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Insurers' contributions to disaster reduction—a series of case studies

edited by Meghan Orie and Walter R. Stahel

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The Geneva Association

(The International Association for the Study of Insurance Economics

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Insurers' contributions to disaster reduction—a series of case studies

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- David Satterthwaite, Senior Global Micro-Insurance Officer, Private Sector Department, Oxfam
- Andreas Spiegel, Director, Senior Climate Change Advisor, Swiss Re
- Swenja Surminski, Ph.D., Senior Research Fellow, London School of Economics.

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Meghan Orie and Walter R. Stahel
Editors

Foreword

Economic losses caused by natural hazards are continuously on the rise. Climate impact, the continuous degradation of our natural environment, the rapid accumulation of risk due to urbanisation and the speedy build-up of infrastructure as economies grow threaten to make disasters more common through increasing exposure to risk. With this comes corresponding pressure on the insurance industry. The expectation that societies can recuperate from disaster with the help of insurance solutions alone is not realistic.

It is critically important to examine how insurance can become an effective measure for reducing disaster losses along with other financial and socio-economic instruments. Insurance has the potential to become an effective tool to reduce disaster risk if paired with the right incentives. Government regulation is critical. Such regulation can ensure the appropriate pricing of risk, create an enabling environment for longer-term planning that accounts for risk, and encourages insurers to offer insurance programmes for multiple risks.

It is from this perspective that we welcome this new collection of case studies. They are a timely contribution to the debate on the role of insurance in the context of disaster risk management. We are delighted to have been able to collaborate with The Geneva Association on this important subject for the 2013 *Global Assessment Report on Disaster Risk Reduction* and welcome the publication of this set of important new analyses.

Margareta Wahlström
Special Representative
of the Secretary-General
for Disaster Risk Reduction

Andrew Maskrey
Coordinator
Global Assessment Report
on Disaster Risk Reduction
UNISDR

Executive summary

"Building a culture of prevention is not easy. While the costs of prevention have to be paid in the present, its benefits lie in a distant future. Moreover, the benefits are not tangible; they are the disasters that did NOT happen"

Kofi Annan (1999)

Geneva Report No. 7 presents case studies on four topics: floods, earthquakes, resilient communities and liability litigation as a tool for disaster remediation. The idea for the report emerged in a meeting on 26 October 2011 between Patrick M. Liedtke and Walter R. Stahel of The Geneva Association, and Margareta Wahlström, Andrew Maskrey and Bina Desai of the United Nations Office for Disaster Risk Reduction (UNISDR).

Its aim is to highlight the interconnections and forms of cooperation that exist between the different stakeholders—individuals, businesses, government authorities, judiciary systems, risk experts, engineers and the insurance industry—involved in mitigating the effects of catastrophic events.

The case studies examine specific aspects of natural catastrophes to provide the basis for much-needed discussions on defining innovative roles for the stakeholders involved. They also show how these different stakeholders can collectively explore new forms of private–public cooperation to make communities more resilient to catastrophic events.

Risk exposures are multiplying

Rapid population growth has taken place over the last 100 years and urban areas have expanded massively, concentrating economic activity. The value of property and infrastructure in high risk areas has also increased accordingly. Disaster risk management has not always kept pace and much development has taken place on natural flood plains, for example. Climate change will lead to more frequent and more extreme weather events. Floods in urban centres in Japan and Thailand are examples of so-called out of phase exposure growth. Case study 1 shows the risks of building in previously undeveloped locations.

Risk pooling by insurers is essential

It is more important than ever to encourage risk pooling solutions and at the same time encourage strong action to reduce risks in advance. Insurers protect the unfortunate few

by sharing out contributions from the lucky many. Insurance enables us to protect those less fortunate and ourselves at the same time. Insurers themselves spread risk around the world via the global reinsurance industry. In 2011 they comfortably met the insured costs of catastrophes in Thailand, Japan, Australia, New Zealand and the U.S. that totalled more than US$108bn.

Government pools can help but they must not undermine insurance

The private insurance market, backed by the global reinsurance industry, takes on trillions of dollars of insurance risk annually. But government pools can distort well-functioning markets by undercutting them. Insurers hold capital to ensure they can meet all their claims with high probability. Actuarial prices have to allow for expected claims, expenses and provide an investment return—even in a low yield environment. Government pools whose price only covers claims and expenses undermine private markets that cannot compete with tax payer backstops. Case study 2, an examination of the National Flood Insurance Program in the U.S., illustrates the potential shortcomings of a public programme.

Governments and insurers can promote risk awareness together

Cost is a strong signal in all parts of the economy. The true costs of living in a risky area help society prioritise where it decides to grow; governments can help promote risk awareness. Insurance also sends a signal because prices must provide a return on risk taken (pension funds are big investors in the insurance industry). This is why risk-based pricing is essential. Governments can provide incentives for stakeholders to mitigate risk, while insurers can recognise actions that are shown to reduce risk by lowering premiums. Case study 4 looks at the Room For The River programme in the Netherlands and suggests ways insurers can contribute to risk mitigation strategies.

Public-private risk transfer programmes require careful design

Public-private cooperation can work in terms of risk transfer as the successful Japanese Earthquake Insurance System shows (Case study 5). Instead of indemnity type coverage, the system provides post-disaster financial relief. The California Earthquake Authority (Case study 6) a publicly administered but privately funded insurance scheme, has insufficient take-up. By contrast, the public-private Norwegian Natural Peril Pool (Case study 7), which is mandatory, effectively spreads risk and keeps premium prices down.

Public-private cooperation helps to build resilient infrastructure

Rebuilding resilient infrastructure is expensive and insurance policies that provide for it could meet resistance from cost-conscious consumers and businesses. But strong building codes and regulation that require insurers to rebuild to high standards will level the playing field and costs will be mutualised across society. Everyone, even in emerging economies, can contribute a little towards building a stronger, more resilient community. In Ethiopa, for example, poor farmers can pay for insurance by working on local climate adaptation measures (Case study 8).

We can learn from disasters

After a catastrophe we can decide whether we want to rebuild, or we can make some space for disaster and relocate to safer locations. When we rebuild, we can do so in a risk

resilient, energy-efficient way. Strong local government policy on land use and building codes, coupled with disaster recovery plans, will allow communities to rebuild quickly and sensibly. But people will need encouragement to adapt; policymakers and industry can work together on a shared vision for sustainable development. In China, insurance is helping inform the government's adaptation strategy (Case study 9).

Governments should make risk data freely available

Risk models are key to understanding the exposure of economic centres to catastrophic loss. They highlight areas for risk reduction and risk mitigation ahead of the event. Governments can contribute to model development by making data freely available to risk professionals. Governments can stimulate the publically funded academic sector to continually improve risk and engineering models and then publish their work in open access journals for everyone's benefit.

Pre-funded aid is usually more effective than litigation

Case studies show that litigation is always a slower route to remediation than pre-funded disaster aid (insurance). Policymakers should work with the insurance industry to encourage risk reduction and pooling, with contract certainty, rather than relying heavily on the protracted and uncertain outcome of litigation for post-event financing. Insurance can strengthen the resilience of developing countries to extreme events through innovative product design better than litigation can. Case studies 10 and 11 contrast the different outcomes of mass litigation after the Bhopal disaster in India and after pollution of the Amazon in Ecuador.

Key findings

Governments can both promote and hinder the contributions of the insurance industry in their public policy and regulatory regimes. At best, such cooperation can speed up reconstruction after a natural catastrophe without placing a strain on state finances; at worst, it can lead to a failure of insurance market solutions. But if losses resulting from natural catastrophes are uninsured, governments have to act as insurers of last resort. As no premiums have been paid, the cost is ultimately borne by the taxpayer.

Government incentives for stakeholders to engage in risk reduction behaviour can both enhance and distort the results, causing unnecessarily repetitive property losses, for example. Given the increasing frequency and severity of catastrophic weather events globally, the manner in which risk mitigation and transfer measures are implemented is all the more important.

The strategies of the nine governments studied in this report (the U.S., Thailand, The Netherlands, Japan, Norway, Ethiopia, China, India and Ecuador) demonstrate—through obstacles encountered and successes achieved—that well-coordinated public-private initiatives are an effective way to manage disasters and promote societal resilience.

Finding 1: Risk-based, actuarially sound pricing is an essential mechanism for insurance to mitigate risk.

When insurers communicate risk levels to their policyholders, they can encourage them to engage in low-risk behaviour. A good example is the California Earthquake Authority (Case study 6), a public–private cooperation that lowers risk-based premiums when property owners take measures to mitigate risk.

When this mechanism fails, as in the U.S. National Flood Insurance Program (Case study 2), losses are repetitive and taxpayers foot the bill. The programme has since had to raise its premiums better to reflect the risks. But high-frequency, high-loss events such as annual floods may prove uninsurable.

Insurers are therefore pushing for jurisdictions to adopt stricter building codes and more sensible land use policies, using price as a persuasive instrument to promote stronger buildings on safer sites.

Finding 2: Public policy issues can facilitate insurance's effectiveness or distort the incentives it provides.

