

A PROPOSED FRAMEWORK AND APPROACH TO EARTHQUAKE MICRO-INSURANCE

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ABSTRACT

There are major benefits in bundling earthquake risks with other catastrophe risks at the micro-insurance level. Consequently this paper is essentially an introduction to catastrophe micro-insurance. The paper outlines the background to catastrophe micro-insurance and the different conceptual frameworks within which it can be perceived and developed. 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.

The proportion of total financial losses paid by insurance has a significant effect on the overall impact of a major disaster. Where it is relatively high, it means funds are quickly available for repair and reconstruction without the delays inherent if a government based relief scheme has to be initiated after a disaster or reliance placed on 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, and reduces their dependence on international aid, especially in the form of loans which will subsequently have to be repaid. Also, and perhaps most importantly, it reduces the stress on the individual property owners suffering financial loss due to damage, who can face the future with a considerable degree of certainty about their financial circumstances.

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, 2003a, 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).

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 occurs in relation to financial services such as those provided by banks. 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>), 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, with catastrophe micro-insurance being promoted as a potential answer to the provision of catastrophe insurance to the poor (Mechler et al, 2006). The latter is the focus of this paper.

2. TRADITIONAL CATASTROPHE INSURANCE

The traditional approach to catastrophe insurance has been to see it as a sub-set of property fire insurance within the insurance sector of a framework of financial services as depicted in figure 1.

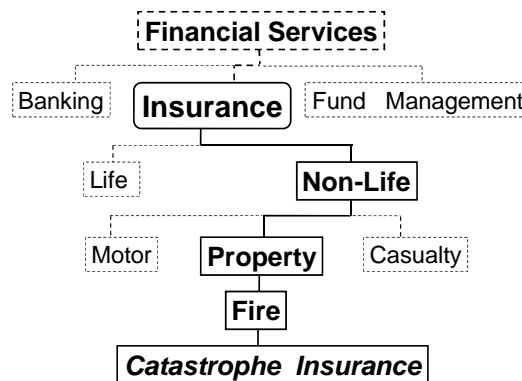


Figure 1 Framework of traditional catastrophe insurance

This occurred as a natural development of property insurance because initially insuring against natural hazards such as severe storms was seen as a natural extension to fire insurance. However, especially after the 1906 San Francisco earthquake, it became evident that while it was a natural fit for marketing purposes, it was not a natural fit from a technical point of view, since it failed one of the basic tests of insurability. Whereas ordinary building fires could be treated as independent events, largely as a result of building requirements relating to fire protection originally enforced by the insurance industry, damage from major natural hazards could not be. When a major catastrophic event occurs there is a high correlation of damage losses within the area affected by the event, leading to the risk of a large accumulation of claims from a single event and negating the basic principle of diversification of risk on which the whole system of property fire insurance is based.

Catastrophe insurance has more similarities with marine insurance in which the equivalent to a catastrophic event is the sinking of a ship causing a large individual loss. Marine insurance developed from the concept of the single event risk being shared by insurers so that no single insurer was at risk from a very large loss, with the diversification occurring by each insurer taking a portion of the risk of many independent marine losses. In respect of catastrophe insurance this is achieved through reinsurance with the risks of major event losses being shared by reinsurance companies, and diversification being achieved by reinsurers taking on as many

independent event risks around the world as they can (Walker 2003b, 2008). To achieve diversification the risks must be of similar magnitude to the reinsurer in terms of the loss at risk. The less the diversification that can be made, the greater the loading on the pure risk that must be charged for the risk transfer to maintain a given level of risk of insolvency. Consequently a major principle of catastrophe insurance is that it is cheaper, and easier, to insure small event risks than large ones. The reinsurance premiums paid for this cover by insurance companies are then passed on the policyholder as part of total property insurance premium.

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 well developed economies in regions where the magnitude of risks from catastrophic hazards are relatively low, where relatively strong controls are exercised by government authorities on building and planning standards thereby ensuring a relatively low vulnerability to damage from major hazards, and where property owners are relatively wealthy and can pay the costs associated with full replacement of the loss as well as the costs associated with complex loss risk assessment and rigorous assessment of claims, this approach to catastrophe insurance has proved relatively successful, especially if this is in association with a degree of compulsion.

In lesser developed economies, and particularly in relation to the poor, the 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.

This suggests that the framework used for traditional catastrophe insurance may not necessarily be the best framework for catastrophe micro-insurance. Three possible frameworks follow.

