USING INDEX-BASED RISK TRANSFER PRODUCTS TO FACILITATE MICRO LENDING IN PERU AND VIETNAM

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Introduction

This article focuses on two technical assistance projects using aggregate index-based risk transfer products (IBRTPs) to transfer significant natural disaster risks, which affect agricultural production over wide regions. The issue in Peru is El Niño events that cause flooding in the northern regions, and in Vietnam, early flooding occurring in the Mekong Delta. These and other countries are constantly faced with how to deal with major natural disasters. When considering how the costs of natural disasters are internalized, it is important to look at institutional arrangements, particularly in the financial sector.

A common problem for banks, microfinance entities, and other lenders with geographically limited loan portfolios is the threat of correlated risks (e.g., drought, flood, excess rain, etc.) that hinders the development of rural financial services and in particular, the provision of credit. The presence of correlated risk poses a dual problem for lenders: 1) the occurrence of a disaster event implies the potential for much greater default rates among agricultural clients, and 2) added liquidity problems as clients simultaneously draw down savings and increase demand for borrowing to cope with the disaster (Skees and Barnett, 2006).

Countries respond to natural disaster risk in many different ways but the costs are always present, and regardless of the institutional and market arrangements, are always internalized in one form or other. In addition to presenting the details of IBRTP design, this article demonstrates how two countries at nearly opposite ends of the institutional spectrum regarding natural catastrophe response have internalized natural disaster risk into agricultural lending systems and how, in both cases, an insurance mechanism to transfer these risks could lead to improvements. In Vietnam, past practices of debt forgiveness following natural disasters have become unsustainable and recent changes to banking regulations are likely to lead to responses more similar to those in Peru where severe credit rationing has emerged as a mechanism banks employ to limit their financial exposure to correlated risk.

Failed institutions attempting to cope with natural disaster risks represent a common story the world over and underscores the importance of making the costs of natural disaster risk more explicit, and of considering new ways to mix market mechanisms and government initiatives to transfer this risk, putting greater emphasis on *ex ante* rules and procedures than on *ex post* responses. This positive approach imposes discipline, transparency, and efficiency to influence the broader financial markets of insurance, credit, and savings. IBRTPs that focus specifically on removing the big risks of correlated events for financial institutions can clear the way for the development of more robust and resilient rural financial markets.

In a companion article to this session, Barnett and Mahul (2007) explain the background, applicability, and relative advantages of index-based risk transfer approaches. Index-based risk transfer approaches use a proxy measurement to pay for significant economic loss. For example if it is known that extreme rainfall or temperatures is highly correlated with production losses, then these measures can be used to proxy loss and make payments. This design helps solve a variety of problems associated with the usual public-sector response to catastrophic risk and to credit constraints in developed countries, namely traditional forms of agricultural insurance and *ad hoc* disaster aid.

The first section of this article follows the link between the benefits of risk transfer and rural lending on economic growth before considering the impact of, and a possible solution to, correlated weather risk on credit market functioning. The experiences of Peru and Vietnam with catastrophic weather risk at select locations are then reviewed and the IBRTPs specifically customized to address this risk for lending activity in each country are compared. The article concludes by offering lessons and logical extensions regarding use of IBRTPs such as alternative mechanisms for micro-level implementation.

Complete Financial Markets Needed for Economic Growth

There is increasing evidence that access to advanced financial services by rural people is linked to accelerated economic development. When farmers have access to a variety of financial services they are better able to make productivity-enhancing investments, to accept the risk of greater specialization and technology adoption that leads to higher returns, and to accumulate wealth in formal savings vehicles that can be reinvested in the local economy (Hardaker et al., 1997; Skees and Barnett, 2006; USAID, 2006). However, some risks are too large to be easily mitigated or self-insured at the farm/household level. When insurance services are available to transfer such non-diversifiable risks, farmers are able to avoid other more costly risk management strategies and have resources available to recover should the insured event occur without the need to liquidate productive resources for consumption smoothing. (Dercon, 2005; Zimmerman and Carter, 2003). The presence of insurance services also facilitates the more accurate consideration and pricing of risk which increases the efficiency of credit markets and resource allocation between different investment decisions (Trivelli et al., 2006; USAID, 2006). Hence, access to credit at favorable rates and economic growth is generally higher when both insurance *and* banking services develop together.