Insurers can contribute most effectively to disaster risk reduction when policymakers allow both the use of risk-based pricing and the implementation of early warning systems, and when jurisdictions adopt stricter building codes (earthquakes and floods) and sensible land use policies (floods). For instance, public policy can require property owners to mitigate wildfire risks by limiting the amount of on-site fuel accumulation, changing roofing materials, clearing brush around the buildings and even by avoiding the use of oil-based plants in the landscaping.

Case study 1 tracks the development of flood disaster mitigation and risk transfer in Southeast Asia, The Netherlands and Japan. It finds that countries and insurers could suffer major losses where disaster mitigation fails to keep pace with development; Case study 9 examines how China's public policy on growth is creating new exposure to risk.

Risk-mitigating policies encourage insurers to offer more affordable cover reflecting reduced risks—of location and facilities, for instance—and help to make compensation more readily available for losses suffered.

Finding 3: Knowledge-building about insurance is essential.

Disaster risk reduction and post-catastrophe reconstruction are helped by public recognition of the value of insuring private assets and by governments allowing insurance business models to function. One of the most prevalent obstacles is the misunderstanding of insurance business models and their unique capacity for mitigating losses from natural catastrophes and other extreme events; unfamiliarity with the insurance industry resources needed rapidly to compensate victims also plays a part.

Both the California Earthquake Authority (Case study 6) and Japanese Earthquake Insurance System (Case study 5) are publicly initiated, privately run cooperations that have suffered from a lack of uptake due to popular misconceptions about the function of insurance. However, the System's response to the magnitude 9.3 Tohoku earthquake of 2011 gave Japanese society a sharp reminder of insurance's important role post-catastrophe.

The Norwegian Natural Peril Pool (Case study 7), a publicly mandated, private insurance pool, encourages citizens to pursue further private options by refusing to compensate damage that can otherwise be covered by private insurance.

Building knowledge is a precondition for better public–private cooperation.

Finding 4: Insurance has relevant expertise in risk reduction and claims compensation so that liquidity is effectively injected into catastrophe-affected economies.

The financial reserves and effective management practices of the insurance industry enable it to deliver fast post-catastrophe compensation, providing much needed injections of liquidity that contribute to economic recovery locally and nationally, as exemplified in the Tohoku earthquake and tsunami (Case study 5). The efficacy of post-catastrophe measures is most notable when absent. The Netherlands (Case study 4) has excellent risk reduction programmes, but its lack of flood insurance means that ex-post catastrophe remediation is inconsistent and thereby runs the risk of being determined by politics.

The insurance industry has a deep fund of knowledge in risk engineering, risk transfer and the capacity to develop innovative products that encourage better loss prevention. Such innovation is shown in the R4 Rural Resilience Initiative (Case study 8), a groundbreaking arrangement that allows poor farmers and rural households to pay for crop insurance with their work on disaster reduction projects.

Finding 5: The role of capital markets and packaging risk in such a way as to attract financial players is key.

Besides straightforward insurance and reinsurance, insurers have a number of other options to cover risks. Alternative risk transfer (ART) can offer innovative solutions such as insurance-linked securities by tapping into the much larger financial capacities of the capital markets. Private finance initiative (PFI) capital market investors bring insurance into their business plans to safeguard their capital and guarantee rapid rebuilding to restore their income base after a disaster. Insurers can take on similar roles.

A major European insurer launched a pioneering infrastructure debt fund in the U.K. in 2012 to help build schools, hospitals and roads. Infrastructure debt is ideal for many investors such as pension funds and insurance companies that need long-term assets to match long-term liabilities.

But an underestimated accumulation of risk can jeopardise the function of insurance, when inherent risks to global supply chains and potentially unlimited business interruption claims can discourage investment by capital markets (Case study 3).

Finding 6: Post-disaster liability litigation can be either an effective means of compensation for victims or a formidable obstacle to victim recovery.

Third-party liability litigation is deeply entrenched in civil law societies and gains favour in common law jurisdictions when governments are increasingly unable to fund compensation schemes for mass loss events. In recent years, there have been many new initiatives seeking to expand the boundaries of legal liability so that third–party claims can be widely asserted to seek compensation as a consequence of extreme events affecting large numbers of people. But this is combining bad policy with poor economics.

Public-private cooperation can help to resolve post-disaster conflicts. Cooperation between Union Carbide and the Indian government (Case study 10) allowed the victims of the Bhopal chemical explosion in 1984 successfully to seek remediation. However, corruption and lack of integrity can multiply the difficulties, "punishing" the victims a second time, as illustrated by the 2001 Ecuador rainforest oil exploration claim (Case study 11), in which a class action lawsuit benefitted third-party investors rather than the Ecuadorian plaintiffs.

Recommendations

Because they are still relevant, we would like to repeat the recommendations of the 2010 *Global insurance industry statement on Adapting to climate change in developing countries*, issued by ClimateWise, The Geneva Association, the Munich Climate Insurance Initiative (MCII) and the United Nations Environment Programme Finance Initiative (UNEP FI):

We call on governments to:

a. Engage in risk reduction activities by taking action on the already agreed Hyogo Framework for Action 2005-2015 for disaster risk reduction. These include appointing national risk officers with the mandate to develop a holistic risk management culture, facilitating loss reduction activities at community, regional and state levels, climate-proofing existing infrastructure investments, putting in place appropriate zoning and building codes and enforcing these—all of which will contribute tangibly to the management of potential risks and losses;

b. Provide a suitable environment to enable risk management, including insurance, through good corporate governance frameworks and whatever systems are necessary for financial market services to function at all levels of society and across appropriate time horizons;

c. Invest in systematic and reliable risk exposure data, both historic and forward-looking, which is made freely available to the public, with multiple adaptation applications;

d. Act on lessons learned about the role of government in convening and seeding regional public-private cooperation such as the Caribbean Catastrophe Risk Insurance Facility and micro-insurance systems which address risk reduction for weather-related events.

Market mechanisms are already operating to create and grow insurance practices in developing countries. However, without suitable economic and regulatory frameworks, insurance risk management mechanisms are falling considerably short of their potential to deliver adaptation benefits. By working together with insurers, governments have the means and capability to leverage this potential, to increase protection of individuals and the economy, to reduce weather impacts and to foster growth through the implementation of insurance risk management systems.

The editors of this report would like to add some further recommendations:

- Given that effective injection of post-catastrophe liquidity by insurers speeds up private reconstruction, we suggest governments consider privately insuring public infrastructure for similar results;
- Governments should employ insurance industry expertise to engage in disaster reduction measures: risk perception, risk education, loss prevention and post-disaster loss management;
- Insurance is making great advances in global catastrophe risk modelling, which could be an effective way to increase local resilience. The international community should continue to support the advancement of scientific modelling;
- We recommend that risk transfer be an objective in the new 2015 Sendai Framework and in the upcoming redefinition of the Millennium Development Goals. Risk transfer is an effective measure of disaster risk reduction and it facilitates disaster risk reduction planning. But truly independent, international standards of modelling are essential.

The insurance industry's contribution to disaster risk reduction is manifold and can be increasingly used by governments to augment societal resilience to natural catastrophes and other extreme events.

Case studies
Topic I: Floods

Introduction

Over the past 20 years, the frequency of floods has radically increased from roughly 10 in 1950 to around 200–250 in 2010, making the overflow of a large amount of water onto normally dry land the most frequently occurring natural disaster (Jha, Bloch and Lamond, 2012). Consequently, the number of people affected and the amount of economic and financial loss has increased. Worldwide, 178 million people were affected in 2010 with an estimated economic loss of US$40bn in the peak years of 1998 and 2010 (Jha, Bloch and Lamond, 2012). Given their increasing impacts and frequency, floods merit a more in-depth investigation into how to better prevent losses and protect those affected by them.

Since floods are high-impact events, it is difficult for insurers to predict how much capital should be reserved in order to pay out annual losses from floods. However, floods repeatedly occur in the same place. Targeting these locations with effective risk management and risk reduction activities can reduce the frequency of flooding events and their economic impact.

Implementing risk management practices can be challenging. It involves the coordination and cooperation of multiple actors transnationally, nationally, regionally and locally before, during and after times of crisis. Given the complexity of coordination and the substantial risk posed by floods, the following cases present various flood risk public–private cooperation initiatives and their associated challenges, strategies and successes. In the first case study, Robert Muir-Wood presents the history of flood risk management, identifying at which point various countries began investing in flood risk management measures. He warns of the dangers of providing insurance in places where comprehensive flood risk mitigation measures have not been implemented. The second case addresses the U.S. government's direct provision of flood insurance and certain solvency issues associated with non-risk-based pricing in high-risk areas. The third case elaborates on the 2011 Thai floods' disruption of supply chains and the consequences of increased risk exposure. The fourth case study explores risk governance strategies in The Netherlands, where a possible public–private partnership was discussed but ultimately failed to take hold, with the result that flood insurance is unavailable.