3. CATASTROPHE MICRO-INSURANCE FRAMEWORKS

3.1 The Insurance Framework

In this framework, depicted in figure 2, micro-insurance is seen as a sub-set of the existing insurance industry. In this framework micro-insurance can be seen as a mirror reflection of ordinary insurance, with each type of insurance having a micro-insurance equivalent with which it will have some affinity, and catastrophe micro-insurance will be seen as a sub-set of property micro-insurance for fire, theft, etc., with an affinity to normal catastrophe insurance.

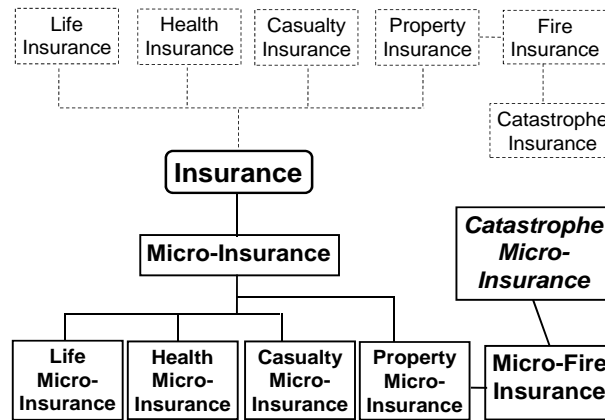


Figure 2 Insurance framework of catastrophe micro-insurance

People whose primary interest is general insurance and reinsurance are likely to perceive catastrophe micro-insurance in this framework. Its strength is that it links into an established industry which understands the basic principles of insurance. A major weakness of this approach is that the same western business conservatism exists within the insurance industry as existed in the banking industry and led to the independent development of micro-finance. The most advanced examples of the application of this framework are probably in India where as a result of legislation Indian insurance companies are required to devote a prescribed proportion of their business to micro-insurance (Ahuja & Guha-Khasnobis, 2005; Pandya et al, 2006).

3.2 The Micro-Finance Framework

People whose primary interest is the whole field of micro-finance and its application to world economic development are likely perceive catastrophe micro-insurance in this framework. In this framework, micro-insurance is seen as a sub-set of micro-finance, and catastrophe micro-insurance is seen as a sub-set of micro-insurance, probably separate from normal property insurance for fire and motor vehicle damage as depicted in figure 3. This is the main framework within which micro-insurance has developed over the past decade, with micro-insurance being offered as an additional service by micro-finance institutions (Roth et al, 2007). To date catastrophe micro-insurance has been a very small proportion of the total number of micro-insurance policies, with life, health and accident micro-insurance dominating, primarily as a form of loan repayment insurance in association with micro-credit

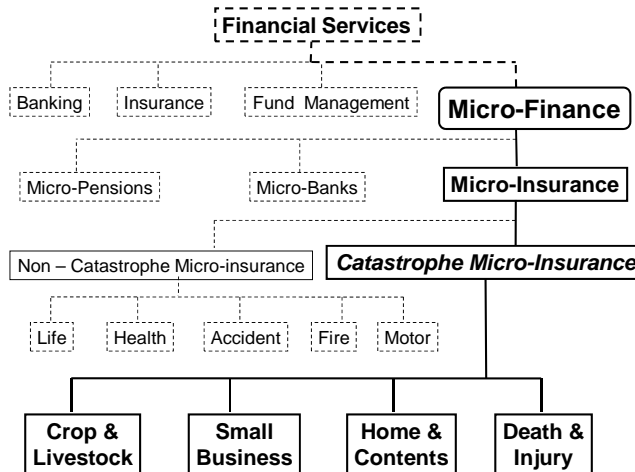


Figure 3 Micro-finance framework of catastrophe micro-insurance

3.3 The Development Enhancing Risk Management Framework

Development enhancing risk management (DERM) is a term coined by Clarke and Doherty (2004). It

describes an approach to disaster risk management in which the recovery phase is focussed not so much on replacing what has been lost as on doing what is best for the future in terms of sustainable development. Although originally proposed in terms of sovereign risk, it is just as applicable at the catastrophe micro-insurance level, where paying off any outstanding loan of property destroyed, and providing funds to get a small home business up and running again or seeds to be purchased for replanting crops may be a much higher priority for those living at the limit of their financial means than repairing or reconstructing damaged property. Figure 4 depicts how catastrophe micro-insurance might fit within a DERM framework.