However, insurance is often the missing market. This is particularly true for catastrophic weather events given the correlated nature of losses which renders traditional risk pooling ineffective. In the insurance literature, such risks are considered uninsurable in the strict sense (Anderson, 1976; Harwood et al., 1999). Correlated weather events covering wide areas affect many agricultural enterprises simultaneously. Farmers are unable to diversify their activities sufficiently to guard against major weather events which can render even off-farm employment largely ineffective. Creditors, likewise, will find their entire lending portfolio at significantly higher default risk following a correlated weather event (Trivelli et al., 2006).

In a market-based economy, the inability to effectively hedge against correlated weather risk generates less activity in the credit market by both lenders and borrowers. Lenders respond by curtailing the volume of credit available, offering credit at less favorable terms, and sometimes by withdrawing credit services entirely following a catastrophic weather event that results in high loan default (USAID, 2006). This response is particularly pronounced when creditors lack traditional forms of collateral, as is common in developing countries. Demand for credit simultaneously falls as the cost of borrowing increases and from fear of the consequences of loan default (Varangis, Hess, and Bryla, 2003; Trivelli et al., 2006; USAID, 2006). When insurance markets are lacking, credit markets fail to work effectively. This restricts economic growth and increases the vulnerability of the poor to poverty traps (Dercon, 2005; Skees and Barnett, 2006).

The development of innovative IBTRPs can remove a portion of the correlated risk that hinders development of financial services by offering banks, microfinance entities, and other credit providers with the means to transfer catastrophic weather shocks that induce loan default and liquidity risk (Miranda and Vedenov, 2001; Varangis, Hess, and Bryla, 2003; Skees and Barnett, 2006). A risk transfer mechanism for correlated weather risks that carefully blends markets with some degree of government effort to facilitate market development can remove a major constraint to rural financial markets (Skees and Barnett, 1999; Skees and Hartell, 2006; Skees, Hartell, and Hao, 2006).

Case Examples: Flood Risk Transfer in Peru and Vietnam

While they face very different risks, the nature of the natural disasters in Peru and Vietnam has similar characteristics and impacts—the correlated risk of flooding creates problems with default among borrowers. The IBRTPs being proposed to manage these large risks are similar in that each is designed to get the big risks out of the way as a first step in improving banking and insurance services.

Despite these similarities, Peru and Vietnam start from very different political and economic institutions that respond to and internalize these risks in different ways and generate different experiences. Table 1 summarizes and contrasts the key characteristics of the natural disaster risk, institutional response, and proposed risk transfer instrument for Peru and Vietnam. In Peru, loan defaults following catastrophic flood risk are internalized by the market economy into interest rates and severe credit rationing. In the Socialist Republic of Vietnam, the response has been to share the risk by charging roughly the same interest rate to all borrowers from the state bank while forgiving and rescheduling loan defaults that were created by natural disasters.

Table 1 Key Characteristics of Natural Disaster Risk, the Proposed Risk Transfer Index, and Institutional Response to Catastrophic Events in Peru and Vietnam

	Peru	Vietnam
Natural disaster event	Sever flooding during El Niño event	Extreme and early arrival of the annual flood
Event impact on agriculture	Crop destruction, erosion	Interrupts harvest completion of summer-autumn rice crop
Event onset measurement	Excess rainfall	Excess river flow
Correlated index for risk transfer with strike/cap value	Sea surface temperature (ENSO 1.2 recorded by NOAA) exceeding 2, maximum 3	River depth at Tan Chau station exceeding 250cm, maximum 350cm
Index measurement period	January–March	June 20–July 10
Producer response to disaster	Loan default	Loan default
Institutional response (creditors)	Credit market withdrawal, interest as high as 50%	Previously debt forgiveness based on ability to repay, now debt restructuring
Institutional motivation for catastrophic risk transfer	Indemnify lending portfolio to enable a return to rural market	Prepare for commercialization by protecting lending portfolio
Impact of most recent event	1998—Massive flooding destroys crops, infrastructure, and trade. Agricultural lending stagnates and falls to 10% of portfolio value during ensuing years.	2000—Extreme early flooding interrupts harvest with ~50% of area affected, increases post harvest losses, destroys infrastructure, and interrupts trade. Extensive loan default follows.