These cases are only a few of the multitude of flood risk management strategies. Other similar cases of interest include:

- the Pacific Adaptation to Climate Change project, an important component of the Federated State of Micronesia's Strategic Development Plan that requires all

infrastructure to be climate-proofed. More information at *http://www.sprep.org/pacc-home*

- the Crop-Credit Insurance Guarantee Program for Small and Marginal Farmers (SEAF) in Brazil, for which farmers must apply risk reduction methods and technology in order for the risk transfer to be valid. A similar approach is taken by the agricultural insurance scheme in Sudan. More information at *http://eprints.lse.ac.uk/46401/1/Building%20effective%20and%20sustainable%20risk%20transfer%20initiative%20in%20low-and%20middle-income%20economies.pdf*
- the Flood Index (ENSO) insurance in Peru providing business interruption insurance and also educating farmers on risk reduction efforts, such as clearing drainage systems. More information at *http://www.agriskmanagementforum.org/doc/enso-business-interruption-index-insurance-catastrophic-flooding-piura-peru*
- Flooding in 2008 in Lomé, Togo was exacerbated by illegal sand mining, which is simultaneously causing migration that leads to densely populated zones and causes land subsidence. The floods destroyed technical systems essential to Lomé's communications hub, further affecting neighbouring countries, particularly those that are landlocked, like Burkina Faso. More information at *http://issuu.com/world.bank.publications/docs/9780821388662*
- the Save the Marikina Project launched in 1993 to reclaim the Pasig River in the Philippines, one of the country's main waterways that had been subject to encroachment and waste disposal. This project aims to rehabilitate the river and surrounding areas into recreational zones. More information at *http://www.marikina.gov.ph/*
- the City of New York's Plant a Million Trees programme, a public–private partnership launched in 2009 to plant a million trees and ensure that land and forests upstate are protected from development to preserve the city's reservoirs and water supply. More information at *http://www.lloyds.com/~/media/Lloyds/Reports/Emerging%20Risk%20Reports/Natural%20Catastrophes%20in%20the%20US.pdf*

Reference

Jha, A., Bloch, R. and Lamond, J. (2012) *Cities and Flooding: A Guide to Integrated Urban Flood Risk Management for the 21st Century*, Washington: The World Bank.

Case study 1

Tracking flood risk mitigation implementation:

The out-of-phase pattern of rapid economic development in floodplains and the growth of the flood risk management culture

Robert Muir-Wood

Summary

Older towns and villages were originally sited on higher ground to avoid all but the rarest floods. But when countries embark on a phase of rapid economic development, they typically build in floodplains. Landowners and developers discover that the price of agricultural land can be rapidly inflated when there is permission to build. Inevitably, floods return and often prove sufficiently catastrophic that the level of risk is considered unsustainable. This leads to a shift in public investment into flood mitigation measures. These out-of-phase patterns of private "rapid exposure development", followed by publically funded "improved flood risk management" can be traced through the history of a number of countries. In most cases it is possible to identify a "pivotal point" date, generally linked to the occurrence of one or more catastrophic floods, when investment priorities shifted. Over the past 50 years, public and private insurance schemes have been established in developed countries to provide financial protection for residual flood risks once other mitigation measures have been put in place. However, in Thailand flood insurance was provided to industrial and commercial properties before the emergence of a proper flood risk management culture. This meant that global insurers and reinsurers suffered big losses in Autumn 2011 when industrial parks in central Thailand were flooded.

Case description

One can find a characteristic pattern in the evolution of flood risk exposure and flood risk management for many countries that have been through a phase of rapid economic development. Based on the experience and memory of previous flooding events, older towns and cities are generally sited so as to avoid locations expected to be flooded. (For regions subject to conflict, the risk of flooding may have been managed alongside other risks associated with the prospect of the town or city coming under armed attack.) Where a town's economic function is principally related to a river crossing or port, then the growth of the city will have had to accommodate the potential for flooding.

In a period of rapid economic development, private investors tend to build in flat floodplains both because such land has not been previously developed and will be relatively cheap to acquire, but increasingly because modern, industrial, commercial and retail facilities require level floors for production lines, distribution systems and access ways. Even the concept of "flood risk" is very different for land used for agriculture, where floods at certain times of year may be welcomed because of their role in sustaining

crop productivity. While the expansion of exposure in floodplains inevitably raises the level of flood risk in a territory, it is only once actual flood events have occurred that this risk becomes recognised. If these floods are sufficiently catastrophic in disrupting livelihoods and the economy, arguments will be made to divert resources into significant public investments in flood risk mitigation.

One of the earliest examples of this out-of-phase pattern of development in floodplains, followed by the emergence of a flood risk management culture, comes from The Netherlands.

Analysis

1. The Netherlands

Before 1000 AD, in the low-lying coastal floodplain of the southern North Sea and around the Rhine delta, the inhabitants lived on dwelling mounds, piled up to lie above the height of extreme tides. By the 10th century, with a population of what is now The Netherlands estimated as 300,000 people, the first dykes were constructed, and within 400 years they protected all significant areas of land from spring tides, allowing animals to graze and people to live in the protected wetlands. The expansion of habitable land encouraged a significant increase in the population exposed to catastrophic floods (Borger and Ligtendag, 1998). The weak sea dykes broke in a series of major storm surge floods through the stormy 13th and 14th centuries (in particular in 1212, 1219, 1287 and 1362), flooding enormous areas (often permanently) and causing more than 200,000 fatalities, reflecting an estimated lifetime mortality rate from flooding for those living in the region in excess of 5 per cent (assuming a 30 year average lifespan; Gottschalk, 1971, 1975, 1977).

To adapt to this increased flood risk, major improvements in the technology of dyke construction and drainage engineering began in the 15th century. As the country became richer and the population increased (to an estimated 950,000 by 1500 and 1.9 million by 1700), it became an imperative not only to provide better levels of protection but also to reclaim land from the sea and from the encroaching lakes, and to expand food production (Hoeksma, 2006). Examples of the technological innovations included the development of windmills for pumping and methods to lift water at least 4m either by running windmills in series or through the use of the wind-powered Archimedes screw.

Equally important was the availability of capital to be invested in joint stock companies for the sole purpose of land reclamation. In 1607, a company was formed to reclaim the 72km^2 Beemster Lake north of Amsterdam (12 times larger than any previous reclamation). A 50km canal and dyke ring were excavated, a total of 50 windmills installed, which after five years pumped the Beemster polder dry, 3–4m below surrounding countryside; and which, within 30 years this land was settled by 200 farmhouses and 2,000 people.

Since the major investment in raising and strengthening flood defences in the 17th century, there was only one major flood in 1717 (when 14,000 people drowned) since which time the total flood mortality has been around 1,000 per century (with two notable floods in 1825 and 1953), equivalent to a lifetime flood mortality rate (assuming a 50-year average lifetime) of around 0.01 per cent: 500 times lower than that of the Middle Ages (Van Baars and Van Kempen, 2009). This change reflects increased protection rather than any

reduction in storminess. Since 1953, the flood risk has been further reduced, by at least another one or two orders of magnitude.

The date of the "pivotal point", from when the overall level of flood risk began to fall (based on metrics such as the average annualised number of people drowned, houses flooded or land lost) as a result of the investment in a strong flood risk management culture, is probably around 1500. Through the late medieval period, risk was rising because of an increase in the population and the number of buildings in the coastal floodplains, as well as rising levels of hazard from long-term delta subsidence (and potentially also an increase in the number or strength of extreme storm surges at this period). This transition period was then followed by several centuries during which there was a long-term reduction in the level of risk, achieved due to building stronger dykes to protect the floodplains.

As the land of The Netherlands has continued to subside, and as flood defences suffer depredations due to lack of ongoing maintenance, inevitably there have been periods of history when risk has been rising (as through the 1940s) before a renewed round of investment, in particular in the aftermath of a catastrophic flood (as in 1953). After 1953, with a principal focus on reducing the risk of marine storm surges, river flood risk was neglected until a scare in 1995 refocused attention and investment. Risk levels are currently considered to be increasing again through sea level rise and land subsidence (Bouwer and Vellinga, 2007).

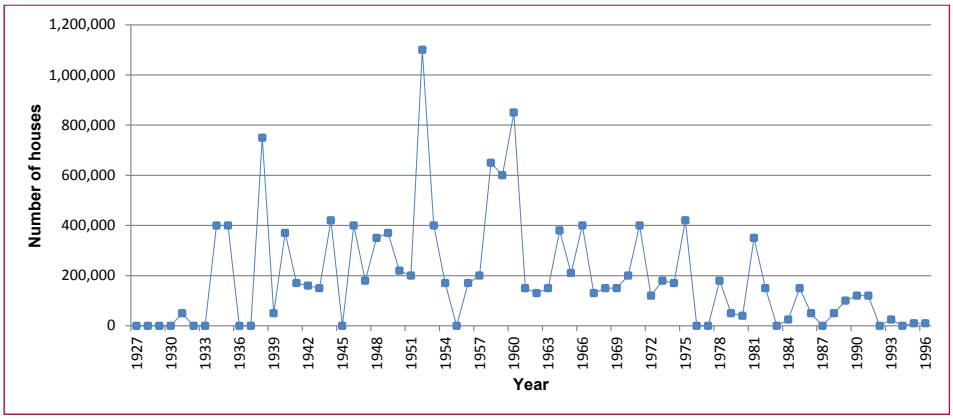
The risk management culture in The Netherlands pre-dates even the late 17th century concept of property insurance (and in particular, the post-1960 development of property insurance for floods). Reflecting this heritage, one cannot today purchase flood insurance in The Netherlands. This is based on the argument that the availability of insurance might take the pressure off the government to invest in engineering solutions to sustain the level of flood risk below official national targets. (The absence of flood insurance also serves to create the impression that there is no flood risk.) However, as recently as 1995, the potential for floods caused by the failure of river dykes required whole towns to be evacuated for fear of the consequences of defence breaches.

