

# **Earthquake Micro-Insurance**

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## **Background to Paper**

This paper is a shortened version of a paper entitled 'A proposed framework and approach to earthquake micro-insurance' to be presented at the 14<sup>th</sup> World Conference on Earthquake Engineering, Beijing, 13-17 October 2008.

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## Abstract

This paper is essentially an introduction to catastrophe micro-insurance due to the benefits of combining earthquake with other perils at the micro-insurance level. The paper outlines the background to catastrophe micro-insurance. It suggests that at the micro-insurance level a parametric or finite insurance approach is likely to be better than the indemnity insurance approach more commonly used for normal catastrophe insurance. The paper concludes with a discussion on possible catastrophe micro-insurance schemes which could cover earthquakes together with other perils.

**Keywords:** micro-insurance, catastrophe, insurance, reinsurance, disaster, development, earthquake

## 1. Introduction

One of the major contrasts between disasters that occur in well developed countries such as Australia and lesser developed countries such as China is the difference in the ratio of insured losses to total financial loss. If a major earthquake occurred in Australia, about 90 percent of the cost of repairing and reconstructing privately owned residential, commercial and industrial buildings would probably be covered by insurance, and probably about 70 percent of the cost of repairing or replacing damaged contents. After taking into account uninsured government owned buildings and infrastructure this would result in the insurance industry probably paying for over half the total damage losses. By contrast it appears that the insured losses in the recent Sichuan earthquake in China will be only a few percent of the total financial cost of the repair and reconstruction and probably less than one percent in the case of dwellings.

Financial losses paid by insurance have a significant effect on the overall impact of a major disaster for a number of reasons.

- It means funds are quickly available for repair and reconstruction without the delays inherent in government based relief schemes or charitable donations collected after the event.
- It reduces the pressures on governments in the aftermath of disasters allowing them to focus on the recovery of community services, once the initial emergency response period is over.
- In developing countries it reduces their dependence on international aid, especially in the form of loans which will subsequently have to be repaid.
- It reduces the stress on the individual property owners suffering financial loss due to damage.

The reasons for large differences in insurance penetration are primarily a mixture of historical, socio-economic and cultural factors. Insurance is about the protection of wealth, and so it is no coincidence that the highest levels of penetration are associated with high levels of wealth. However it is also largely a product of western civilisation and an associated risk averse individualistic culture. In societies which are more family and community orientated and there is a more fatalistic approach to risk, spending money on insurance does not appear to be so attractive. This situation is compounded in the case of the poor. Even in western society high levels of penetration of catastrophe insurance generally only occur because of historical factors, as is the case for windstorm generally and earthquake in Australia, or because of compulsory measures (Walker, 2000, 2003, 2008). Even in wealthy countries where it is a voluntary addition to fire insurance the penetration is much less (Wharton, 2008). These factors pose major challenges to those who believe that the sustainability of societies, whatever their socio-economic status, is significantly improved by the provision of some form of catastrophe insurance cover (Gurenko, 2004; Clarke & Doherty, 2004; Debrat et al, 2007).

## 2. Problems With Traditional Catastrophe Insurance

A characteristic of traditional catastrophe insurance is that its purpose is to indemnify losses resulting from a catastrophic event, because that is the underlying basis of fire insurance. This has a number of consequences.

- The risk to be insured is fixed by the value of the property at risk.
- For an actuarially sound scheme, which is necessary for the sustainability of an insurance company, this means there is a minimum premium that can be charged.
- To estimate the risk it is necessary to not only assess the hazard risk, but also assess the vulnerability of the property to the hazard, which requires complex modelling.
- Because the loss is indemnified traditional catastrophe risk acts as a disincentive to the policyholders in respect of mitigation of damage (Walker, 1995).
- Because claims are based on financial losses the assessment of claims must be reasonably rigorous to limit moral hazard and can be demanding on available loss adjustment resources leading to delays in payment.

In lesser developed economies, and particularly in relation to the poor, this indemnity approach poses problems.

- Poor building controls often mean that the vulnerability of property to hazards if they occur is high.
- Many of the most populous regions of the developing world are also regions of high hazard risk.
- Actuarially sound premiums based on indemnifying losses are usually not affordable, and even if they are, they must compete with other demands on very limited budgets which often have higher personal priorities than a loss from an extreme event for which there is only a low probability it will occur in a short to medium range time span.
- The cost of developing reliable loss risk models is as great for poorer countries as it is for wealthy countries, even though the sum insured values may be very much less, making it a large overhead cost.
- Because of limited levels of governance moral hazard is perceived as being high in relation to claims handling.

## 3. The Micro-Finance Revolution

While traditional catastrophe insurance appears to work reasonably well for a significant section of the developed world it does not appear to be the solution for the developing world and particularly the large numbers of poor people who dominate this sector. A similar situation occurred in relation to financial services such as those provided by banks. 30 years ago lending to the poor by financial institutions was considered impracticable, leaving them at the mercy of moneylenders with a reputation for keeping the poor very poor!

