranda, M. J., and P. Liu. “Dependence Structure in Agricultural Index Insurance Design and Product Development.” Unpublished working paper, Department of Agricultural, Environmental and Development Economics, The Ohio State University, Columbus, OH, November, 2010.

Morawczynski, O., and M. Pickens. “Poor People Using Mobile Financial Services: Observations on Usage and Impact of M-PESA.” CGAP Brief, Consultative Group to Assist the Poor (CGAP), Washington, DC, August, 2009; Accessed March 28, 2011. http: //www. cgap. org/gm/document–1. 9. 36723/BR_Poor_People_Using_Mobile_Financial_Services. pdf

Morduch J. "Consumption Smoothing across Space: Testing Theories of Risk-Sharing in the ICRISAT Study Region of South India." *Insurance against Poverty.* Dercon, S., ed. Oxford: Oxford University Press, 2005.

Morduch J. "Poverty and Vulnerability." *American Economic Review* 84(1994): 221–225.

Morgan, S. L., and C. Winship. *Counterfactuals and Causal Inference: Methods and Principles of Social Research*. Cambridge: Cambridge University Press, 2007.

Munich Re. "Protecting Cooperatives and Their Low-Income Members in the Philippines against Extreme Weather Events through Microinsurance." Press release. October 11, 2010; Accessed March 28, 2011. http: //www. munichre. com/en/media_relations/press_releases/2010/2010_10_11_press_release. aspx.

Osgood, D. E., M. McLaurin, M. Carriquiry, A. Mishra, F. Fiondella, J. Hansen, N. Peterson, and N. Ward. "Designing Weather Insurance Contracts for Farmers in Malawi, Tanzania, and Kenya." Final report to the Commodity Risk Management Group (CRMG), World Bank, and the International Research Institute for Climate and Society (IRI), Columbia University, 2007.

Oxfam America. "Horn of Africa Risk Transfer for Adaptation, HARITA." Project Brief, Oxfam America, Boston, MA, August, 2009.

Pawson, R., and N. Tilley. *Realistic Evaluation*. London, UK: Sage, 1997.

Ray, D. *Development Economics.* Princeton, NJ: Princeton University Press, 1998.

Rohregger, B., and M. Rompel. "Microinsurance and Public-Private Partnerships in the Context of Catastrophic Risk Management: Examples from Indonesia." *Microinsurance — An Innovative Tool for Risk and Disaster Management*. Morelli, E., and G. Amsicora Onnis, eds. Davos, Switzerland: GRF Davos, 2010.

Rosenbaum, P. R. *Design of Observational Studies*. New York, NY: Springer, 2010.

Rosenzweig, M. R., and H. P. Binswanger. "Wealth, Weather Risk, and the Consumption and Profitability of Agricultural Investments." *Economic Journal* 103(1993): 56–78.

Rossi, P. H., M. W. Lipsey, and H. E. Freeman. *Evaluation: A Systematic Approach*. 7th ed. Thousand Oaks: Sage, 2004.

Santos, P., and C. B. Barrett. "Heterogeneous Wealth Dyanamics: On the Roles of Risk and Ability." Working paper, Cornell University, Ithaca, NY, 2006.

Shadish, W. R., T. D. Cook, and L. C. Leviton. *Foundations of Program Evaluation: Theories of Practice*. Newbury Park: Sage, 1991.

Skees, J. R. "New Approaches for Index Insurance: ENSO Insurance in Peru." *Innovations in Rural Finance for Developing Countries, 2020 Vision Initiative Brief Series.* Kloeppinger-Todd, R., and M. Sharma, eds. Washington, DC: International Food Policy Research Institute (IFPRI), 2010.

Skees, J. R. "Challenges for Use of Index-based Weather Insurance in Lower income Countries." *Agricultural Finance Review* 68(2008): 197–217.

Skees, J. R., and B. J. Barnett. "Enhancing Micro Finance Using Index-based Risk Transfer Products." *Agricultural Finance Review* 66(2006): 235–250.

Skees, J. R., and B. Collier. "New Approaches for Index Insurance: ENSO Insurance in Peru." 2020 Focus Brief: Innovations in Rural and Agriculture Finance, Focus 18, Brief 11, International Food Policy Research Institute (IFPRI), Washington, DC, July, 2010.

Skees, J. R., and A. G. Murphy. "Index-based Livestock Insurance Pilot Final Report." Report prepared for the government of Mongolia, GlobalAgRisk, Lexington, KY, April, 2009.

Skees, J. R., and A. G. Murphy. "ENSO Business Interruption Index Insurance for Catastrophic Flooding in Piura, Peru." Concept note, GlobalAgRisk, Lexington, KY, February, 2009.

Skees, J. R., J. R. Black, and B. J. Barnett. "Designing and Rating an Area Yield Crop Insurance Contract." *American Journal of Agricultural Economics* 79(1997): 430–438.

Skees, J. R., A. G. Murphy, B. Collier, M. J. McCord, and J. Roth. "Scaling Up Index Insurance: What Is Needed for the Next Big Leap Forward?" Weather insurance review prepared by the MicroInsurance Centre and GlobalAgRisk for Kreditanstalt für Wiederaufbau (KfW), December, 2007.

Sossouvi, K. "Helping Ensure That Small Haitian Businesses Can Start Over." Mercy Corp Blog. April 18, 2010; Accessed March 28, 2011. http://www.mercycorps.org/koko%C3%A9visossouvi/blog/20722

Sundararajan, M., and R. Devabalan. "From Compensations to Claims: Benefits of Micro Insurance for the Poor." Report, CARE India, New Delhi, India, 2009.

SBS (Superintendencia de Banca, Seguros, y AFP). "Decreto Supremo No. 006-2009-PCM Texto Único Ordenado de La Ley de Protección al Consumidor." Lima, Perú, 2009.

SBS (Superintendencia de Banca, Seguros, y AFP). "Resolution No. 1765-2005: Reglamento de Transparencia de Informacion y Disposiciones Aplicables a la Contratacion con Usuarios del Sistema Financiero." Lima, Perú, 2005.

Syngenta Foundation. "Fact sheet: Kilimo Salama ('Safe Agriculture')." Online fact sheet, 2010; Accessed March 28, 2011. http: //www. syngentafoundation. org/__temp/Kilimo_Salama_Fact_sheet_FINAL. pdf

Syngenta Foundation. "Foundation and Partners Extend Insurance Reach, As Drought Sows Fears in Kenyan Fields, Major Expansion of Innovative Micro-insurance Program Gives Farmers New Way to Manage Risks." Syngenta Foundation in the News, February 25, 2011; Accessed March 28, 2011. http: //www. syngentafoundation. org/index. cfm?pageid=224&newsid=147

Tversky, A. and D. Kahneman. "Availability: A Heuristic for Judging Frequency and Probability." *Cognitive Psychology* 5(1973):207–232.

USAID (United States Agency for International Development). "Evaluation Policy." Policy paper, Evaluation Policy Task Team, Bureau for Policy, Planning, and Learning, January 19th,

2011; Accessed March 28, 2011.
http: //www. usaid. gov/evaluation/USAID_EVALUATION_POLICY. pdf

Weiss, C. H. *Evaluation Research: Methods for Assessing Program Effectiveness.* Englewood Cliffs, NJ: Prentice-Hall, 1972.

Zimmerman, F. J., and M. R. Carter. "Asset Smoothing, Consumption Smoothing, and the Reproduction of Inequality under Risk and Subsistence Constraints." *Journal of Development Economics* 71(2003): 233–260.