Source: Authors; Reports by GlobalAgRisk, Inc., have more detail for both case studies presented in this article; for Peru under USAID/DAI Prime Contract LAG-I-00-98-0026-00 BASIS Task Order 8, Rural Finance Market Development, and Vietnam under project TA 4480 sponsored by the Asian Development Bank with a contract with World Perspectives Incorporated.

The potential value of these new insurance markets in Peru is for the easing of an important constraint to lending. The IBRTPs can be used immediately to assist in managing default risk faced by lenders and, potentially, to help lower interest rates and make credit more widely available. This institutional innovation can help in achieving efficiencies and improving access where there is already substantial market activity but serious credit rationing due to the correlated risk problem of extreme flooding.

Introducing a new insurance market to transfer catastrophic risks should facilitate Vietnam's transition to a greater market orientation. The introduction of IBRTPs in Vietnam can stimulate further dialog about how natural disaster risk and commercial lending are linked and why it is important to adopt market principles that provide better incentives for both local lending agencies and farm households in responding to natural disaster risk.

Flood insurance is missing in developing countries for many good reasons. In addition to difficulties of managing correlated risk, loss adjustment for small farms is prohibitively expensive, and moral hazard and adverse selection are pervasive. Each of these problems pose a significant barrier to those attempting to build insurance markets because their usual starting point is to think about how to design and sell products to individuals before investigating how to transfer the big risk. Instead, the Peru and Vietnam projects start by identifying ways to remove the correlated risk through natural aggregators, such as banks and microfinance entities, who are in effect risk poolers but are unable to effectively diversify this risk. As a starting point, the approach is to indemnify the lender that removes the large undiversifiable risk and enables further financial market development. Focusing on existing risk aggregators is likely more feasible than attempting to create an explicit structure to provide the benefits of risk transfer directly to individual farm households. Nonetheless, effective internal policies to deal with default risk remain a challenge for agricultural lenders. More will be said about this issue in the conclusion.

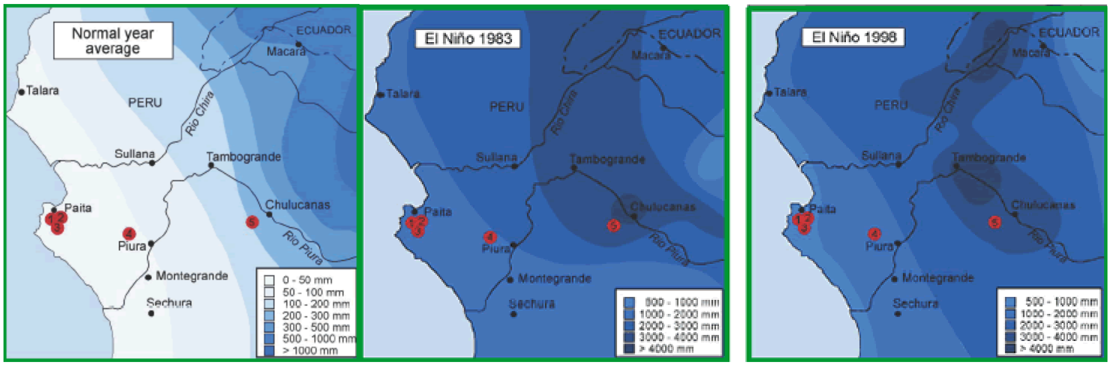
Peru: Growing the Market

The overall objective of the project in Peru was linking microfinance institutions (MFIs) to innovations in weather index insurance. The motivation was to contribute to the expansion and sustainability of rural finance in Peru by providing new index insurance instruments that would reduce both the portfolio risk for the MFIs and the risk to individual farm loans. In both cases, the focus was on reducing exposure to correlated risk.