However during the last 30 years a revolution has occurred in the provision of financial services to the poor with the development of what are now known as the micro-finance institutions, the most well known of which is probably the Grameen Bank in Bangladesh (<[www.grameen-info.org](http://www.grameen-info.org)>), which together with its founder, Professor Yunus, was awarded the Nobel Peace Prize in 2006. The Grameen Bank was founded in 1976 and is based on the provision of micro-credit – small loans to poor people without any collateral requirement. It currently has over 7 ½ million borrowers (of whom 97 percent are women) and since it was founded it has dispersed over USD7 billion in loans with a recovery rate greater than 98 percent.

The concept has spread rapidly through the developing world and in 2006 it was estimated that the total number of borrowers from micro-finance institutions was about half a billion of the potential market of about 3 billion poor people (Helms, 2006). The success of micro-credit has led to the development of a corresponding approach to insurance known as micro-insurance (Roth et al, 2007), with catastrophe micro-insurance being promoted as a potential answer to the provision of catastrophe insurance to the poor (Mechler et al, 2006). A key aspect of catastrophe micro-insurance is the use of a parametric approach rather than indemnity approach.

#### **4. Parametric Catastrophe Insurance**

The primary alternative to indemnity insurance is parametric or finite insurance. Parametric insurance is often used in respect of insurance against weather related events. One common form is in relation to weather cancellation insurance for outdoor events when an organiser, concerned at the loss that might be sustained if rain causes a planned event to be cancelled, takes out insurance for a specified amount of cover which can be claimed if the rainfall exceeds a specified value in a defined preceding time period. The premium is based on the risk of this occurring in the locality of the event at the time of the year it is being held.

There are a number of advantages of this approach.

- The amount of cover is determined by the policyholder in terms of affordability and overall priorities within a limited budget.
- The premium rate is dependent only on the hazard risk expressed as the risk of a specified measurable parameter being exceeded.
- Estimating hazard risk is generally much easier than estimating loss risk.
- As claims are not a function of loss, claim assessment is quick and the scope for moral hazard is greatly reduced.
- Because losses are not indemnified and in general claims will be less than actual losses, there is a greater incentive for mitigation.

There are also some disadvantages.

- It may be difficult to identify a parameter that is correlated closely with the occurrence and severity of loss from catastrophic events.
- Monitoring this parameter often requires a sophisticated system of instrumentation.
- It is inevitable that there will be a difference, known as basis risk, between actual losses sustained and the amount of the claim, which may be positive or negative.
- Basis risk in general is more easily handled corporately than individually and more easily handled by large organisations than small ones.

There appears to be increasing recognition that at least in respect of developing countries the advantages outweigh the disadvantages for catastrophe insurance in general. As Clarke and Doherty (2004) say 'it shifts the focus of the risk management problem from the backward view "How do we pay for what has been lost?" to the forward-looking "How do we ensure appropriate funding for all post-loss projects?" and "How do we ensure budgetary discipline to ensure that post-loss projects maximise welfare?'. The latter is particularly appropriate to catastrophe micro-insurance where the amount of cover to be bought may be more dependent on how much is needed to get one's life re-established and some income coming back in, than the cost of repairing damage to one's home, which might be a secondary consideration.

#### **5. EARTHQUAKE MICRO-INSURANCE**

Is earthquake micro-insurance feasible? The answer has to be yes as there is at least one established catastrophe micro-insurance scheme covering earthquake risk, the Gujarat State Disaster Management Authority (GSDMA) scheme established after the 2001 Gujarat earthquake (Pandya, 2006). It is a system established largely within the insurance framework but with some special characteristics including:

- It only applies to houses rebuilt by the GSDMA after the earthquake and was mandatory.
- The rebuilding was financed by the GSDMA and a premium providing cover for 10 years was deducted from the final payment prior to occupation.
- The insurance cover is jointly provided by the Gujarat government and private insurance companies under a partnership agreement.
- At the village level the houses are insured as a group, not individually, with claims also being submitted and paid on a group basis.
- It is a bundled form of insurance covering most perils including earthquake.

Some characteristics of the scheme could well be features of a more general system – particularly the concept of public-private partnership which is an integral part of the Swiss Re proposed platform (Mitchell & Schnarwiler, 2008), the group insurance at village level which is compatible with the local delivery of most micro-finance (Helms, 2006), and the bundling of hazards which diversifies the risk at local levels, thus reducing the loading on pure risk and making the product more marketable (Mechler et al, 2006). For sustainability it is essential that ultimately any scheme be reinsured as recognised by Vate (2004) who proposed a Planet Re as a global institutional insurance equivalent of the World Bank. Ideally for the reasons already outlined it should also be based on parametric insurance.