2. Japan

A comparable pattern of out-of-phase exposure growth in floodplains, followed by the development of a mature flood risk management culture, can also be found in Japan.

Away from the coastal plains, the landscape of Japan is mountainous, but almost entirely undeveloped, so that towns and cities cluster around the edge of the surrounding lowlands. Through the middle of the 20th century, Japan underwent rapid economic growth and industrialisation. The expansion of cities and the development of industrial parks inevitably meant more exposure accumulated in both coastal and fluvial floodplains. Today 49 per cent of the population and 75 per cent of the total property are located on former river and coastal floodplains that together cover about 14 per cent of the land area (Sato, 2006). Some of the highest rates of economic growth were experienced through the late 1940s and 1950s and during this period there was a dramatic increase in the exposure at risk from flooding. The annual number of flooded properties in Japan was around 200,000 properties flooded each year through the late 1930s, rising to an average of around 300,000 properties flooded each year in the 1950s. More than one million properties were flooded in the worst single year in 1953.

Fig 1: Annual number of buildings flooded by typhoons in Japan: 1927–1996



In 1959, the Isewan storm surge flood overwhelmed the coastal defences and inundated large areas around the city of Nagoya. More than 5,000 people drowned. This event shocked attitudes in Japan and government policy on flood risk management. In the 1960 "Disaster Measures Basic Law" a considerable diversion of national resources was identified to support risk reduction. In 1961, around 8 per cent of the national budget (about 1.5 per cent of GDP) was allocated to disaster risk reduction activities. This proportion declined slowly over time, even as the monetary amounts continued to rise. Disaster management activities still consumed about 4.5 per cent of the national budget (and 0.5 per cent of GDP) by the late 1980s, by which time this represented an annual budget of around JPY4tn (circa US$40bn).

Among a range of outcomes across a range of perils, this investment had a significant impact on reducing national flood risk. The concentration of most of the exposure at risk of flooding in large towns and cities meant that it was possible to achieve significant reductions in flood risk through building-engineered flood defences. By the late 1980s, the annual number of properties flooded in Japan had fallen to around 30,000: a reduction by a factor of around 10 relative to the number of annual flooded properties in the 1950s.

Insurance against typhoon was first introduced in Japan in 1984, after the flood risk from typhoon had been largely brought under control. The homeowners' policies for typhoon were designed to refund a component of the associated flood losses (in a series of steps, which ultimately cover about two thirds of the damage cost of a flood). Private insurance was therefore an important component of the overall publically-funded flood risk management culture. While hard flood reduction measures (as with flood defences or flood alleviation schemes) could significantly reduce the level of flood loss, they could not completely eliminate it.

3. Developing economies in Southeast Asia

Since the early 1990s, a number of countries in Southeast Asia, including Malaysia, Thailand, Indonesia, The Philippines and Vietnam have experienced rapid economic growth. This growth has been manifest in the rapid expansion of urban footprints, and in the development of large industrial parks. Deforestation and urbanisation have further increased the rate of run-off increasing the local hazard from flooding. Major floods have

resulted, as for example in Jakarta in 1996, 2002 and—the worst of the past century—in February 2007; in Manila in September 2009, 2011 and 2012 and, most notoriously for insurers, in central Thailand in autumn 2011.

Industrial parks in Thailand are developed and managed by the Industrial Estate Authority of Thailand founded in 1972, answering to the Ministry of Industry. As of October 2010, the Industrial Estate Authority had established 42 industrial estates in 15 provinces. Those in the central region of the country north of Bangkok were founded from the late 1980s through to 2003. The parks themselves were established by the private sector and are 60–70 per cent allocated to factories. The Industrial Estate Authority set out to provide all the necessary infrastructure for these facilities, which were claimed to include "flood protection" but without any specification about the return period to which protection was provided.

In the headlong rush for development, investments are focused where they can bring the fastest return, as in developing infrastructure to support new industries and in building industrial plants. Developers in these areas are generally unaware of the risks, or may believe that the government has taken care of the problem. Investments in flood risk management, such as building higher flood defences, do not appear to have any immediate return. However all this can change in the aftermath of a catastrophic flood, when demonstrable investments in flood prevention may be necessary to convince major corporations to sustain their investment in the region.

In the last two decades, rapid expansion of industrial facilities, shopping malls, etc. into floodplains has also been very prevalent in many developed countries. However, in developed countries there are pre-existing institutions focused around the mapping and mitigation of flood risk, and as a result many floodplain developments will already have gained flood protection. Risk modelling for flood insurance is also becoming well established so that the insurer should have a good understanding of the potential for flood losses.

Following the prolonged flooding of autumn 2011, the Thai government announced significant investment in flood defences to protect the central Thailand industrial parks. Developing all these defences to a sufficient standard is likely to take several years, and significant challenges will remain around operating these facilities in future floods. During a month or longer period of high river levels, even if the facilities themselves can be kept flood-free, it will be a significant challenge to sustain sewage disposal, access for workers, as well as deliveries and pick-ups of manufactured goods.

The government in Indonesia has also identified US$250m in 2011 for the Ministry of Public Works to dredge over the next four years three key rivers running through the capital Jakarta. While it is not clear that this represents a dramatic shift in the level of flood risk management, it is clearly a step in the right direction.

Lessons learned

The novel feature of the 2011 situation in Thailand is that a significant proportion of the industrial estate exposure was insured. Typically, flood insurance is only introduced in a country with an advanced flood risk management culture. The situation in Thailand was a direct consequence of globalisation, in that, while the owners of these manufacturing facilities were based in developed countries (principally Japan) with a strong flood risk management culture, they had exported their operations to low-wage developing countries

with a poor flood risk management culture. Globally, insurance is expanding faster than strong flood risk management. Corporate policies are offering protection for facilities in countries without any appreciation of the underlying risks. This has itself been driven by a belief among international re/insurers that diversification is a virtue in spreading risk, irrespective of whether the actual level of risk is known or modelled.

After the proposed future investment in improved flood defences in Thailand, the level of residual flood risk in the industrial parks in the centre of the country should be insurable. However there will still remain a great concentration of manufacturing facilities within each industrial park as well as multiple industrial parks located in a single river floodplain. The industrial development policies that encouraged the development of these industry clusters are antithetical to the underlying principles of diversification that define insurance.

The role of flood catastrophe loss modelling in this situation should be to identify the locations at greatest risk as well as highlight concentrations of flood exposure before the occurrence of a catastrophic flood.

Conclusion

Economic development typically leads to new building becoming concentrated in previously undeveloped locations in floodplains, expanding flood risk exposure. This phase of development typically lasts until one or more catastrophic floods occur. To prevent people abandoning the new settlements or industries, a corresponding phase of investment in flood risk reduction takes place.

When considering the level of flood risk in different countries it is therefore useful to understand what point the country or region has reached on this out-of-phase path of development and flood risk management.

The Netherlands has been involved in active flood risk management since around 1500. In the U.S., a significant phase of investment in flood risk reduction followed catastrophic floods in the 1920s and 1930s. In Japan, major investments in flood risk management began around 1960. The pivotal point in China was passed around the year 2000, with increased investment in flood risk reduction taking place. In many developing countries, the start point of major investment in flood risk reduction lies somewhere in the future.

A consequence of the behaviour discussed in this paper is that trends in international economic or insured flood losses cannot readily be used as potential indicators of increased flooding related to climate change. Countries embarking on rapid development tend to locate much new exposure in floodplains, and so an increase in flood losses could be a signal of rapid economic development. In the second phase of major investment in improved flood risk management, flood losses will become reduced through better defences and flood control, as has been the case in Japan (where the average number of properties flooded reduced by a factor of 10 from 1960 to 1990). Strong signals related to expanded risk exposure and improved flood risk management are likely to dominate all other flood signals related to climate change, especially where such trends cannot be detected independently from observations of extreme river flows.

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Case study 2

U.S. National Flood Insurance Program[1]

Meghan Orie

Summary

The U.S. government created the National Flood Insurance Program (NFIP)[2] in 1968 because, for various reasons, the market for private flood insurance is small in the U.S. The programme was designed to be financially self-supporting but it has been supplemented with U.S. Treasury loans and ex post *catastrophe funds. The programme offers risk-based premiums for newer properties but it subsidises a large number of older, high-risk properties, which contributes to the programme's gross indebtedness. In addition, the low pricing of insurance available to property owners through the NFIP has undermined the incentive to mitigate risk and instead encouraged repetitive development in the vulnerable areas it covers. The Biggert-Waters Flood Insurance Reform Act passed in June 2012 with the aim of diversifying risk and introducing actuarially sound premiums.*

Case description

The National Flood Insurance Program (NFIP) was created by the U.S. Congress in 1968 to provide flood insurance protection associated with hurricanes, tropical storms and heavy rain when flood insurance was considered to be an undesirable line of business. For this, NFIP produces floodplain maps, designating risk in different flood zones and sets deductibles and premiums. In return, property owners in participating local communities are eligible to buy NFIP insurance. It is optional for local community members, however, prospective property owners are legally obliged by federally-regulated mortgage lenders to purchase NFIP insurance when taking out a loan to buy property in Special Flood Hazard Areas (SFHAs) (GAO, 2007). Programme participants are also supposed to commit to sound floodplain management and related disaster mitigation measures, such as ensuring that buildings adhere to specific building codes. Implementing these measures is overseen by NFIP's Community Rating System (CRs) and should lower the risk the buildings are exposed to, thus qualifying members for lower premiums.