After performing a risk assessment from a wide range of weather data in Peru, it became clear that El Niño events are the major source of catastrophic risk in Peru. El Niño has a long history in Peru. Indigenous populations have predicted El Niño for hundreds of years. If a haze reduced the number of stars in the constellation Pleiades that were visible at high altitudes, they did not plant as this was a sign of a coming El Niño. Quechua peasants in the Central Andes of southern Peru still hike up the Andes on the summer solstice to count stars in the Pleiades. (Orlove et al., 2002).

The two most recent severe El Niño events (1983 and 1998) devastated a number of regions in Peru with massive flooding. The flooding washed away crops, destroyed basic infrastructure, and disrupted all forms of small trade. The volume of lending by MFIs in Peru grew 350 percent between 1998 and 2003. (De Janvry, et al., 2003). However, during the same period, agricultural lending by the same MFIs had virtually no change in volume and agricultural lending currently accounts for only about 10 percent of all MFI lending. At the extreme, one MFI has nearly stopped lending to agriculture altogether—the predicted response from lending institutions when there is a correlated weather risk that is likely to increase default rates. Default rates for all MFIs operating in the northern coastal department of Piura prior to the 1998 El Niño were around 8 percent. After El Niño default rates increased to about 18 percent. While not all of this increase can be attributed to El Niño, much of it was driven by the major disruptions created by El Niño flooding. Figure 1 shows the differences in normal rainfall versus rainfall in the two extreme El Niño years. In both 1983 and 1998, the ENSO (El Niño Southern Oscillation) 1.2 index exceeded 2.5. The ENSO 1.2 index measures changes in Pacific sea surface temperatures off the coast of Peru. Abnormal increases in temperature typically indicate an El Niño weather pattern. More detailed statistical work on these relationships can be found in Khalil, et al. (2007).

Figure 1 Precipitation Levels in Normal Years versus El Niño Years, 1983 and 1996 (Piura)



Source: www.condesan.org/cuencasandinas/piura.htm

Based on feedback from a major reinsurer, it became clear that writing a direct insurance contract on the ENSO 1.2 was both easy to do and would provide for significant risk transfer for catastrophic events. For index insurance contracts, reinsurers are most receptive to a secure measure that has a long time series. ENSO indexes are measured, maintained, and published by the U.S. National Oceanographic and Atmospheric Administration (NOAA). Daily records that use very similar technology exist for about 50 years. Older records from oceangoing ships that measured sea surface temperatures begin in the 1860s. One basic contract would simply make linear payments when the ENSO 1.2 index during the January–March flooding period exceeds 2 with a maximum payout when the index reaches 3. For example, an MFI with a $100 million portfolio and estimating that a severe El Niño could cause an increase in default rates of 10 percentage points, could purchase a value insured of $10 million. If the ENSO 1.2 value was 2.6, the payment rate would be 60 percent of the value insured, or $6 million. The Peruvian regulator approved ENSO insurance in the summer of 2006, based on the promise that this instrument will allow for the transfer of a major catastrophic risk plaguing Peru for centuries.