A possible approach would be to utilise the existing networks of local community groups which form an essential part of most micro-finance institutions, with separate catastrophe micro-insurance fund managers set up at district, regional or state level whose clients would be the local community groups. The fund managers would be responsible for establishing the parameters to be used, establishing the premium rates to be charged for different perils, collecting premiums, negotiating reinsurance through established insurance and reinsurance companies, and also negotiating any subsidies from governments and NGO's to reduce the premiums to be paid by local community groups.

It would be the responsibility of the local groups to determine how the premiums would be raised from members and claims received from the system used for the benefit of the members of the local group. Unlike health insurance, catastrophe insurance is not perceived as a high priority by the majority of individuals apart from during the immediate aftermath of a major event. It is at the community level and above that it is seen as important. Consequently its success does depend on a degree of compulsion even in developed economies. The most likely approach for a successful outcome is where premiums can be embedded in routine payments for other services, such as repayments of loans through the premium being incorporated in the loan and paid upfront at the beginning of the loan for the period of the loan, similar to the GSDMA scheme.

Reinsurers may still want annual premiums based on annual exposure, but one of the roles of the catastrophe micro-insurance fund managers could be to establish reserves from these payments from which the annual reinsurance premiums are paid. With parametric insurance the liability remains fixed so there is not the uncertainty associated with multi-year indemnity insurance from inflation, although changes in risk due to climate change would need to be accounted for. However with forecast changes in hazard characteristics being now expressed in probabilistic form this is not the handicap it might have been in the past.

The biggest challenge will be that posed by establishing a reliable system for recording parameter values. Earthquake specialists can assist in the identification of an appropriate set of parameters to minimise basis risk, the design of monitoring systems, and the associated event risk modelling.

## 6. References

Clarke, C. & Doherty, N.A. (2004). Development-enhancing risk management. In Gurenko, E.N. (Ed.), *Catastrophe Risk and Reinsurance: A Country Risk Management Perspective*, 135-155, Risk Books, London.

Debrat, J-M, Nabeth, M. and Vate, M. (2007). Micro-insurance insurance, reinsurance: effective tools for development, *Les Notes*, 11, Thomas More Institute <[www.institut-thomas-more.org](http://www.institut-thomas-more.org)>.

Gurenko, E.N. (2004). Building effective catastrophe insurance programmes at the country level: a risk management perspective. In Gurenko, E.N. (Ed.), *Catastrophe Risk and Reinsurance: A Country Risk Management Perspective*, 3-16, Risk Books, London.

Helms, B. (2006). Access to the Poor. World Bank, Washington <[www.worldbank.org](http://www.worldbank.org)>.

Mechler, M., Linnerooth-Bayer, J. and Peppiatt, D. (2006). Disaster Insurance for the Poor: A Review of Micro-insurance for Natural Disaster Risks in Developing Countries, Provention Consortium <[www.proventionconsortium.org](http://www.proventionconsortium.org)>.

Michell, M. and Schnarwiler, R., (2008). Disaster risk financing: reducing the burden on public budgets. *Focus Report*, Swiss Re <[www.swissre.com](http://www.swissre.com)>.

Pandya, M., Mitchell, T. and Shah, A. (2006). Transferring Risk Through Microinsurance, Microcredit and Livelihood Relief: Best Practice Case Studies. All India Disaster Mitigation Institute. <[www.aidmi.org](http://www.aidmi.org)>.

Roth, J., McCord M.J. and Liber, D. (2007). The Landscape of Microinsurance in the World's 100 Poorest Countries. Microinsurance Centre <[www.microinsurancecentre.org](http://www.microinsurancecentre.org)>.

Vate, M. (2004). Reinsuring the planet: towards a pro-poor financial globalisation. *Les Notes* 1, Thomas More Institute <[www.institut-thomas-more.org](http://www.institut-thomas-more.org)>.

Walker, G.R. (1995). Insurance as a Tool for Reducing Natural Hazard Impact. In N.R. Britton, J. Oliver and J. McDonald (Eds), *Insurance Viability and Loss Mitigation: Partners in Risk Resolution*, 211-223, Alexander Howden Reinsurance Brokers (Australia) Ltd, Sydney.

Walker, G.R. (2000). Earthquake engineering and insurance – past, present and future. *Proceedings, 12<sup>th</sup> World Conference on Earthquake Engineering*, New Zealand Society for Earthquake Engineering. <[www.nzsee.org.nz](http://www.nzsee.org.nz)>.

Walker, G.R. (2003). Wind disasters and insurance. *Proceedings, 11<sup>th</sup> International Conference on Wind Engineering*, Texas Tech University, Lubbock. (CD-ROM)

Walker, G.R. (2008). Earthquake insurance: an Australian perspective. *Australian Journal of Structural Engineering*, **8:1**, 39-48.

Wharton. (2008). Managing Large Scale Risks in an Era of Catastrophes: Insuring, Mitigating and Financing Recovery From Large Scale Disasters in the US. Wharton Risk Management and Decision Processes Centre, Pennsylvania University, Philadelphia, <<http://opim.wharton.upenn.edu/risk/>>.