The role of microinsurance as a safety net against environmental risks in Bangladesh

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Abstract

The Intergovernmental Panel on Climate Change (IPCC) identifies Bangladesh as one of the countries that will be hardest hit by the anticipated effects of climate change. The poorest people are the most vulnerable, as they do not have sufficient means to cope with environmental risks. In the absence of effective safety nets, poor people become trapped in chronic poverty due to the recurrent damage caused by natural disasters. Recently, there has been growing optimism among policy makers and practitioners about the role of microinsurance as a safety net against weather risks for the poorest and most vulnerable people of Bangladesh. This article sheds light on this issue by synthesizing the findings of half a decade of research on the prospects of weather microinsurance in Bangladesh. Three key conclusions are drawn from the synthesis. First, the market for a standard, stand-alone weather microinsurance in Bangladesh is characterized by low demand, poor governance, and lack of prospects for commercial viability. Second, although the index-based flood insurance model has theoretical appeal (i.e., no moral hazard or adverse selection and low transaction cost), high economic cost might be associated with its highly complex practical implementation. Finally, the current (un)regulatory arrangement of microinsurance supply in Bangladesh, which does not guarantee accountability and protect clients' rights, is likely to increase rather than decrease poor people's vulnerability. The study makes two key recommendations: (1) exploring options for non-traditional insurance models (e.g., group-based and ex-post premium-based models), and (2) considering regulatory reforms to ensure good governance and to foster market efficiency through low-cost delivery and product innovation.

1. Introduction

Climate change has intensified the risk of natural disasters all over the world. Residents of low-income countries are particularly susceptible to these risks (Strömberg, 2007). Bangladesh is one of the poorest and most natural disaster-prone countries in the world. The country is situated in one of the three mega-deltas (the Ganges-Brahmaputra delta) expected to be among the regions hardest hit by the anticipated effects of climate change (IPCC, 2007). Approximately 75 percent of the total population of 140 million people live in the rural areas, earning on average US$1,300 per household per year (Bangladesh Bureau of Statistics, 2010). Half of this population relies on nature dependent income sources (i.e. agriculture, forestry and fisheries) for their livelihoods (Bangladesh Bureau of Statistics, 2005). Once in every five to ten years hydro-meteorological hazards (e.g. floods, storm surge and coastal cyclones) cause asset loss, crop damage, unemployment, disease and fatalities. The increased frequency and magnitude of natural disasters caused by climate change over the past few decades have exacerbated the income risks facing the rural households whose livelihoods depend on natural resources. Poorer households are considered more vulnerable to these shocks as they are more exposed to risks and have a lower capacity to adapt to changing climate (Brouwer, Akter, Brander & Haque, 2007). In the absence of adequate social safety nets, the poorest sections of the population often find themselves trapped in chronic poverty due to the recurrent damage caused by natural calamities.

The management of increased climatic risks is one of the key challenges facing the government of Bangladesh in this century. Traditionally, natural disaster risk management in Bangladesh revolved around infrastructural measures such as building embankments and polders. Some ad hoc non-structural measures have also been used. These measures include the distribution of post-disaster relief (e.g. free food, clothing, drinking water, medicine) and increased access to post-disaster agricultural credit. In recent years, the concept of 'reactive adaptation' has gained attention in Bangladesh's natural disaster risk management programs. Reactive adaptive measures refer to a system for accessing funding or other resources to rebuild the society after a disaster. Reactive adaptation is considered a superior strategy to proactive adaptation, particularly when the occurrence and impact of weather events are unpredictable (Duus-Otterström & Jagers, 2011). Along this line, the Bangladesh Ministry of Environment and Forests prepared the National Adaptation Program of Action (NAPA) and the Bangladesh Climate Change Strategy and Action Plan (BCCSAP). The NAPA outlines the Bangladesh government's long-term strategic plans to deal with climate change, identifies key adaptation needs and lists priority projects. The BCCSAP is a short-term implementation plan of the NAPA. It outlines the Bangladesh government's 10-year (2009-2018) action plan to build capacity and resilience among communities that are vulnerable to climatic risks.