Vietnam: Leading the Market

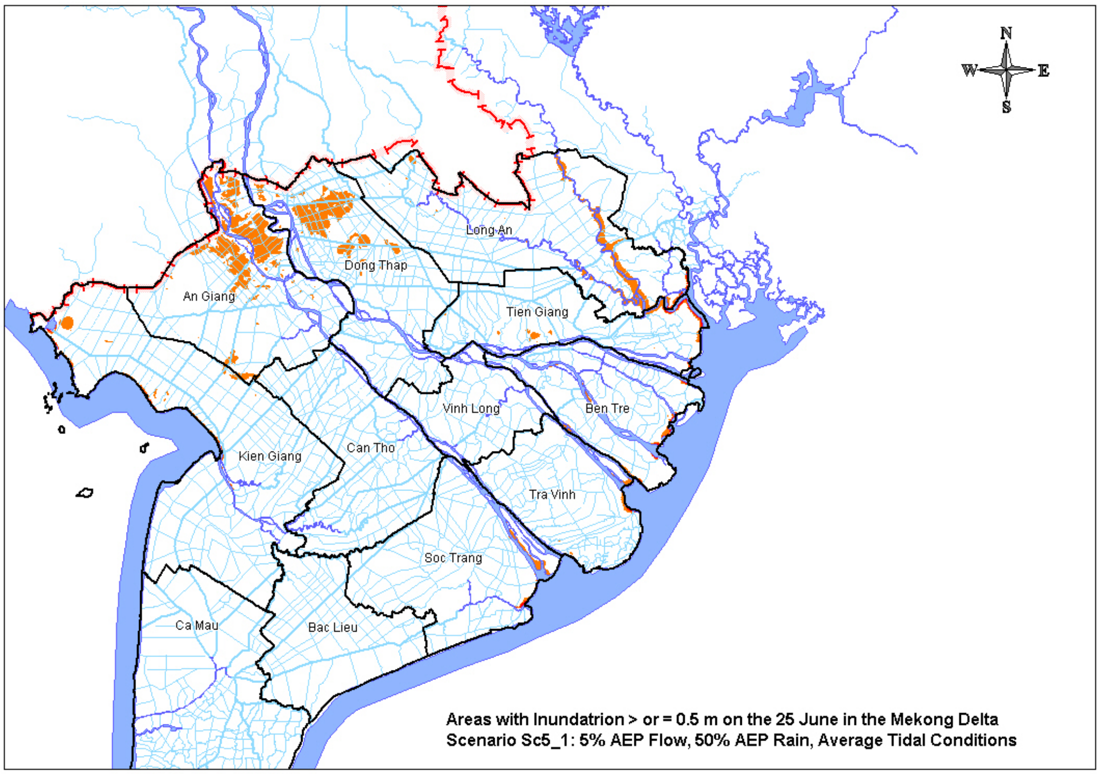
In contrast to the experience in Peru, Vietnam faces a very different institutional environment but also one that is in flux. The Socialist Republic is currently transitioning many of its state-owned banking and financial services toward greater market orientation in a process referred to as "equitization." This process includes the modernization of insurance regulation and other changes to improve the conditions for general insurability and risk transfer.

There has been little success to date in offering agricultural insurance in Vietnam. For example, the state-owned insurance company, BaoViet, suffered actuarial losses in excess of VND 5 billon (16,000 VND = US$1) on insurance based on rice-yield loss offered over the 1993–1997 time period, resulting in an aggregate loss ratio of 110 percent. A subsequent attempt in 1997/1998 to offer traditional multiple peril crop insurance, particularly for rice, was also terminated due to massive losses (Dufhues, Lemke, and Fischer, 2004). At present, there is essentially no agricultural insurance activity in Vietnam.

The state agricultural bank, the Vietnam Bank for Agriculture and Rural Development (VBARD), has become the *de facto* risk aggregator and agricultural insurer through its lending practices. Characteristics of VBARD lending include: 1) nearly flat interest rates that are charged throughout the country, thus VBARD pools risk nationally; and 2) in the event of a natural disaster that impacts loan repayment ability, it performs a loss assessment to determine if loans should be rescheduled or forgiven. In the past, the government periodically recapitalized the bank for loan forgiveness but this practice has recently been discontinued as the government moves to shape VBARD into a more accountable commercial enterprise. Loan rescheduling and some amount of commune-level loss adjustment continue to take place if the borrower qualifies. And like an insurer, VBARD now maintains local reserves to protect against losses created when debt is postponed. These recent regulatory changes with the movement towards commercialization are serving as an important catalyst for VBARD and other lenders to consider innovative options to cover their lending exposure from natural disaster risk.

The focus in Vietnam has been on early flooding that negatively impacts the second rice crop prior to harvest. Figure 2 provides an indication of the areas of the Mekong Delta where the event of flooding levels above one-half meter is likely in 1 out of 20 years on June 25.