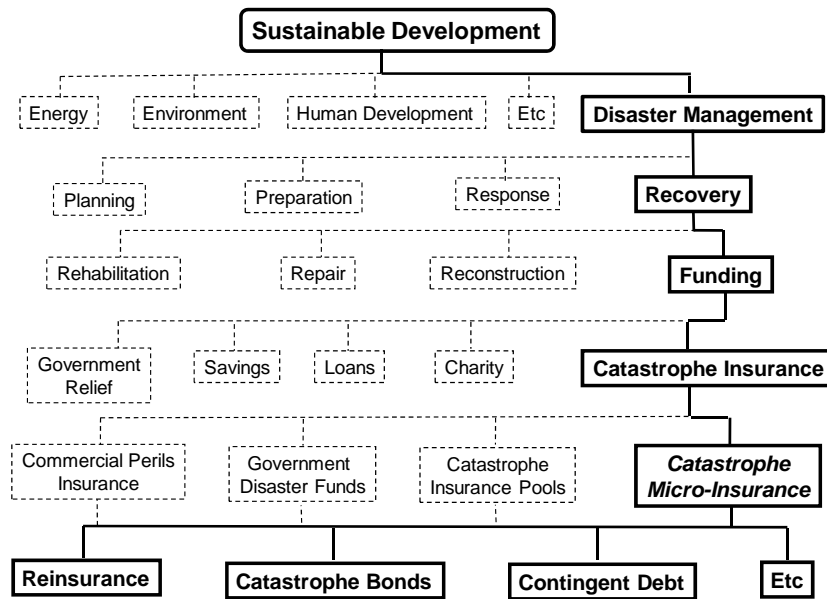


Figure 4 DERM framework of catastrophe micro-insurance

In this framework catastrophe micro-insurance is seen as one component of funding the post-disaster recovery phase along with other forms of catastrophe insurance, government relief, savings, loans and charity. Also in this framework catastrophe micro-insurance is seen as being underpinned separately, but in similar fashion to other forms of catastrophe insurance, by reinsurance, catastrophe bonds, contingent debt and other emerging forms of financing and transferring catastrophe financial risk. People whose primary interest is in disaster management, either as a sub-set of sustainable development or as a separate discipline and the application to it of micro-insurance are likely to perceive catastrophe micro-insurance this framework.

4. PARAMETRIC CATASTROPHE INSURANCE

The primary alternative to indemnity insurance is parametric or finite insurance (also known as index 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. An increasing use for larger scale events is in the form of catastrophe bonds for large magnitude event risks as an alternative to traditional reinsurance, and in weather derivatives to provide insurance against major disruptions to industry or agriculture caused by abnormal weather.

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.

Catastrophe bonds are proving successful as an alternative to reinsurance for large insurance and reinsurance companies in covering very large magnitude event risks which attract a very high loading on reinsurance premiums because of the lack of diversification. There is also increasing interest in its use for providing catastrophe insurance of sovereign funds following its use for the Caribbean Catastrophe Risk Insurance Facility <www.ccrif.org>. However it is also being used successfully in agricultural insurance at the individual level, and Swiss Re have produced an innovative public private partnership platform based on a parametric insurance that is claimed to have potential use for catastrophe micro-insurance (Mitchell & Schnarwiler, 2008).

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 basic principle for any catastrophe insurance scheme, including micro-insurance, is that the premiums should be actuarially sound, which means they should be risk based. This is necessary if there is to be an incentive for mitigation (Walker, 1995; Wharton, 2008) and also necessary for sustainability of the private insurance industry. Cross-subsidisation within insurance or reinsurance companies may be viable for small scale operations but if catastrophe micro-insurance is to make a major contribution to post-disaster recovery in the context of economic development then it is not a commercially viable option. If premiums paid at the local community group level are to be more affordable by being less than the actuarially sound premium it should be a consequence of a public-private-NGO (non-government organisation) partnership with government and NGO contributions being regarded as part of social policy and ultimately funded by taxpayers and donors. NGO contributions might be as premium subsidies. Government and associated institutional contributions might be towards assuming a portion of the risk, and providing infrastructure support in the form of systems of instrumentation for monitoring the critical parameters and appropriate building and planning controls designed to mitigate damage from major hazards.

The scheme of risk financing proposed by (Mitchell & Schnarwiler, 2008) is one alternative, although it may be unduly complex for many situations where the overall event insured loss magnitude is not excessive and normal reinsurance can provide a very efficient and cost-effective solution without the need for more sophisticated approaches such as catastrophe bonds, which seem to have been the model for the proposed system.

An alternative which may be more efficient in some situations might 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.

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