Both the NAPA and BCCSAP recommend exploring options for a micro-flood-insurance market as a potential reactive adaptation strategy to cope with climate change impacts (MoEF, 2005; MoEF, 2009). Whilst some microinsurance schemes are available to cover life and health risks, there are currently no insurance schemes to hedge natural disaster risks in Bangladesh. However, the country has previous experience with a multiple peril micro-crop-insurance program introduced in 1977 by the Shadharan Bima Corporation (SBC) on a directive from the central government. The scheme was not financially successful as compensation claims consistently exceeded risk premiums. In ten of the 17 years that the plan was in operation, the loss ratio was over 400 percent (Rahman, 2007). The program ended in 1992 when SBC could no longer finance the scheme's losses.

Given the vivid memories of SBC’s failure to operate a micro-crop-insurance program in the past, Bangladeshi policy makers have vowed to be prudent with their future microinsurance initiatives. Careful pre-assessments have been ongoing for over half a decade to finalize the details of a microinsurance contract that can withstand the anticipated climate change impacts in the Bengal delta. As part of the pre-assessment initiatives, two research projects were conducted. The first project entitled ‘Development and testing of an effective insurance market to alleviate flood risk vulnerability and poverty in Bangladesh’ was conducted between 2006 and 2007. The project was conceived under the Poverty Reduction and Environmental Management (PREM) program of the Dutch Ministry of Foreign Affairs. The second project entitled ‘Crop insurance as a risk management strategy in Bangladesh’ was conducted between 2007 and 2008 by the Climate Change Cell of the Department of Environment under the Ministry of Environment and Forests as part of their ‘Climate Change Adaptation Research’ initiative. Both studies involved household surveys, focus group discussions and key stakeholder interviews in the riverine and coastal floodplains and flashflood-prone areas of Bangladesh.

These two research projects yielded a number of scientific journal papers and reports (French & Silver, 2007; Khan & Islam, 2008; Akter, Brouwer, Choudhury & Aziz, 2009; Brouwer & Akter, 2010; Akter et al., 2011; Akter & Fatema, 2011). They document the research findings with regard to demand and supply obstacles, features of the best suited microinsurance model and the framework of an appropriate institutional-organizational model for cost-effective insurance delivery. In light of these published and unpublished reports and journal papers, this paper will discuss the key issues relevant for a weather microinsurance market in the riverine and coastal floodplains of Bangladesh with respect to its potential role as a safety net for the poor. To be more specific, the main objectives of this paper are to (1) synthesize the key findings and recommendations of the research projects, (2) discuss their implications for the role of weather microinsurance as a safety net for poor and ultra-poor households in Bangladesh and (3) identify issues that need attention in future research. Although the discussions presented here focus predominantly on Bangladesh-related research works, they are relevant for weather microinsurance markets in other low-income countries, particularly those countries located in the tropics and sub-tropics (e.g. Sri Lanka, Cambodia, Indonesia, the Philippines, Thailand, Vietnam). Existing review papers in the weather microinsurance literature (e.g. Collier, Skees & Barnett, 2009; Hochrainer, Mechler & Pflug, 2009) have summarized research findings on drought insurance in semi-arid and arid regions. To the best of my knowledge, no previous study has summarized the empirical literature on weather microinsurance prospects in a flood-prone reverine delta.

The next section presents a brief overview of the weather insurance literature. Sections 3 and 4 discuss the challenges associated with the demand and supply of weather microinsurance in Bangladesh. Section 5 summarizes the problems and prospects of an index-based insurance model in Bangladesh followed by a discussion about the potential sources of premium subsidy in Section 6. Section 7 summarizes the discussion and presents concluding remarks.

2. Worldwide Experience of Weather Insurance

In the literature of disaster risk reduction, weather insurance is referred to as an effective tool for reducing, sharing and spreading natural disaster risks (Bouwer & Vellinga, 2002; Botzen & van den Bergh, 2008). However, the available evidence indicates that weather insurance programs have not been very successful on standard commercial criteria throughout the world. Low voluntary participation in these programs is one of the key obstacles to their success. According to the U.S. Senate Republican Policy Committee report, less than 30 percent of the vulnerable homeowners in the USA purchased insurance against flood peril despite the large number of explicit and implicit subsidies provided by the National Flood Insurance Program (NFIP) (US Senate Republican Policy Committee, 2006). A case study by Giné, Townsend and Vickery (2008) showed that less than five percent of the eligible farmers in a drought-prone region of India bought rainfall index insurance. The insurance scheme failed to attract the target group of farmers. The insurance was purchased mainly by those farmers who needed it least.