Figure 2 Mekong Delta Inundation Greater than ½ Meter at the 5 Percentile for June 25

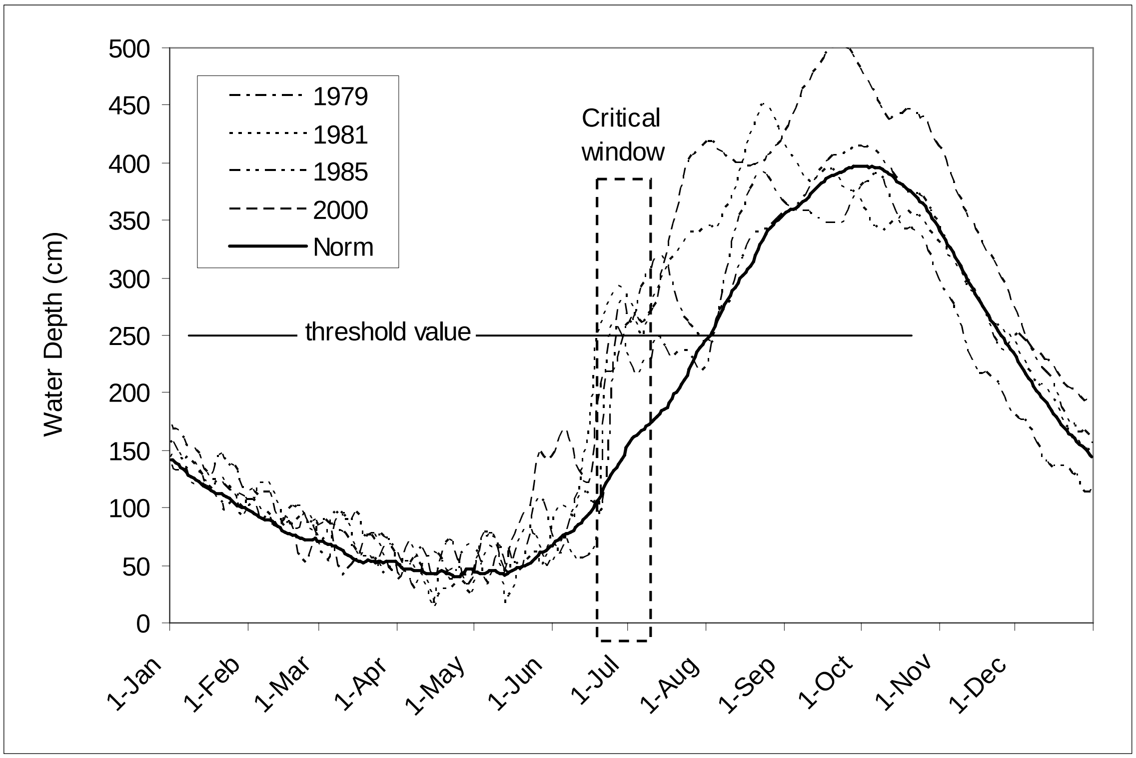


Source: Southern Institute of Water Resources Planning (SIWRP), 2007

In some of the districts, none of the rice is harvested by this date. While the Mekong Delta floods every year, Vietnam has made massive investments in infrastructure to manage the normal extent of flood in its early stages to extend the growing season. River flow normally starts to increase in June but significant river flows usually do not begin until mid- to late July, with the annual flood levels peaking in October. The problem comes when flows increase significantly during the later part of June and early July when farmers still have their summer-autumn rice crop in the fields. The area in Figure 2 represents in excess of 200,000 hectares of summer-autumn rice valued at over US$150 million.

While flooding in the Mekong Delta is a function of multiple conditions, hydrological modeling performed by the Southern Institute of Water Resources Planning (2007) reveals that water coming across the border from Cambodia is the dominating factor influencing flooding. Daily water level data obtained from Tan Chau hydrological station from 1977–2004 were used to examine levels exceeding 250 cm for dates between June 20 and July 10. This 250 cm value is the level at which downstream flooding becomes a serious problem while the June 20–July 10 period coincides with greatest harvest activity. When this measure is used, 4 out of 27 years had excess water levels during this period. This threshold represents roughly a 1-in-7-year chance which should be an acceptable level of frequency for most insurance providers. Figure 3 shows the daily water levels for these key years superimposed with the normal water levels.