The NFIP engages in a public–private partnership called the Write-Your-Own (WYO) Program with roughly 90 property and casualty (P&C) insurance companies who write and service NFIP insurance policies in their own name but bear none of the risk. NFIP

[1] Based on Lloyd's (2011) and Michel-Kerjean (2010).

[2] The programme was originally intended to be supplemented by private insurance and today there are some supplementary private insurance options.

benefits from private insurers' marketing and distribution channels while member insurers of the WYO receive an "expense allowance".[3]

As of March 2011, approximately 5.6 million properties were insured by the NFIP. The programme "…is designed to be financially self-supporting, or close to it, most of the time, but cannot handle extreme financial catastrophes by itself" (Michel-Kerjan, 2010). From a claims-paying perspective, the programme has been relatively successful. In fact, until 2006, NFIP paid out almost 95 per cent of its claims from Hurricane Katrina. It was not until a number of other natural catastrophes occurred that same year that it had to take out an US$18.6bn loan from the U.S. Treasury, an act it was designed to do in cases of extreme natural catastrophe. For the natural catastrophes occurring after Hurricane Katrina, it is unlikely that it will be able to pay out all claims.

Despite its capacity for the most part to consistently pay out claims, the programme is not adequately funded because the premium rates have not covered the government's exposure and it has relied on *ex post* funding mechanisms to cover catastrophic losses (GAO, 2007). *Ex post* funding mechanisms seem to be generally less efficient and effective than *ex ante* funding mechanisms. The NFIP faces certain challenges that have exacerbated its reliance on *ex post* funding and which have made the programme insolvent in cases of extreme natural catastrophes, including issues of moral hazard, lack of insurance penetration, floodplain management and relatively unmonitored administrative costs. NFIP has been running a deficit since 1968, as it has been rolling over expenses year after year.

In June 2012, the Biggert-Waters Flood Insurance Reform Act was passed. This piece of legislation renewed and fiscally reformed the programme, as will be discussed later. It is still too early to determine the reform's outcome.

Analysis: subsidising high-risk properties?

Since its establishment, the programme has campaigned to expand the number of policyholders it covers. Homes built after the creation of flood maps to an approved building code in floodplains pay what NFIP considers actuarially sound premiums, or premiums that are "sufficient on average to cover the total flood claims and administrative costs for those policies based on the agency's maps and its estimates of the frequency of different size floods" (CBO, 2009).

However, NFIP must legally offer reduced premium rates for homes that were built in floodplains prior to the creation of Flood Insurance Rate Maps (FIRM). Subsidised policies comprise roughly one quarter of NFIP policies. Even with somewhat higher premiums, these participating members still only pay roughly 40 per cent of the risk-based rate. Originally rates were subsidised in order to attract policyholders with the hope that ultimately as the housing stock turned over, fewer policies would be subsidised, but this process is taking longer than expected. According to Derrig and Tennyson as cited in Sandink *et al.* (2010), this price interference has forced some insurance companies out of the market while others have failed.

First, many NFIP policyholders profit from a lack of risk-based pricing. Risk-based pricing would provide disincentives to build or rebuild in high-risk or vulnerable areas.

[3] The members of the WYO Program receive in total roughly one third of premiums or 50 per cent of loading costs as an "expense allowance", according to Michel-Kerjan (2010). For instance, for servicing and selling policies to farmers under the national crop insurance programme, insurers receive 24 per cent of unsubsidised premiums.

Without it, moral hazard is encouraged,[4] leading to repetitive losses. An estimated 25-30 per cent of claims paid are for repetitive losses on homes that are most prone to flooding. Repeat claims on underpriced premiums create large liabilities for the taxpayer. Attempts to provide incentives to mitigate risk through the CRS programme have been relatively unsuccessful mainly due to communities' lack of understanding of insurance. As a result, Congress has been attempting to mitigate these repetitive losses, particularly in vulnerable areas, by acquiring the properties, re-locating property owners or demolishing flood-prone structures, turning the properties into open space, though it is still too early to determine whether this programme is successful.

Second, policyholders with properties located both within and outside SFHAs are surrendering their policies after short periods of time. For these ex-policyholders, the government may experience political pressure post catastrophe to rely upon its *ex post* funds to cover damage instead of relying on NFIP. For SFHAs, mortgage lenders—who are legally supposed to ensure that policyholders in SFHAs own NFIP policies—are losing track of them as the accounts are transferred to capital markets. The oversight mechanism is faltering. Thus policyholders who live in SFHAs are able to surrender their policies instead of repeatedly renewing them as they are supposed to. Generally, most policyholders surrender their policies after only two to four years. According to Michel-Kerjan *et al.* (2012), they see insurance as an investment and, if after a certain period it does not pay off, they opt out of the policy, meaning that they misunderstand the function of insurance. Other reasons could be that policyholders choose to use their budget for other purposes or have a disincentive to purchase insurance because the federal government's provision of *ex post* funds covers property damage after a flood.

In addition, NFIP tends not to transfer risks into international capital markets through reinsurance. Public finances may have to carry debt into the future. NFIP owes the U.S. Treasury roughly US$1bn per year and US$17.8bn in total. It is in great need of financial reform (GAO, 2007).

Third, floodplain management plans are often not enforced or are out of date. Out-of-date maps mean that policyholders in higher-risk zones may not be paying accurate risk-based prices nor are proper mitigation measures being implemented, exposing older buildings to high levels of risk (Burby, 2001). Updating floodplain maps is politically undesirable since it means expanding the higher-risk zones, which could decrease the value of people's property and require them to pay higher premiums. This further contributes to the NFIP's deficit.

Last, an issue affecting the solvency of NFIP is the administrative cost affecting the WYO Program. A 20–30 per cent loading cost is normal for insurers who take on the risk of the premiums they sell, but NFIP's insurance members do not bear risks. The Federal Emergency Management Agency (FEMA) does not have the information it needs to determine whether WYO payments are reasonable and the amount of profit to the WYOs that are included in its payments. According to the United States Government Accountability Office (GAO, 2009), "Considering actual expense information would provide transparency and accountability over payments to the WYOs."

To address these solvency issues and pay back its US$18bn debt, the Biggert-Waters Flood Insurance Reform Act was passed in June 2012. Among the changes, NFIP will

[4] Moral hazard is the effect of having insurance on one's behaviour. Having insurance changes the costs of misfortune and therefore, people may make less of an effort to avoid misfortune.

phase out subsidies on properties with repetitive losses and cap annual premium increases at 20 per cent—10 per cent more than last year's cap. Second, it importantly establishes a technical mapping advisory council to modernise the floodplain maps, and therefore can re-zone areas so that premiums more closely reflect the area's risk. Third, it will include minimum deductibles for flood claims. Fourth, the legislation allows FEMA to purchase reinsurance, further transferring risk into the capital markets (Widmer, 2012). Last, the WYO Program will remain unchanged.

Though these alterations do not address NFIP's administrative issues, they do facilitate diversified risk and actuarially sound premiums. Risk-based premiums and the requirement for a minimum deductible should provide disincentives for moral hazard and discourage repetitive losses. Ultimately, these reforms should make the programme fiscally sound. The Congressional Budget Office (CBO) claims that they would "reduce NFIP's need to borrow by $380m between 2012 and 2014 and result in a net income increase of $4.7bn by 2012" (Widmer, 2012). However, they may not be sufficient for NFIP to pay back its debt to the U.S. Treasury.

Lessons learned

- Frequently updating flood maps will allow NFIP to charge better risk-based premiums.
- Lowering subsidies over time could encourage more policyholders to move or engage in risk mitigation measures.
- It is essential for the government to raise awareness of the importance of insurance and to explain how it works.
- Transferring risk, whether through reinsurance or natural catastrophe bonds, is a solution to the centralisation of risk.
- NFIP could oversee mortgage lenders to ensure that SFHAs properties have flood insurance.
- NFIP could offer flood insurance under longer-term contracts, or multi-year flood insurance contracts (Michel-Kerjan, 2010).
- Raising insurance premiums may be politically difficult but necessary to achieve more actuarially sound premiums.

Conclusion

A public programme that is not based on risk-based premiums is likely to encounter financial difficulties. NFIP underprices a large portion of its contracts by subsidising higher-risk and less risk-mitigated properties and operates with out-of-date floodplain maps. Such an approach encourages moral hazard and repetitive losses which further jeopardises NFIP's ability to pay for catastrophe losses without relying on tax payments or *ex post* emergency funds.

Part of the NFIP's difficulty is that the public lacks understanding of the need to accept reforms and continuously participate in the programme. Moreover, updating flood maps has been resisted by the public because expanding high-risk or vulnerable areas can lower property prices and increase flood premiums. In addition, local policies have been surrendered and the CRS, a programme that incentivises disaster mitigation measures, has been unsuccessful because its value is not apparent to the public. Raised awareness of insurance's worth and the importance of investing in risk mitigation measures is essential.