The causes of under-insurance against natural disaster losses received significant scholarly attention over the past 40 years (e.g. Cook & Graham, 1975; Camerer, & Kunreuther, 1989; Giné et al., 2008). In most instances, the standard neo-classical theories of risk and insurance were found to be inadequate to explain people's decisions to purchase weather insurance. People tend to use ad hoc rules to assess the underlying risk associated with the occurrence of the event as well as the credibility of the risk transfer instruments in question (Camerer & Kunreuther, 1989). Browne and Hoyt (2000) showed that households' risk perception, instead of actual risk, was an important determinant of the insurance purchasing decision. Lewis and Nickerson (1989) showed that the availability and access to ex-post public relief programs (e.g. disaster loans, grants) worked as a disincentive for households to invest personal resources in protective actions such as insurance. The most stated reason among non-purchasers of an insurance program in India was that they did not understand the insurance product, while insufficient income was an important reason for not buying the insurance scheme in less than a quarter of the cases (Giné et al., 2008). Another quarter of the non-purchasers were sceptical about the insurance payout in the event of a disaster. Risk-averse households were less likely to purchase insurance as a result of the uncertainty about the risk mitigation instrument that arose from their lack of experience with it (Giné et al., 2008).

Initiatives to supply weather insurance have also been remarkably low throughout the world. This is mainly due to the covariate nature of weather risks. The standard principle of paying out damage compensation to affected clients by pooling resources from non-affected clients does not apply in the case of weather insurance. Therefore, insurers face the risk of having to compensate losses that affect clients across an entire community or region. Consequently, private insurers remain reluctant to offer policies covering flood and other natural hazard risks. In low-income countries, the highest number of microinsurance contracts is offered in the fields of life and health insurance; the lowest number of contracts is offered to cover agricultural and climatic risks (Mosley, 2009). However, some increase in the supply of weather microinsurance has currently been observed in the semi-arid and arid countries after the innovation of the weather index-based microinsurance model. The fundamental difference between index-based and traditional insurance schemes is that in the former case, indemnities are based on measurements of a specific weather parameter (e.g. rainfall or temperature) instead of actual damage. Therefore, the scheme does not require any damage assessment. It offers a specific amount of payout if, for example, rainfall at a local station falls below a threshold level. Index insurance mitigates moral hazard and adverse selection problems associated with traditional yield-based insurance schemes.

A growing number of pilot programs of index-based microinsurance have been implemented in Asia, Africa and Latin America (e.g. India, Kenya, Philippines, Peru, Malawi, Mexico, Mongolia, Moroccoand Uganda). There is little empirical evidence about the effectiveness of these programs. In most cases, the schemes are heavily subsidized by the government or donor agencies, yet they suffer from low take-up rate and consequently struggle on the ground of commercial viability (Burke, Janvry & Quintero, 2010). Giné et al. (2008) and

Cole et al. (2009) found a less than ten percent adoption rate for rainfall insurance policies among farmers in rural India. Raju and Chand (2008) showed that the government-operated National Agriculture Insurance Scheme (NAIS) in India operates at a substantial loss. During its five years of operation, the premium revenues covered one-third of the indemnity claims. Fuchs and Wolff (2011) found that an index-based insurance in Mexico had significantly increased agricultural productivity and farmer's income although the program was cost-inefficient from a societal perspective. In some instances, index-based insurance contracts suffer from poor design. For example, an efficiency evaluation of wind-indexed typhoon insurance for rice yield losses in the Philippines by Banerjee and Berg (2011) revealed a substantially low correlation (1%) between wind speed and rice yield loss. Clarke (2011) showed that a number of existing weather indexed insurance policies were poorly designed as they constituted combinations of high premiums and low correlation between claims and losses.

