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SR14: Microinsurance and climatic-related disasters: challenges and options

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Introduction¹

This paper describes where microinsurance can and cannot help in mitigating the impact on people in low-income countries of natural disasters whose severity or frequency is increased as a result of climate change. It also describes what would need to happen in order for microinsurance to provide a significant level of protection against the impact of natural disasters, whether related to climate change or not.

As microinsurance is already being used in a number of countries as a means of protecting poor people from the adverse effects of the risks they face in their daily lives, it is natural to ask whether it will be able to provide protection to the same and an increased number of poor people if climate change increases the risks they have to face. We will describe how changing risks, whether real or perceived, will alter the effectiveness of microinsurance products.

While the whole range of microinsurance products includes both life and non-life insurance, this paper will consider only non-life microinsurance products which provide, for example, agricultural or building insurance for a short, typically annual, period. Such short-term insurance offers protection against unforeseen disasters but does not offer protection against long-term changes to the underlying risks faced. If the effects of climate change on the livelihoods of workers in developing countries become particularly severe so that they cannot adapt and sustain themselves and their families, then no amount of short-term insurance protection will enable them to remain where they are and they are likely to migrate elsewhere. Whether people in this situation will migrate within or across borders will depend on many factors, such as immigration policies in potential host countries and the ability of affected people to afford the high cost of international or intercontinental migration. Moreover, the effect of short-term insurance on migration patterns in the aftermath of disasters is not clear: claim payments could be used by households to support costly rebuilding or for costly migration. However, it seems unlikely that microinsurance will either lead to or stem mass migration as a result of climate change.

As the number of extremely large (mega) cities increases, particularly in Asia, the number of people exposed to the effect of a single natural disaster affecting one of these cities will dramatically increase. While insurance against the impact of a natural disaster could be taken out by individuals, it seems that governments would need to be heavily involved to ensure that products are affordable and sound and that coverage is sufficient.

In this paper we will first describe what microinsurance looks like, the various types of product available, and how microinsurance could protect against the effect of catastrophes. We will then look at how climate change may affect the risks that insurance typically protects against and how microinsurance can respond to these changes. Finally, we consider supply and demand issues and the special case of Asian megacities before concluding with various options for future developments. We leave it to others to discuss the actual extent to which climate change is causing and will cause more and worse natural disasters and more or less migration (see Overseas Development Institute, 2006, and Coleman, 2009).

¹ Without implicating them in the shortcomings of the work, we thank Nora Ferm, three referees and the editor of the Foresight Project for very useful comments on aspects of the paper.

What is (micro)insurance?

Churchill (2006) defines microinsurance as ‘the protection of low-income people against specific perils in exchange for regular premium payments proportionate to the likelihood and cost of the risk involved’. Under this commonly used definition, microinsurance is just insurance for low-income people. However, since the target consumers of microinsurance products are quite different to the middle- and high-income people targeted by developed country personal lines insurers, one might not be surprised to learn that successful microinsurance products are quite different in some respects to insurance products sold in the developed world.

Naturally, existing microinsurance products target perils that affect low-income households. Many of the perils covered by microinsurers, including life, health and home fire, are routinely insured in developed countries. However, with 900 million rural poor dependent on the uncertain business of agriculture for their livelihoods, agricultural insurance is a much more important line of business for microinsurers than for traditional insurers.

This focus on agricultural insurance, particularly by development economists, has stimulated innovations of some significance for the current discussion on protection for climatic-related perils. In particular, microinsurers have experimented with offering *indexed insurance* products to their clients.

Under a traditional *indemnity insurance* product the claim payment to the insured depends only on their own loss: if the insured incurs a large enough insured loss the insurer is contractually obligated to make a claim payment. It may be possible to offer indemnity-based insurance for some climatic-related disasters. For example, Turkey’s system of earthquake insurance for homes and the Philippines’ new scheme for typhoon insurance for homes are both indemnity based (Gurenko *et al.*, 2006; Morsink *et al.*, 2011). However, indemnity-based approaches to insurance do not seem possible for some important perils. Using the example of agricultural insurance, an indemnity-based insurance policy such as a *multiple peril crop insurance (MPCI)* policy would lead to a claim payment to a farmer if that farmer’s yield for specified crops on specified plots was below a contractually agreed threshold. Such individual indemnity-based policies have been sold in many countries but are plagued by problems of moral hazard, where insured farmers take less care over their farm than uninsured farmers; adverse selection, where only low expected yield, high-risk farmers voluntarily purchase insurance, leading to high expected claim payments from the insurer and therefore high premiums; and widespread insurance fraud due to the high cost to the insurer of detecting fraudulent behaviour. These information asymmetries and contracting costs have been so acute in practice that there have been very few, if any, successful MPCI schemes for small-scale farmers (Hazell, 1992; Skees, *et al.* 1999).