The U.S. government's enactment of the Biggert-Waters Flood Insurance Reform Act supports the notion that risk-based pricing is the most efficient and effective way to rate insurance risks, cover the cost of losses and protect policyholders from future losses. These proposals should render the programme more fiscally sound, but it is too soon to tell whether the reforms will allow NFIP to repay its debt from 2008.

Although the NFIP has crowded out recent private initiatives, the U.S. government is planning to study whether private insurance could take over the flood insurance market.

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Case study 3

The 2011 Thai floods[5]

Meghan Orie and Walter R. Stahel

Summary

Thailand experiences flooding every year yet until 2011 flooding was considered a low natural catastrophe risk. But the floods of 2011 proved to be the country's most expensive disaster to date and, with an insurance market loss of US$16bn to US$18bn, was one of the world's most costly insured events. Insured and economic losses were primarily in manufacturing, housing, tourism and agriculture. Large-scale, unexpected industrial losses were incurred because supply chains of global companies in the automotive and electronic sector were disrupted. The scale of losses, combined with the inadequacy of risk mitigation measures, changed insurers' assessment of Thailand's risk exposure. Premium rates have increased sharply and sub-limits have been imposed. Consequently, the government is aiming to supplement its disaster risk mitigation measures with a public–private catastrophe fund to backstop insurers. The government may access the capital markets for funding.

Case description

Beginning in July 2011, the combination of the remnants of tropical depression Haima and tropical Storm Nok-ten caused severe flooding in 65 of Thailand's 77 provinces, mostly in the Mekong and Chao Phraya basins (AFP, 2011), and led to major manufacturing disruptions by the end of October. The total economic damages and losses of the Thai floods, according to the World Bank, were THB1,425bn (US$45.7bn) (The World Bank, 2011). Insured losses were high, causing insurers and reinsurers to tighten conditions and raise premiums. Some even left the market. Consequently, the Thai government implemented a public-private catastrophe fund, the National Catastrophe Insurance Fund (NCIF), to offer catastrophe insurance to households, small and medium enterprises (SME) and industrial factories. Though not covered by the NCIF, farmers were also greatly affected by the 2011 Thai floods. They are able to benefit from a public—private cooperation from the Bank for Agriculture and Agricultural Cooperatives (BAAC) and the General Insurance Association which offer subsidised crop insurance.

[5] Modified from Courbage, Orie, and Stahel (2012).

The impact to the insurance industry—insured losses and flood insurance

Though Thailand has perennially experienced yearly flooding, insurers had assessed it as at low risk for natural catastrophe until 2011. Thailand's risk exposure changed mainly due to nascent economic development[6] and its subsequent consequences: urbanisation due to population growth, large-scale industrial agriculture and the construction of industrial estates that are closely-interlinked with other distant manufacturing centres. These activities changed economic land use patterns, damaging ecosystems that can mitigate the effects of a natural catastrophe and left technical systems exposed.

Flooding in Thailand set a new loss record, making it not only the country's most expensive catastrophe to date, but also the world's most expensive flood disaster. According to Standard and Poor's (2012), estimates for the Thai floods concur with an insurance market loss range of US$16bn to US$18bn.[7] Of these losses it expects 10 to 15 per cent to be retained by the domestic market, 65 to 70 per cent by Japanese joint ventures or local subsidiaries and parent company branches in Thailand and up to 20 per cent by regional operations of international insurers. However, calculating the true cost of the floods could take years in terms of working out the lost business to Thailand. Indeed, there are many difficulties and much uncertainty in accurately estimating income lost to production shutdowns, and incurred costs due to supply chain disruptions and damage to property and equipment. In addition, loss adjustors only had limited access to sites beginning in mid-December 2011. The overbooking of loss adjustors is still an obstacle (Casanova, 2013; Santimahakullert, 2013)

At the time of the floods, less than one per cent of households in Thailand had insurance coverage for floods. Mandatory household insurance only covered fire but the owner could buy additional protection for floods for only 0.02 per cent of the sum insured, according to the General Insurance Association (GIA). Due to this marginal penetration of flood insurance for residential properties, the losses came almost entirely from manufacturing and supply chains. Most commercial properties such as factories had industrial all-risk (IAR) policies with flood cover, with almost 100 per cent of the sum covered. Production or business interruption cover was separate from IAR policies. The majority of the multinational firms in Thailand either bought this coverage from foreign insurers or self-insured through captive insurance operations. In 2012, flood coverage was separated from IAR policies (A.M. Best, 2012).

Due to high insured losses caused by the flood, many property reinsurers and insurers left the markets. Flood insurance became very difficult to obtain. Ultimately, some reinsurers and insurers stayed in the Thai market and others even entered (Tjaardstra, 2013). Multinational reinsurers who stayed or entered the market greatly increased premiums for flood and all-risk policies while capping flood coverage. As of April 2013, reinsurers' rates are flat or risk adjusted and are consistent with prices in the region (Corona, 2013a).

Like reinsurers, after the Thai floods most primary insurers in the market also instituted rate hikes, heavy sub-limits and are including more policy exclusions, as they now

[6] Thailand is a middle-income country that enjoyed solid growth, averaging more than four per cent a year from 2000 to 2007. However, its stable growth was disrupted in 2011 by political turmoil and the Thai floods.

[7] Munich Re's 2012 *Geo Report* estimates US$10bn of insured losses (Munich Re, 2012). Whereas, the latest, 2013 Swiss Re sigma report estimates insured losses at US$15.315bn (Swiss Re, 2013).

consider Thailand a high-catastrophe-risk country. In March 2013 Kittiratt Na-Ranong, Deputy Prime Minister and Minister of Finance of Thailand announced that insurance premium rates were gradually decreasing (Na-Ranong, 2013). Suzanne Corona, chief underwriter, Asia Catastrophe Pool/Asia Agriculture Pool, Asia Capital Reinsurance Malaysia Sdn Bhd. said that prices are still well above those practiced before the 2011 floods and cautioned that many factors including conditions, coverage terms and risk management can justify prices. Though some risks have been mitigated since the floods, she attributes these somewhat lowered prices to continued tightened conditions (Corona, 2013b).

These higher premiums and tightened insurance conditions in the short term, as the market remained in a "harder cycle", can explain the Office of Insurance Commission's (OIC) claim that 2012 was a major year of growth for insurance including a 27.9 per cent increase in non-life premiums year over year (Tjaardstra, 2013). Still, this growth is impressive given that insurers had to overcome major obstacles presented by the 2011 Thai flood. The OIC anticipates continued growth but slower growth than 2012 in the insurance sector in 2013 (OIC, 2013).

Analysis: public-private catastrophe-risk fund and public-private crop insurance—protection for major unexpected losses

Due to concerns about the insurance industry's ability to absorb another hit in the future and ensure affordable flood insurance coverage, the OIC set up NCIF, a THB50bn (US$1.6bn) catastrophe fund to make Thailand an attractive place for investments and offer competitive coverage for natural catastrophes by providing insurance coverage for floods, windstorms and earthquakes at attractive rates up to a sub-limit which depends on the type of risk. It covers property but not business interruption. This risk-sharing scheme between the Thai government and the Thai non-life insurance sector offers protection for households, SMEs and industrial factories and is run by an independent committee. Cover beyond the sub-limit may be purchased from private insurers at higher prices.

This catastrophe fund acts as primary reinsurer and purchases reinsurance to enhance capacity. Under this scheme, insurance companies issue Catastrophe Insurance Policies as an extended cover to the fire insurance policy or IAR policy at the limits[8] and prices set by the NCIF. Insurers are required to bear a minimum risk of 0.5–1 per cent. The remaining risk is forwarded to the NCIF. The NCIF bears a part of the risk and should cede the rest to reinsurance companies in a quota-sharing scheme (OIC, 2012). The catastrophe fund struggled in 2012 to secure that level of reinsurance coverage in the market at a reasonable cost as rates for Thai exposures rose after the floods, thereby limiting risk transfer possibilities. According to Corona, "Because of insurers' low limits and the fund's lack of risk transfer, The Thai National Catastrophe Fund is greatly exposed to the volatility of catastrophe risks. They most certainly are now working on ways to mitigate these risks and keep them within their risk tolerance" (Corona, 2013b).

Households are required to purchase NCIF's catastrophe insurance and the extended natural catastrophe guarantee is automatically included on residential risks upon policy

[8] The catastrophe fund is sub-limited to THB100,000 (US$3,000) per household; 30 per cent of the sum insured with a limit of THB50m (US$1.6m) per small and medium enterprise; and 30 per cent of the sum insured with a limit of THB50m per industrial company (NCIF, 2013).

renewal (Corona, 2013b), whereas SME and industries must first possess a fire insurance policy or IAR in order to purchase NCIF's catastrophe insurance. For floods, the coverage is not offered to properties located in government-designated floodways. These areas are covered directly by government special indemnification assistance (NCIF, 2013).

Claims are paid in case of "catastrophe" as defined by the National Catastrophe Insurance Fund Committee. Catastrophes occur upon the advice given by the Department of Disaster Prevention and Mitigation; or the total claim for catastrophe damages exceeds THB5bn per 60-day event with minimum two claims; or in case of magnitude 7 earthquake or higher or windstorm with minimum speeds of 120 km per hour (OIC, 2012).