3. Demand for Weather Microinsurance in Bangladesh

The success of microinsurance in reducing environmental risk-induced vulnerability depends to a large extent on the target population's willingness and ability to pay for the insurance scheme. Therefore, it is important to know how the target clients want the insurance scheme to be designed and how much they are willing to pay for the desired features. This is no simple matter given the absence of "insurance culture" in traditional Bangladeshi society (Siegel, Alwang & Canagarajah, 2001). Although educated urban and well-off households in Bangladesh are fairly familiar with health and life insurance policies, the practice of buying non-life insurance schemes to cover property or livelihood risks is limited in both rural and urban societies. In addition, people are accustomed to receiving financial returns for the schemes they purchase. Most health and life insurance policies offered in Bangladesh work like a bond. They have a face value and a maturity period. Insurance clients pay a yearly premium and receive financial return at regular intervals during the life of the policy. The face value of the policy is returned after the policy reaches its maturity date. Given this long tradition of a financial return-based model of insurance to cover life and health risks, a standard weather insurance model that offers compensation only when damage is caused by a natural disaster and no return otherwise is unlikely to attract a large number of buyers. Therefore, it is not surprising that over a third of the sampled respondents of Akter et al.'s (2011) study refused to participate in the proposed insurance program because the scheme did not offer any financial return if no natural disaster occurred. This trait (which could be either cultural or institutional) is one of the major obstacles to microinsurance take-up in Bangladesh, yet to date it has received very little empirical attention.

Apart from this trait, the low affordability of insurance premiums tends to limit insurance participation (Brouwer & Akter, 2010; Akter & Fatema, 2011). Most respondents who refused to participate in the hypothetical insurance program referred to 'limited financial income' as a primary reason for non-participation. Relatively wealthier households with large areas of farmland were willing and able to pay the offered insurance premium (Akter et al., 2009). The average willingness to pay an insurance premium was substantially lower than the damage. The mean willingness to pay a premium for crop insurance was estimated at Taka 42 (US$0.6) per household per week (Akter et al., 2009). This amount was two percent of the average weekly income of the sampled farm households and 30 percent of their annual crop damage cost. Comparing the mean household willingness to pay with the expected indemnity and insurance delivery costs, Akter et al. (2011) showed that a standard standalone crop insurance scheme is likely to suffer 25 to 50 percent loss each year.

Recently, a number of alternative insurance models have been developed to resolve the affordability issue. The interlinked credit and insurance market is one such model (Carter, Cheng & Sarris, 2011). Under the interlinked credit-insurance arrangement, farmers borrow money at a higher interest rate that includes a weather insurance premium. If a natural disaster occurs, then the farmers repay only a fraction of the loan, while the rest is paid by the insurer to the bank. This model reduces the risk of weather-driven default for borrowers and thus helps induce agricultural productivity as farmers are able to use credit to switch to a higher-risk, higher-yield farming technology. The Malawi pilot program on a bundled insurance scheme that was rolled out in 2005-2006 provides an example of how credit and insurance can be integrated to manage agricultural production risk. The interlinkage between credit and insurance can also be established through ex-post premium payment as a state-contingent loan: in the good state of nature the clients pay back the loan, the premium payment on the insurance and the interest on both, but in the bad state of nature the clients owe nothing. The suitability of these newly developed insurance models need to be tested in Bangladesh in order to extend the microinsurance safety net to the most vulnerable population groups.

The existence of informal insurance arrangements needs to be given careful consideration while designing the formal insurance contract (Akter & Fatema, 2011). There is substantial evidence in the social vulnerability literature suggesting that rural households cope with weather risks through neighbourhood network-based informal support systems (Brouwer et al., 2007). Although a natural disaster is a region-wide covariate shock, it may contain significant idiosyncratic components at local level (Townsend, 1994; Dercon & Krishnan, 2000). This is due to the income and wealth differences across rural households. Vulnerability to environmental risk varies depending both on exposures to natural hazards and people's capacity to cope with these hazards (Few, 2003). Households facing the same level of environmental risk may have different strategies and resources which affect their vulnerability to covariate risks differently (Brouwer et al., 2007). Therefore, significant scope for risk-sharing within a village community remains even in the presence of common shocks.

Household decisions to purchase an insurance contract ex-ante are negatively affected by the availability of informal insurance (Akter & Fatema, 2011). Informal insurance has a number of advantages over formal insurance contracts. Formal insurance requires regular payments in advance for a specific period of time. They cover damages incurred to the product(s) for which the insurance was purchased, for example crop, livestock or house. Also, the amount of compensation offered by a formal insurance contract is often uncertain as it is subject to post-disaster damage assessment by the insurance provider which may furthermore involve a considerable waiting period and complex bureaucratic procedures. Informal insurance arrangements do not have these strings attached to them. They are accessed after the disaster. The money can be used to cover any kind of expense and they are fairly quick, simple and less uncertain for people who are part of the informal social network. However, informal risk sharing arrangements are only effective against low to moderate weather shocks. These arrangements tend to fail in the face of extreme covariate weather shocks (Hazell & Hess, 2010; Collier et al., 2009). The design and promotion of formal weather insurance products, therefore, require an understanding of the dynamics between adverse weather events and the effectiveness of informal insurance arrangements. Most importantly, the threshold of a covariate shock above which a formal insurance contract is necessary for risk coping needs to be identified through empirical research in future (Akter & Fatema, 2011).