By contrast, under an indexed insurance product, the claim payment to the insured depends only on the realisation of some *index*, typically chosen to be objective and correlated with the insured’s loss. Rainfall indexed insurance is one example of an index insurance policy that has been sold to farmers, for which the index is a measure of the rainfall at a specified contractual weather station. Too much or too little rainfall at the wrong time might spell disaster for a farmer and so an indexed insurance policy may be designed to pay if the rainfall index is either too high or too low. Since the product depends only on the rain at the contractual rainfall station, the same product can be sold to a large number of farmers working near the contractual weather station, who will then all receive the same claim payment (Giné *et al.*, 2010).

A wide variety of indices can be used and they can be tailored to specific crops, or other risks that are being insured. Certain crops are sensitive to hours of sunlight, temperature or humidity and so indices have been developed based on these parameters. Rather than setting an index based on inputs to the agricultural process, such as rainfall and sunshine, a special category of indices are termed 'sample-based indices' and are calculated as the mean from a statistical sample of outputs, such as the yield or mortality rate of livestock. For example, a sample-based area yield index is the sample mean yield for a particular crop in a defined geographic area, where the sample of plots in which yield assessment is conducted is chosen to be representative of the area (Mahul *et al.*, 2011).

By conditioning claim payments on an objective, cheaply observable index, over which policy holders have little control or private information, indexed insurance can significantly reduce the problems of moral hazard, adverse selection and insurance fraud which can plague indemnity insurance contracts. However, indexed insurance has one significant disadvantage: it is only a hedge, and does not offer watertight protection. Of particular concern, it increases exposure to downside risk. For example, without any agricultural insurance the worst agricultural outcome that can occur from the perspective of a farmer is one in which the farmer loses his or her entire crop. However, a farmer who has purchased weather indexed insurance is exposed to the risk of an even worse outcome; the farmer could lose his or her entire crop due to pestilence, disease or localised weather conditions but receive a negative net income from the insurance contract arising from a premium having been paid to the insurer but no claim being paid since the weather at the contractual weather station was good (Clarke, 2011).

Attractive indexed insurance policies offer low premiums, relative to the level of cover, and claim payments that are highly correlated with the losses of target policy holders (American Academy of Actuaries, 1999). In particular, a good index should trigger claim payments when the insured has incurred a large loss on the insured asset. For example, conditional on a home being destroyed, a good indexed home insurance policy will have a high probability of making a material payout and, conditional on a crop being destroyed, leading to very low yield, a good indexed crop insurance policy will have a high probability of making a material payout.

Despite the growth in indexed insurance policies in developed countries there has been very little analysis of whether these products are objectively good. Although such analysis has been conducted in developed countries for indexed insurance policies and other derivatives purchased by firms (for example, see Cummins *et al.*, 2004), derivatives are typically not sold to individuals in developed countries. Moreover, the available evidence for indexed insurance policies sold in developing countries is somewhat negative. For example, Clarke (2011) finds that a portfolio of weather indexed insurance policies sold to poor farmers in 2007 comprised mostly objectively poor products, owing to the combination of high premiums and low correlation between claims and losses. Banerjee *et al.* (2011) find a correlation of 1% between wind speed indexed insurance policies and losses incurred by rice farmers in the Philippines. Whilst this research is not yet conclusive, these findings are concerning.

One approach that may be appropriate for some perils is to combine indexed insurance contracts, designed to accurately capture aggregate shocks, with local risk pooling, which can cheaply capture individual shocks. Whilst individual indemnity insurance may be impossible for a formal insurer to offer on a sustainable basis, individuals living in the same village may have good, verifiable information about large shocks that affect each other. The combination of local mutual indemnity-based insurance, providing protection against individual shocks, and formal indexed insurance, providing protection to the mutual, could lead to both low basis risk and an acceptable cost for some perils (Dercon *et al.*, 2011).

Insurance and climate change

If people wish to reduce the risks they face they can try and transfer all or part of the risk or take steps to reduce the impact of these risks. Farmers have traditionally had a number of informal ways of reducing and transferring risk such as diversifying the crops they grow, having more than one source of income, sending family members to work in cities, or taking part in some form of community-based risk-pooling process. Insurance is a form of risk transfer that can supplement or replace some of these more traditional methods, especially where they cannot provide sufficient protection against those risks which are not diversifiable at farmer and community level.