Overall, the number of insurers engaged in NCIF is still low. According to Na-Ranong, "At present 52 non-life insurance companies are offering catastrophe policies under the Fund. As of 30 February 2013, the sales totalled at 707,643 policies with THB71.2bn (US$2.4bn) sum insured while insurance premium was THB508m (US$16.9m)" (Na-Rong, 2013). This is a consequence of the automatic inclusion of the catastrophe extension on residential risks upon renewal and because people tend to buy insurance after catastrophes. SME and industrial risks will most likely have bought the coverage due to an increase in risk awareness (Corona, 2013b). That said, Jean-Philippe Casanova, Consulting Actuary in Asian Catastrophe Insurance and Reinsurance & Former Executive Vice President, CCR, assessed that 60 to 70 per cent of large commercial / large industrial risks are underinsured (Casanova, 2013).

As of April 2013, some insurers have been choosing not to cede all of their SME/Industrial risks to the pool, instead they are offering private flood guarantee to win accounts. This may be problematic for NCIF, as it would prefer all risks to be ceded in order to have a better risk spread and decease adverse selection. According to Corona, insurers may also offer cover separate from the NCIF for SME and industrial risks because NCIF catastrophe cover is triggered by a declaration from the Thai government. With private coverage, insurers can determine their own triggers (Corona, 2013a).

The NCIF does not offer crop insurance, however before the 2011 floods the government had implemented another public–private cooperation in order to ensure that basic crop insurance was offered. That said, very few farmers had crop insurance during the devastating 2011 floods and they were thus also greatly impacted. Crop insurance only recently became available in Thailand. It was implemented locally in the 2009–2010 cultivation season, and was offered to farmers nationwide for the first time in 2011 (*Bangkok Post*, 2012). This insurance is jointly implemented by the BAAC and the GIA, and thus far covers, in a limited capacity, seasonal rice crops only. Premiums are subsidised by the government and collected by the BAAC, which acts as an intermediary and forwards the premium to private insurance companies. The plan charges a low premium of THB129.47 per rai (1,600m^2), putting premium income at THB130m but with a payout as high as THB400m in 2011. With such low premium income, few insurers have joined the programme. Faced with this limited insurance capacity, the BAAC proposed a crop insurance fund to provide higher risk cover from natural disasters. As of March 2012, the fund was to begin with at least THB5bn (US$164m) in its coffers, providing protection for valued crops like rice, maize and tapioca. The new fund could compensate farmers at full cost, such as THB5,000 a rai for rice farmers, and more for orchard growers (*Bangkok Post*, 2012).

Risk mitigation measures implemented

Before and during the 2011 floods, the Thai government had disaster risk reduction plans, though it failed to fund and execute them effectively. According to many experts, this resulted from political instability—including a powerful and politically engaged military—social polarisation and public mismanagement (Montlake, 2012), which ultimately revealed problems in general and issues in disaster risk reduction governance (*Thai Travel News*, 2011). Among many complaints were that the government failed to act on early weather warnings, had faulty storm tracking computers, poor flood protection organisation, and poor flood fortifications (Guy Carpenter, 2011).

After the 2011 floods, the Thai government mapped out a national flood plan costing some US$13.6bn over the following five years to prevent a repeat disaster and secure investor confidence. In 2012, the Thai government approved a budget of THB5bn (around US$162m) to implement 117 new "flagship" water management and flood prevention projects. Around 240,000 hectares of land were set aside as water catchment areas, which the prime minister said should store nearly 5bn m^3 of water.

Lessons learned

- Mandatory purchase requirements can ensure that households are protected in case of catastrophe and contribute to a diversification of risks within the pool.
- Public—private cooperation to offer catastrophe crop insurance can be used to complement natural catastrophe insurance.
- The government can enhance risk awareness by:
  - implementing strict zoning and building code standards and providing subsidies for mitigation practices undertaken,
  - investing in public protection infrastructure,
  - facilitating communication and coordination *ex ante* and *ex post* in disaster risk reduction initiatives, and
  - promoting early warning systems.

Conclusion

Thailand's "out-of-phase" exposure development was created by the export of manufacturing from developed countries that have a strong risk management culture to a developing country where the (flood risk) management culture was weaker. The absence of urban planning, combined with the rapid growth of industrial estates exposed new vulnerabilities leading to high losses. Moreover, the 2011 Thai floods caused substantial losses which, because of globalisation, were no longer limited geographically. As with the Tohoku earthquake and tsunami, the Thai floods created a shortage of electronic components and car parts in North America and Europe.

After the floods, the Thai government came under pressure to simultaneously invest in risk mitigation measures while attempting to facilitate risk-transfer mechanisms like establishing a public–private catastrophe risk fund, issuing catastrophe bonds and making available subsidised crop insurance and weather-index crop insurance.

The floods also highlighted how the government can enhance risk awareness by investing in public protection infrastructure and by promoting early warning systems.

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Case study 4

De-polderising The Netherlands

Meghan Orie, with gratitude to Wouter Botzen[9]

Summary

Two thirds of Dutch people live in flood prone areas and 70 per cent of Dutch GDP is produced in places that are at risk of flooding. After generations of managing flood risk by building dykes or levees (polderising) the government changed its flood mitigation strategy and in 2005 began its €2.2bn Room for the River strategy. The new strategy is to invest in flood prevention measures and, because flood insurance is not available in The Netherlands, to compensate losses with ex post *catastrophe funds. The Room for the River programme is also part of a wider shift in flood protection measures that is intended to encourage public awareness of water management and capture stakeholder interest in environmental solutions. The programme has attracted some criticism and the exclusion of insurance could discourage risk mitigation by homeowners and/or could leave shortfalls in compensation if the system fails.*

Case description

Sixty per cent of The Netherlands is at or below sea level; two thirds of Dutch people live in flood-prone areas; and 70 per cent of Dutch GDP is produced in areas that are at risk of flooding (Jones-Bos, 2011). The government has for decades adapted to these circumstances with a "delta works programme", by building ever higher dykes or levees and consequently turning floodplains into "polders",[10] or by draining entire bays (such as the Zuidersee), and converting them into land. This newly dried land was then developed, for the most part, into farmland. While these dykes protected flood-affected areas, they also left them more vulnerable. When the waters breached the dykes, they caused devastating losses in life and wealth, as during the 1953 floods. According to Swiss Re, flood protection on the coast is very good, as the dykes are designed to withstand events with return periods of 4,000 to 10,000 years. However, areas along the river required more protection (Swiss Re, 1998).

The government decided to change its flood mitigation strategies after the country experienced a series of dyke-breaching floods in the 1990s and when the government

[9] Institute for Environmental Studies, Free University, The Netherlands for his guidance and proofreading.

[10] The Dutch word "polder" means dry land created by enclosing floodplains (or shallow waters) with dykes. Thus "de-polderising" the land translates to removing or lowering the surrounding dykes and turning land back into floodplains.

was confronted with the limitations of its evacuation capacities after observing the shortcomings in the U.S. during Hurricane Katrina.

In 2005, the government began a €2.2bn Room for the River Programme, which effectively "de-polderised" the country by deepening riverbeds, moving dykes inward and allowing the plains to be potentially flooded at 39 locations along the Meuse, Rhine, IJssel and Waal rivers. It paid market value to the farmers who had settled on the polders to either move elsewhere or compensated them to raise their farms by moving them onto a mound or "terp". Nevertheless, the government is aware that waters could still breach the dykes, and is mitigating the consequences of a flood at these locations. For example, the city of Rotterdam has built a 10,000m^3-tank into a new, underground car park. The tank is large enough to catch 25 per cent of the water from a "once-in-a-century flood" (*The Economist*, 2012).

Analysis: protection without insurance

After a major flood in 1953, the Dutch Association of Insurers legally forbade its members from insuring flood damages caused by the failure of flood defences because they were concerned about business continuity (Jongejan and Barrieu, 2008). This debate was re-opened after the devastating floods in the 1990s. After the dykes were breached and, due to the lack of flood insurance available, the federal government was pressured to pass the Calamities Compensation Act (1998) under which the government serves as a backstop for catastrophe insurance by providing a government compensation fund (*ex post* funds) that pays ad hoc compensation for loss or damage which cannot be (commercially) insured up to a maximum of €450m per year and only under certain circumstances (Paklina, 2003). Despite limited and inconsistent coverage, this public compensation is crowding out the private market.

Also in the 1990s, the Council of State, the Dutch supreme administrative court, advised against establishing a public–private partnership with the Dutch Association of Insurers because the Dutch government is responsible for the "habitability of the land". If the government were no longer to pay for natural disasters, it would deny its responsibility for events that threaten national interests (Jongejan and Barrieu, 2008). It was not until 2006 that a committee was installed to evaluate the government's framework for handling uninsured losses. It recommended that the government consider private sector solutions for floods, which the Dutch government pursued because it had become increasingly reluctant to provide this ad hoc compensation and was attempting to stimulate the development of new private insurance arrangements to alleviate budget pressures.[11] Until 2010, discussions took place between the government and the insurance industry about engaging in a public–private partnership, where insurance would cover a certain limited amount of an extreme loss and the government would cover the rest. However, these discussions stopped in 2010 due to the economic crisis. Such a scheme would likely have been compulsory and it would have increased the insurance premium people had to pay in the short term, putting downward pressure on people's income (Botzen, 2012).[12]

The debate about who should provide flood loss compensation in The Netherlands touches upon a political decision whether risk transfer mechanisms should be privatised,

[11] Botzen and van den Bergh (2008); Jongejan and Barrieu (2008); Collins (2009); Bouwer *et al.* (2007).