The outreach of the informal insurance network during low and moderate weather shocks needs some attention too. There is growing awareness that there may be significant holes in informal insurance-based social safety nets (Bhattamishra & Barrett, 2010). Evidence shows that conventional networks based on informal support systems exclude marginalized sub-populations of the society, e.g. women, the poorest, disabled people and people from minority religions (De Weerdt, 2005; Santos & Barrett, 2006). These "invisible" groups are often the most vulnerable groups. A well-designed formal insurance contract needs to be developed through market segmentation and product diversification to protect these marginalized sub-populations (Frankiewicz & Churchill, 2011).

4. Supply of Weather Microinsurance in Bangladesh

Once the demand for weather insurance contracts is established, the next challenge is to ensure their supply in a sustainable manner. As discussed in Section 2, the most difficult aspect of weather insurance supply is the very nature of weather risks. Natural disasters result in systematic losses correlated across clients and geographical regions. Private insurers remain reluctant to embark on risky and unprofitable ventures. Also, private insurers prefer financially solvent clients with regular income flows, thus refusing to offer insurance to individuals with low, irregular or seasonal income (Al Hasan, 2007). In view of the apparent lack of profit-led motivation, governments of some countries legislate policies that make it mandatory for private insurance companies to extend a certain percentage of their business to rural sectors offering both life and non-life insurance services. India is an important example in this regard. Insurance companies in India are legally obliged to service the rural and low-income segment of the society from the first year of commencement of operations. Non-fulfilment of these obligations may result in penalties being imposed by the regulator. This regulation has inspired collaboration between microfinance institutions (MFIs) and nongovernmental organizations (NGOs) with the mainstream insurers. It has also provided incentives for research and innovation for product design that can meet poor people's needs (M-CRIL, 2008).

At present Bangladesh lacks such regulations[i]. Nevertheless, a handful of private insurance companies and a considerable number of NGOs/MFIs have been offering life/health and loan microinsurance services in the rural areas of Bangladesh for the past two decades. In terms of the amount of client outreach, NGOs/MFIs hold 80 percent of the market share (21 million clients) (INAFI, 2007). The insurance services provided by NGOs/MFIs are not registered with the Insurance Directorate and hence these services are not regulated or supervised under the Bangladesh Insurance Act which regulates the insurer's business. This means that 80 percent of the existing microinsurance contracts in Bangladesh do not conform to any legally binding formal guideline. Further, the insurance products offered by the NGO/MFIs are not developed based on any sound actuarial knowledge. The majority of NGOs/MFIs determine premiums by rule of thumb, which leads to a premium rate much higher or lower than the actuarially fair premium (Hasan, 2006). The premium rate is set either based on a rough estimate of the expected losses adjusted by high risk loading factor or to match the willingness to pay of the target population (Beiner, 2011). In the former case, insurance becomes unaffordable by the target population due to overpricing the risks by means of high loadings. In the latter case, the microinsurers face a substantial risk of insolvency due to underpricing the risks (Dror & Armstrong, 2006; Beiner, 2011).

An additional problem that impedes efficient delivery of microinsurance in Bangladesh is the lack of a common regulatory regime for insurance practice (French & Silver, 2007). Akter et al. (2011) showed that a partner-agent model of insurance supply is the key to financial viability of weather-related microinsurance products in Bangladesh. In a partner-agent model, insurance companies and micro-credit providers collaborate to jointly offer the insurance schemes. Generally, insurance companies bear the full risk, while micro-credit providers carry out most of the field-level operational and administrative work through their established extensive client network. The administrative cost of offering, distributing and maintaining insurance contracts under such a scheme is reduced either to zero or to a very negligible amount per insurance contract. The partner-agent model became the dominant approach to micro-insurance supply in India. For example, Vimo SEWA, an Indian insurance cooperative owned and run by women working in the informal sector, offers its life, health and asset coverage in partnership with various private insurers. CARE India, a humanitarian organization, launched a three-year partnership with Bajaj Allianz, a leading private insurance company in India, to provide microinsurance to over 75,000 people in the tsunami-affected southern Indian state of Tamil Nadu.