Microinsurance will be able to protect against the impact of climate change only if products covering the effects of natural disasters are available at affordable prices. However, to the extent that future climate change affects the overall level of risk and volatility of a catastrophe, microinsurance providers will respond by increasing premiums or deductibles, broadening exclusions or withdrawing cover. If a microinsurance provider did not do at least one of these and had insufficient reinsurance it would be exposing itself to an increased risk of insolvency and inability to meet its claims.

Climate change could have a number of different effects on the risks covered by microinsurance. Climate change could result in a shift in the average outcome and/or a change in the frequency or severity of extreme events. As well as how climate changes the distribution of risk, the speed of the change will also affect how responsive microinsurance would be to the change in risk.

Insurance premiums are broadly made up of a 'risk premium' to cover the cost of the expected claims plus loadings for the cost of holding capital, administrative and marketing expenses, and profit:

$$\text{Commercial Premium} = \text{Risk Premium} + \text{Cost of Capital} + \text{Expenses} + \text{Expected Profit}$$

The risk premium is generally set using statistical analysis of past experience, incorporating expert opinion and allowing for noticeable trends in past experience. However, it will take some time, or greater reliance on expert opinion, for microinsurance providers to be able to determine how changes in the impact of disasters relate to changes in the underlying frequency or severity with which these disasters occur. Insurers may be aware that the risks are changing but not be able to determine by how much and whether the change is in the frequency of disasters or in the severity, or both. They may also be faced with different experience in different areas that will make it even more difficult to assess how widespread the effects are. This lack of knowledge will lead them to take a more prudent approach in setting premium rates or to being more restrictive in what they offer.

The cost of holding capital arises as a result of insurers and reinsurers holding additional capital as a buffer against worse than expected claims experience. While insurers may have their own view of how much capital to hold, regulators set minimum standards; for example, Solvency II in the EU will require insurers to demonstrate resilience against a '1 in 200 year' event. This can lead to high capital requirements for insurance against events with uncertain

odds, such as climatic-related disasters. The cost of acquiring this capital and holding it in the form of suitable assets is rightly passed on to policy holders and can be substantial. For example, it is typical for the premium for catastrophic cover against natural disasters to be more than four times the risk premium (Perry, 2009).

Microinsurance products are thus likely to appear to provide less value for money, even if potential buyers are also aware that the risks they face are changing.

One of the possible mechanisms by which climate change could affect farmers is by causing a slow but continual deterioration in their environment, for example a slow increase or decrease in the amount of rainfall. Such a gradual change may not be severe enough in the short term to trigger a claim under an insurance policy. By the time the environment has deteriorated to a level at which the farmers could make a claim, the insurance companies, having already identified the trend, may have changed the trigger point. If the deterioration continues, then even if there is a claim under an insurance policy, farmers may not be able to remain where they are as the conditions may be such that they can no longer adapt and produce sufficient food to support themselves and their families. Their situation may have come to such a pass that even with the insurance payout (all of which may be needed to repay outstanding loans) they may have insufficient assets to enable them to invest in alternative livelihoods or even to migrate except as paupers.

Supply of microinsurance

There are a large number of challenges in providing suitable microinsurance products at premiums that farmers and poor urban dwellers can afford. However, paraphrasing Sen (1995), one must avoid the danger of designing products aimed at the poor that end up being poor products.

The traditional risk carriers for microinsurance products are insurance companies, reinsurance companies including the large multinational reinsurers, and governments. NGOs and some mutual organisations have in some places provided forms of cover but these have been acting as informal insurers with the risk that, as they are unregulated, they may not be able to pay contractually agreed claims in the aftermath of a disaster.

Only if microinsurance products are profitable will it be attractive for insurance companies to offer them in significant volumes. In order to be profitable the premiums charged, without any subsidy, must cover the cost to the company of covering the insured risk, its marketing and administration costs and the cost of holding capital.

Increasing the reach of microinsurance will require insurers to have suitable distribution and administration capacity provided by themselves or in collaboration with others (see Churchill, 2006, Part 4). By definition, microinsurance will be for relatively small premiums but potentially for large numbers of policy holders. Insurers will therefore need to develop cost-effective means of reaching their customer base, for example by partnering with community-based mutuals, microfinance organisations or other intermediaries and by making use of developments in technology such as the increasing reach of mobile phones. Administering large volumes of small policies will, in order to be profitable, demand low overheads and highly efficient administration systems. In some cases the development and implementation of these systems will need to be subsidised. Insurers could try and make use of existing infrastructure to distribute and administer their products thus reducing the cost involved in introducing

microinsurance products. They will need to be satisfied that they are partnering organisations that are trustworthy and financially secure.