Figure 3 Daily Water Levels During 4 Extreme Water Level Years (June 20–July 10)



Source: Authors

Using this information, an aggregate IBRTP can be constructed that indexes the level of water at the Tan Chou station and provides indemnity payments directly to rural lenders. This targets the economic costs of flooding to creditors and is intended to cover business costs associated with default risk and restructuring the loan portfolio. Furthermore, a certain percentage of loans will never be repaid even after restructuring. The significant question is how to evaluate these credit risks and to what extent the bank would want to reserve for these costs versus the purchase of an insurance product that would compensate for the losses. The optimal strategy is likely a blend of these two risk management mechanisms.

The most straightforward aggregate index-based transfer contract for excess water levels during this time frame would be a linear payout. Using the available 27 years of data, if the contract agreed to pay for water levels measured at Tan Chou station above 250 cm (the threshold) and stop payment at 350 cm, there would be a 1 percent payment for every 1 cm of water above 250. Any risk aggregator who purchased a contract would determine their amount of exposure and then make a decision about the liability needed to protect this exposure. The liability selected would drive both the premium and the indemnity payments. For example, if the liability was VND 4 billion and the premium rate was 10 percent, the purchaser of the index insurance contract would pay VND 400 million (.10 x 4 billion). If the water level reached 275 cm during the critical period, the indemnity payment would be 25 percent or VND 1 billion.

Conclusions and Extensions Emerging from Peru and Vietnam

The country case studies of Peru and Vietnam provide two very different institutional and market maturity examples of how it may be possible to construct aggregate IBRTPs that blend banking and insurance to remove a lender's correlated portfolio risk. However, such aggregate risk transfer is only a beginning step in the process of developing efficient credit markets in developing countries, with several issues and caveats that need to be addressed.

One issue involves the challenge of providing a direct linkage between the aggregate IBRTP and financing and delivering some level of efficient insurance product to protect smallholder borrowers and to protect the lender from defaults. While the initial focus is on removing the big constraints for the lender, there is some question as to whether this alone will provide the desired level of "trickle down" benefit to drive an active credit market (Trivelli et al., 2006). Allowing lenders to pass through the benefits of the large indemnity payment from the IBRTP may be the most efficient way to deal with the large transaction costs associated with providing more complete financial services to small households. This does not mean that the lender would be underwriting the weather risks, but rather the lender would link the benefits of the aggregate index payments to the small loans. Given special considerations from regulators about microinsurance, this arrangement could evolve into more sophisticated products that would allow payments based on risk zones for group lending and group indemnity. Those in higher risk zones would be required to pay higher interest rates for this form of composite product.

One promising area of research is the use of more advance technology to make estimates of local losses, which would reduce the transaction cost of extending insurance products at a disaggregate level while also controlling for moral hazard and adverse selection problems. For example, there is ongoing work in risk-zone modeling to developed accurate and reliable maps for the specific timing of catastrophic flooding events (Southern Institute for Water Resources Planning, 2007). Technological innovations in satellite and radar imagery may also offer potential in providing rapid and reliable methods for evaluating water inundation on small parcels. The institutional innovation associated with index-based insurance products can be a motivation for investing in technological advances that improve estimation of losses at the local level.

Finally, mitigation remains a critical first step when designing any risk management strategy within a country. It is important to remember, however, that mitigation also comes at a real economic cost and that overconfidence with engineering solutions obscure important residual risks. For example, Vietnam has invested extensively in dyke and canal systems to control flooding in the Mekong Delta. Yet experience and initial hydrological modeling both indicate that these systems can be overwhelmed. In Peru, there have been discussions about the potential for the construction of flood control structures but these are estimated to be enormously expensive. The economic tradeoff between engineered mitigation solutions relative to financial solutions for extreme catastrophic risk remains an important area of research.

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