Such collaboration between private insurance companies and NGOs/MFIs appears unlikely under disparate regulatory regimes. The private microinsurance companies and NGOs/MFIs currently operate under different regulatory authorities. For NGOs/MFIs the main governing body is the Microcredit Regulatory Authority (MRA), under the Ministry of Finance while mainstream insurance providers operate through the Bangladesh Insurance Act 2010 under the supervision of the Insurance Development and Regulatory Authority Bangladesh. This difference in regulatory regimes results in inconsistencies and incoherence of regulations, thereby reducing opportunities for collaboration among key players and often causes conflicts of interests.

In addition to different regulatory regimes, a considerable amount of tension exists between private insurance companies and NGOs/MFIs with regard to a mutually acceptable share of power and stake in outcome under a partner-agent model of microinsurance supply (French & Silver, 2007). Both private insurance companies and NGOs/MFIs hold significant power and stake in outcome in the microinsurance market of Bangladesh. Mainstream insurers have the financial power, insurance experience and expertise to undertake actuarial analysis. NGOs/MFIs have greater access to the client base, better infrastructural facilities across even the most remote parts of Bangladesh, a greater degree of trust and reliability among clients and pre-existing information on client portfolios and risk history (French & Silver, 2007). Combining the respective powers of both parties could result in a win-win situation for the prospective weather insurance market (Mechler & Linnerooth-Bayer, 2006). However, it turns out that the organizations have different motivations for offering weather microinsurance. Social concerns are the prime motivation for NGOs/MFIs in offering weather microinsurance while private insurance companies aim to maximize profit. This disagreement in the type of stake in outcome (either for financial gain or to achieve objectives of poverty reduction) poses a barrier to collaboration (French & Silver, 2007).

5. Problems and Prospects of an Index-based Insurance Model

An appropriate insurance model is necessary for efficient product design. Khan and Islam (2008) investigated this issue and recommended an index-based insurance model for Bangladesh. This section outlines the strength and weaknesses of this recommendation.

As discussed in Section 2, the index-based insurance model has a number of advantages over the traditional yield-based insurance model. The three most important advantages are (1) no adverse selection, (2) no moral hazard and (3) low administration cost. However, it is important to note that the index insurance model is designed and widely implemented to cover drought risk which is based on a single parameter, namely the amount of precipitation recorded at a local weather station. Let's say, for example, r is the realized amount of rainfall and r* is the trigger. No indemnity is paid if the realized value of rainfall at a weather station is greater than or equal to the trigger. If the actual rainfall r is less than the trigger r*, the insured is paid an indemnity.

Bangladesh is a low lying flood-prone delta. The northwestern districts of the country are semi-arid where the index-based insurance model might be suitable to reduce drought-induced vulnerability. The suitability of this model for the flood-prone districts of the country is doubtful. There are significant differences between drought and flood risks which make the task of extending the standard framework of rainfall index-based drought insurance to the design of a flood-index insurance complicated. The most important distinction lies in the number of parameters required to develop the indices. Unlike a drought episode, a single parameter is not sufficient to fully describe a flood event. The depth and duration of water discharge during flood have critical impacts on the potential damage to agricultural production (Hellmuth, Osgood, Hess, Moorhead & Bhojwani, 2009). The timing of the flood also has important implications for crop damage (Hellmuth et al., 2009). Crops are more vulnerable to damage when they are younger and at the flowering stage. Flood-index insurance therefore requires a composite index. This involves identifying the correlation between multiple attributes of a weather parameter (e.g. duration, level of inundation, timing) with crop damage in a manner that allows individual as well as simultaneous variations of these parameters to be mapped to an indemnity payout schedule. For example, a flood-index trigger level could be determined as flood depth of above 50 cm, with flood duration of more than five days during a certain period of a crop calendar (Hellmuth et al., 2009).

Implementation of flood-index insurance also requires a reliable and consistent measure of the index. Remote sensing and geographic information systems are useful tools that may enable objective and accurate assessment of flood extent and duration at high resolution given that the required data (e.g. topography, hydrology, land use, farmer's location, infrastructure) are available. Successful use of these technologies requires highly skilled manpower and sophisticated infrastructural facilities. The time and cost of obtaining data and the required technological standards need to be taken into account in the flood-index-insurance feasibility studies.