There will also need to be a high level of trust in financial institutions on the part of the potential purchasers of insurance.

Demand for microinsurance

There is a clear need for insurance for the poor. Being poor in a poor country is extremely risky. Self-employment provides unpredictable income, and the constant threat of health or mortality shocks leaves households vulnerable to serious hardship (Dercon, 2004; Collins *et al.* 2009). Although the financial size of shocks may be small compared with those in developed countries, there is nothing 'micro' about the shocks faced by the poor in poor countries; it is not unheard of for households to respond to large income shocks by taking children out of school and reducing nutritional intake, particularly for girls and women (Dercon and Krishnan, 2000; Ferreira and Schady, 2009).

By affecting entire communities and extended families at the same time, natural disasters have an even larger impact than idiosyncratic shocks which affect one individual at a time. Those affected are typically left with little in the way of assets, and surviving the aftermath often requires selling any remaining assets, such as jewellery, at fire sale prices. Friends and families, whilst useful for support in the event of idiosyncratic shocks, are all affected at the same time and cannot offer substantial help. By providing income from an external source in the event of natural disasters, insurance can lessen their impact on the vulnerable.

However, need is not the same as demand. If one extrapolates from decisions made about low-impact, high-probability events, people should be willing to pay a large premium for disaster insurance. However, even people in rich countries with high levels of financial education consistently underinsure against high-impact, low-probability events (Kunreuther and Michel-Kerjan, 2008). One reason is that personal experience is typically useless for making such decisions; once-in-a-lifetime events typically happen only once in a lifetime.

For microinsurers, faced with low levels of financial literacy, the problem is harder still (Gaurav *et al.*, 2010). Trust is likely to significantly suppress demand, since an insurer alone may find it difficult to convince clients that they will be able to make claim payments in the aftermath of a large disaster. Even in the absence of trust issues, a responsible microinsurer must provide information and training programmes, clearly defined products with simple rules and restrictions, and easily accessible claims documentation requirements, all without overselling the benefits of insurance. Indexed insurance may be particularly difficult to sell, since clients may be rightly worried about incurring large losses but receiving no claim payment owing to an inappropriately designed index.

Microinsurance and Asian megacities

The five largest cities in the world are all situated in Asia (Tokyo, Guangzhou, Seoul, Delhi and Mumbai) and, of the largest 25 cities, 14 are in Asia (Brinkhoff, 2011). These 'megacities' have different exposures to natural disasters (for example, earthquakes, storms, tsunamis) and to the impact of climate change. They will also have different adaptive capacities. What they do share is that the population at risk is huge.

To the extent that climate change increases the frequency or severity of storms, hurricanes and tornadoes which hit urban areas, the Asian megacities, in the absence of sufficient adaptation programmes, will be at increased risk of natural disasters happening. Those megacities that are also coastal will also be at risk from flooding because of increased average sea levels. For example, out of China's estimated urban population of 400 million, an estimated 130 million live in coastal cities that are vulnerable to sea-level rise (Prasad *et al.*, 2009).

Finally, these cities may be affected by climate change-induced migration from rural areas. Although this migration is not an insurable event, the influx of large numbers of migrants could have a serious negative impact on the cities' infrastructures, which may, in turn, increase the incidence of insurable events. For example, if the cities' sewage systems are overwhelmed by the influx of migrants, this could increase the incidence of disease.

Some of these risks, which are made more pronounced as a result of climate change, are potentially insurable using traditional or microinsurance products. However, whoever is providing the insurance would need to ensure that they are not overly exposed to the potentially large numbers of claims from a single event. This can be achieved by limiting the amount of insurance they provide in a single city, by selling insurance across diverse geographical or climatic regions or by accessing, through reinsurance, the greater level of diversification available to international reinsurers. Alternatively, governments or supranational organisations could act effectively as a reinsurer of last resort. But even so, calculating premium rates for products that will cover the impact of climate change-related disasters will be challenging owing to a lack of data and appropriate models. Innovative marketing and distribution methods, as well as premium collection and claim payment systems, would be required to reach the poor, who will often be living in the slum areas of the city. As with crop insurance, indexed products could be designed which would reduce the cost of claim assessment, such as the property indexed insurance product currently being sold in Jakarta, which pays claims when the water level rises above a certain fixed point on the Manggarai Flood Gate in the city.

Options

Parties interested in providing or supporting the provision of insurance for climatic-related disasters would do well to bear the following points in mind.