In addition to the technical complexities, the index-based insurance model bears an inherent risk which is known as basis risk. This risk arises due to the difference between the payout offered by the index and actual damage experienced at the firm (Collier et al., 2009). Basis risk is higher (1) when the weather variable used as the index does not have high correlation with damage and (2) when the weather variable is not highly spatially covariate, i.e. weather variable measured at the weather station is different from its amount at the household/farm level. In both cases, there is a risk that the payout from index insurance will not accurately match the loss incurred. This risk is considered one of the most challenging demand-side obstacles of implementing weather index insurance (Giné et al., 2008; Cole et al., 2009). For a composite index like the one discussed for flood-index insurance, basis risk is likely to be greater if the correlations between crop damage and multiple attributes of a weather parameter (e.g. duration, level of inundation, timing) are not accurately estimated. Further, remote sensing and geographic information systems-based measures of the index can be implemented across a broad geographical region e.g. at district or sub-district level. This suggests that there is likely to be significant discrepancy between the realized value of the index at the household and district/sub-district levels. This will also contribute to a higher basis risk.

Group-based models of weather insurance contracts have been recommended as a means to minimize basis risk through group-based loss assessment and payout rules (Trærup, 2012). Theoretically, the overall basis risk facing individual group members can be broken down into a covariate and an idiosyncratic component (Clarke & Kalani, 2011). The idiosyncratic risk can be minimized by developing an informal payment rule which is based on loss assessment by the other members of the group. Trærup (2012) outlines the following steps for operationalization of a group-based index insurance contract: (1) an existing informal clients' network can be considered as one insurance taker; (2) the informal clients' network pays one collective premium to the insurance provider and also receives a single payout as one insurer; and (3) the network distributes the payout among its members based on the information flow within the network. This model holds a great deal of promise for Bangladesh due to the unprecedented success of the group-based microcredit model. The joint liability lending approach where a group of borrowers is made responsible for the repayment of an individual loan taken out by the group members was first innovated and implemented in Bangladesh. If one group member does not repay the loan, others may have to contribute so as to ensure repayment. The existing group-based micro-lending network can be used as a platform to launch group-based microinsurance programs. However, a demand assessment needs to be carried out first to determine the attractiveness of this model to the potential insurance clients.

6. Subsidising Weather Microinsurance Premiums

There is very little doubt among researchers, practitioners and policy makers about the lack of profitability of weather microinsurance contracts. Regardless of the type of insurance model applied (standard or index-based) or the type of supply provision used (partner-agent or full service), it is quite evident that the rural households of Bangladesh are unlikely to be able to afford weather microinsurance at full cost. Premium subsidies are inevitable, at least at the outset of the program (Khan & Islam, 2008; Akter et al., 2011). The question is: What would be the best possible way to finance the premium subsidy? Khan and Islam (2008) recommended cutting back expenses that are used to finance post-disaster relief and rehabilitation assistance. They compared the Bangladesh government's expenditure in the agricultural sector in the wake of cyclone Sidr - a category four tropical cyclone that struck the southwest coast of the country in 2007 - with the expected indemnity payable under a weather-microinsurance program. Based on a back-of-the-envelope analysis, they concluded that weather insurance can be commercially viable if the premium subsidy is drawn at the cost of post-disaster relief and rehabilitation expenditure (Khan & Islam, 2008 p. 136).

Although the recommendation may be justifiable in economic terms, its social and ethical implications need careful consideration for two reasons. First, post-disaster relief assistance (e.g. distribution of food, water, clothing, medicine) and microinsurance (in its present form) are relevant for different income groups of the society. The recipients of disaster relief assistance are generally the ultra-poor and marginalized clusters who live in high risk areas and have very little capacity to cope with natural disaster risk. Relatively well-off households do not access post-disaster relief assistance even if they are in desperate need of help. They view the process of accessing charity as shameful and socially demeaning (Longhurst, 1986). This income group relies on formal and informal credit facilities to cope with damage. Weather microinsurance is likely to be greeted with a sigh of relief by this group. For this reason, the demand for weather insurance in Bangladesh shows no evidence of "charity hazard": a feature of post-disaster relief assistance which creates disincentives for households to invest in ex-ante disaster prevention measures including the purchase of insurance (Raschky & Weck-Hannemann, 2007). Brouwer and Akter (2010) and Akter and Fatema (2011) tested for the relationship between receipt of ex-post relief assistance and household demand for microinsurance. They did not find any significant relationship between the two. Using post-disaster relief expenses to finance weather microinsurance programs is therefore likely to help relatively wealthier households to cope with weather risks at the cost of increased vulnerability of the ultra-poor households.

Second, ex-post management of a natural disaster involves three distinct phases: response, recovery and rehabilitation. During the response phase victims require emergency assistance to deal with the immediate aftermath of a natural disaster. For example, during a flood event, flood-stricken households need basic food, shelter and medical assistance as long as their properties remain inundated. The recovery phase starts after the flood water subsides. Weather microinsurance, if implemented, will serve as a natural disaster recovery strategy. It will help some groups in the society to cope with the damages caused by natural disasters, e.g. repairing house damage, coping with crop loss. In the rehabilitation phase, households need access to resources that enable them to invest in securing their livelihoods for future. The ex-post disaster loan distributed by the government facilitates rehabilitation of flood stricken agricultural farmers. This support is crucial because, with the exception of major NGOs/MFIs (e.g. Grameen Bank, BRAC), most rural financial institutions' ability to lend money declines considerably after a region-wide covariate shock as they experience widespread credit default. If post-disaster loan disbursement expenses are used to finance weather microinsurance premium subsidies, it may speed up the recovery process but it will slow down rehabilitation.

7. Conclusions

The summary of half a decade of research results suggests that the market for a standard, standalone weather microinsurance in Bangladesh is characterized by low demand, poor governance and lack of prospects for commercial viability. Microinsurance's role as a safety net against environmental risks for the poor does not bode well either. Unless microinsurance products are designed specifically to address the needs of the poorest population groups through market segmentation to allow cross-subsidization, there is very little hope that the most vulnerable people of Bangladesh can be brought under microinsurance coverage. The lack of prospects for financial viability means there is a need to identify potential sources to fund the inevitable premium subsidies. The recommendation to reduce funding from post-disaster relief and rehabilitation expenses to subsidize weather microinsurance premiums needs to be treated with caution. This kind of policy is likely to provide relatively well-off households with a stronger safety net at the cost of increased vulnerability of the ultra-poor and marginalized groups within the society. Even if this solution is efficient from an economic standpoint, the outcome may not be desirable from an ethical perspective.

More research is necessary to understand the prospects for non-traditional insurance models. In particular, a combination of group-based and ex-post premium-based models needs urgent empirical attention. The group-based model may help to mitigate basis risk while the ex-post premium-based model will help to address the low affordability issue. Although the index-based flood insurance model has theoretical appeal (i.e. no moral hazard or adverse selection and low transaction cost), high economic cost might be associated with its highly complex practical implementation. A benefit-cost analysis that compares the gain from no moral hazard, no adverse selection and low administration cost with the cost of designing, monitoring and measuring a realistic and reasonable flood-index will facilitate objective decision making.

The current (un)regulatory arrangement of microinsurance supply in Bangladesh is not suitable for introducing weather microinsurance contracts. Without a properly functioning regulatory environment that guarantees accountability and protects clients' rights, weather microinsurance services are likely to increase rather than decrease poor people's vulnerability. Regulatory reforms are necessary to ensure good governance and to foster market efficiency through low-cost delivery and product innovation. Existing disparities between the key players, both in terms of regulatory regime and motivation to offer weather microinsurance, need to be reconciled. This can be done by implementing regulatory reform that will enact a standard set of legally binding practices for all parties offering microinsurance and compel private insurance companies to invest part of their resources in non-profit ventures.

Finally, future research initiatives on weather microinsurance in Bangladesh need coordinated efforts among scholars, stakeholders, practitioners and policy makers in order to avoid repetition, to ensure cross-study comparison and complementarity of the research projects. Currently the science, practitioner and policy communities appear to be working in isolation. Consequently, practitioners and policy makers remain oblivious to the best available scientific knowledge in the field. Likewise, scientists remain unaware of the high priority research needs identified by the policy makers and practitioners. The science-policy interface can be strengthened by creating a National Weather Microinsurance Research Network. This will help develop a coordinated approach to microinsurance research and foster dialogue among national and international scientists, as well as the broader policy and practice communities.

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