First, it seems unlikely that any disaster insurance scheme would be successful without significant government involvement. As already mentioned, people seem to consistently underinsure against low-frequency, high-impact events. At one extreme, governments have the power to compel disaster insurance purchase, as is the case for farmers who take out loans for agricultural purposes in India (Mahul *et al.*, 2011). As a softer alternative, governments could 'nudge' individuals towards purchasing disaster insurance by, for example, requiring that standard building insurance policies or standard loans for agricultural investments include insurance cover for disaster, even if opt-out is possible if explicitly chosen by the client. Governments can also nudge through publicly funded promotion of disaster insurance purchase, as Turkey does on a large scale as a complement to its Compulsory Earthquake Insurance Scheme (Gurenko *et al.*, 2006). Such government intervention might be justified on public goods grounds, since basic education about the value of insurance against disasters is likely to be undersupplied by private sector organisations because of concerns about free riding from competitors.

Governments should also have a technical role in approving disaster insurance products based on international best practice, to protect policy holders against inappropriate small print, and could require standard information disclosure. In many developed countries lenders must publicise the annual percentage rate (APR) of their products to allow a simple, if somewhat crude, comparison between products; governments could require insurers to provide objective estimates of the insurance *multiple*, the ratio of the premium to the expected claim payment, and a reasonable measure of the actuarial cost of the product, or the historic claim payments that would have been made from a given indexed product.

Insurance indices are a public good in the economic sense, requiring a coordinated long-term investment. Governments are likely to have an important role to play in the collection and validation of long-term data series to form the basis for trustworthy indices, such as the weather or yield data underlying weather or area yield indices.

Second, thinking more broadly, if insurance cover for climatic-related disasters is to be available at reasonable prices, there may also be a role for an appropriately designed supranational body in offering reinsurance for specific climatic-related perils. As described above, sensible insurance regulation naturally leads to high capital costs, and therefore high premiums, for insurance against catastrophic events with uncertain odds. The way in which the private sector packages this risk, for example through cat bonds or other risk transfer instruments, does not affect this capital cost very much: behind all the financial wizardry regulators require someone to hold substantial assets that could be sold quickly to pay claims as they fall due, and this liquidity is costly. To substantially reduce capital costs for catastrophic risks with uncertain odds, one needs access to liquidity without having to hold large amounts of liquid assets. Creditworthy governments, or groups of governments, could provide liquidity without having to hold large amounts of liquid assets, since they can borrow against future tax revenues, and could therefore offer disaster insurance at a much lower cost than sensibly regulated private insurers or reinsurers.

There are many practical challenges to creating a 'World Re', or expanding the remit of existing supranational institutions to offer reinsurance for specified climatic-related perils, but such a facility may need to be investigated if climate change increases uncertainty for economically important perils. Note that the present suggestion is fundamentally different to a 'Climate Change Insurance Mechanism' as proposed at the 2010 United Nations Climate Change Conference (COP 16) and described in Adamson and Sagar (2002), for which governments would provide reserves, not guarantees.

Third, whilst indexed approaches to disaster insurance offer speedy claim payment and (relatively) low premiums, designers should take the risk of mismatch between losses and claim payments seriously. One option would be to move from weather station measurement-based indices to sample-based indices. For example, for a residential property earthquake insurance policy, all insurers offering cover could inspect just a sample of local residential properties, with sampling and inspections audited by the government, and with claim payments due to all local policy holders based on the average damage from the sample. If the degree of damage is locally correlated, or there is some degree of local risk pooling, this can offer dependable cover without requiring insurers to assess the damage from all insured properties. In the case of agricultural insurance, this approach is termed 'area yield' indexed insurance and has been successfully implemented on a large scale in India, with substantial government involvement (Mahul *et al.*, 2011). Whilst, to the authors' knowledge, it has not yet been attempted for other natural disaster perils, the sample-based index approach could be used for catastrophic hurricane, windstorm or flooding insurance, or for reinsuring local insurers providing indemnity-based cover to individuals.

Finally, insurance for the poor does not necessarily require microinsurance products to be delivered directly to the poor. Regardless of how personal assets are affected, in the aftermath of a large natural disaster individuals are much better off if governments and firms are able to continue to offer services and jobs. For example, immediately following a large natural disaster, tax revenues typically fall significantly and can leave governments unable to pay key public sector employees offering critical services. Reinsurance or a line of contingent credit could protect governments against such a short-term liquidity crunch and provide financing for the rebuilding of public assets, thereby reducing the effect of the disaster on those affected (Clarke and Mahul, 2011). By insuring assets or purchasing business interruption insurance, firms can also offer some degree of protection to employees and customers from the financial repercussions of natural disasters. The poor therefore have much to gain not only from personal microinsurance products but also from improved risk management for developing country governments and firms (Cummins and Mahul, 2009).

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