[12] In any case, costs are currently paid indirectly via taxes if the government compensates damages.

as governments tend to be responsible for risk reduction mechanisms, whereas insurance can provide knowledge on these measures, provide proper risk assessment and allocation mechanisms, speed up loss adjustment services and provide effective incentives to reduce risk exposure (Monti, 2011).[13]

The Room for the River programme

The best alternative solution for the Dutch government was for them to focus on flood protection. The Room for the River programme is one flood protection strategy among many, ensuring that primary flood defences meet their statutory safety standards and reduce the extreme water levels (10–40cm) to lower the probability of a breach of primary flood defences[14] with the cooperation of 17 partners including the provinces, municipalities, water boards and Rijkswaterstaat. Ultimately, the Minister of Transport, Public Works and Water Management bears the overall responsibility for the programme to create safer and more attractive river regions. The programme is thus the result of a paradigm shift in thinking about flood protection from a technocratic, top-down process towards the "greening of water management", an inclusive process that focuses on restoring the water system to a more natural state and "living with water" rather than attempting to control it. This shift started in the 1980s and 1990s (Huitema and Meijerink, 2009).

While Dutch citizens are highly aware of flood risks, they may feel a false sense of security because of the extensive protective works in The Netherlands, which could encourage risky behaviour. Establishing an inclusive process for creating the programme raised awareness of the value of flood protection. Citizens were consulted multiple times at different stages of project development. For example, the Fourth Memorandum on Water Management was created in an open planning process with 3,000 participants, a major change from the earlier engineering discussions (van der Brugge *et al*., 2005). And while the national authorities set safety frameworks, regional and local branches of government elaborated on it with residents' input and then projects were ultimately approved by the state secretary of Infrastructure and the Environment. This is a key new development because local levels of government can make spatial adjustments more palatable for people and demonstrate the value of the spatial changes (Stam and Severijn, personal communication, 2012). Brouwer and van Ek's (2004) cost-benefit analysis demonstrated that traditional flood control policy is the most cost-effective option, particularly given that dyke infrastructure is already in place. However, land use changes and floodplain restoration "can be justified economically in the long run (next 100 years) if, besides the expected value of the damage avoided, the additional non-priced socio-economic and environmental benefits associated measures are also taken into account."[15] In sum, the Room for the River programme has the added value of encouraging public awareness

[13] For more information see the World Meteorological Organization's excellent piece *Risk Sharing in Flood Management: A Tool for Integrated Flood Management* (WMO, 2009).

[14] Even though the government compensation scheme lowered a group of survey participants' willingness to buy insurance, there was still a large number who wanted to buy private flood insurance because they realised the uncertainty of being paid out after a catastrophe (Botzen and van den Bergh, 2012).

[15] For the long-term horizon, "certain assumptions were made on cost-benefit analysis and the valuation of the flow of costs and benefits in time through the applied discount rate" (Brouwer and van Ek, 2004). Assumptions are also made on the area's economic development and value of protected assets.

of water system dynamics and resilience, capturing stakeholder interest, and increasing environmental values.[16]

Supplementing these programmes are two policies: Retain, Store, Drain and Living With Water (Jones-Bos, 2011). They encourage neighbourhoods to retain water where it falls, build floodable parks and legally require certain houses to use cisterns. Living With Water requires that urban planners and water managers create communities wherein water is a cherished asset and not something to fear. In addition, the locations chosen to be de-polderised were mainly rural farmland and were mandated not to be further developed.

The Room for the River programme directorate (PDR) ensures that the national and regional levels share information and stay in contact. It also monitors the budget and guides the processes. This keeps the programme on track and facilitates communication between different levels of government (Stam and Severijn, 2012).[17] In addition, EU initiatives like FloodResilienCity (FRC) and Adaptive Land Use for Flood Alleviation (ALFA) facilitate better information-sharing for flood protection between European cities. The Dutch government also works with neighbouring countries to make shared rivers safer.

Programme controversy

Despite this more open and participatory process, there are still some criticism of and resistance to the programme.[18] Indeed, negotiations for demolishing houses were difficult in Nijmegen, but the local population was able to participate by designing how to use the waterfront area, putting in floating restaurants and a marina (ClimateWise, 2012). According to Huitema and Meijerink (2009), the new ideas for river management have not completely supplanted the "old" ways of managing the rivers. Though nature development is formally part of the design task, stringent safety regulations and a low budget may constrain advancement of the "greening of water management." But it is nonetheless a laudatory process that was, in very basic terms, hard won through individual initiatives and coalitions, pursued by various actors and that the government ultimately accepted and is implementing with strict standards the provision of national security for its people.

Programme disadvantages: a role for the private sector

The government discussions in the 1990s on public–private partnerships demonstrate that insurance could play a greater role in Dutch flood risk transfer and in some aspects of risk evaluation. The disadvantages to excluding insurance from risk mitigation strategies are:

- When the system does fail, damages are substantial and may be partially compensated by the government, as "determination of the extent of the compensation provided lies with the government that is in office when the disaster takes place. Therefore, these decisions are influenced by political will and public pressure" (Botzen and van den Bergh, 2008).
- Though the Room for the River programme increases environmental values, this may not translate into preventative action. Basing a compensation system on risk-based

[16] The cost-benefit analysis shows the same if the environmental benefits are monetised.

[17] *Ibid.*

[18] See Wolsink (2005).

premiums would incentivise individuals to engage in less risky behaviour and risk mitigation measures, such as flood-proofing or retrofitting homes.

- As in the case of the NFIP, risk spreading is not optimal. With a government compensation programme, all risks are borne by the Dutch government (taxpayers) and are not hedged on (international) insurance markets.

Given the challenges of low-probability, high-loss events like floods, the government would likely need to establish a public–private partnership with insurers in order to encourage them to offer flood coverage. If the government were to do so, it seems most suitable for it to reinsure industry coverage. In fact, during the post-1990s floods, this was the proposed form of partnership discussed by the government and the insurance industry. Such an arrangement would ensure that the government would still ultimately remain responsible for the habitability of the land while shifting some of the financial responsibilities to the private sector as well as benefitting from insurance's operational capacities, efficacy and expertise.

Lessons learned

- The government has a strong role to play in risk reduction. Governments and citizens should decide to what extent insurance should play a role in risk transfer and reduction.
- Advantages to having private insurance are that insurance is contractually bound to pay its obligations, whereas government post-catastrophe payouts may be determined by politics.
- Insurance could contribute by spreading risk internationally, while government-run programmes may not.

Conclusions

The Dutch have a long history of managing the risk of floods (see Robert Muir-Wood, Case Study 1, p. 15) and the Room For The River programme, started in 2005, is the latest stage in the country's flood protection strategy.

The Room For The River Programme is primarily intended to ensure that primary flood defences meet their statutory standards and reduce water levels. Secondly, the programme is intended to turn flood protection into a more socially inclusive programme of environmental water management and to raise awareness of water system dynamics and resilience.

The Dutch government has taken a proactive approach to limiting damages in the event of catastrophic flooding. It has translated policy into programmes and demanded that all levels of government communicate about policy measures and coordinate flood planning with neighbouring countries.

Insurance could still play a bigger role in risk reduction as well as risk transfer, however. A public–private cooperation would encourage insurers to offer flood coverage and the government could itself offset risk with the reinsurance industry. In terms of risk reduction, insurers would contribute technical know-how and disincentives to engage in risky behaviour.

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Case studies
Topic II: Earthquakes and natural perils

Introduction

Earthquakes[19] may be the most destructive natural disaster in terms of loss of life and property damage. Roughly 10,000 people die annually in earthquakes mainly due to building collapse, with earthquake economic losses reaching a record high of more than US$226bn in 2011 (Swiss Re, 2012). These damages can be compounded by secondary hazards—like aftershocks, mudslides, fires and tsunamis—that can enlarge the affected area. For example, the 2003 tsunami triggered by the Sumatra earthquake caused havoc and a large number of causalities in distant Sri Lanky and other regions. It is, then, reasonable to consider earthquakes and natural perils in tandem.

While earthquake-affected zones are well known, an earthquake's timing, force[20] and area affected are difficult to anticipate. As is the case for floods, these uncertainties make it difficult for insurers to predict adequate capital reserves. Thus, it is important to target at-risk areas with effective risk management and risk mitigation measures to contain damages and prevent untimely deaths.

While no risk can ever be completely mitigated, earthquake risk and losses depend greatly on man-made factors such as population density, emergency preparedness and building codes. As seismologists like to say, "Earthquakes don't kill people, buildings do." If we compare the outcomes of two major earthquakes in 1988/89, we will see that the death toll of 62 people for California's World Series Earthquake, with a magnitude of 6.9, was far less than that of an earthquake of a similar magnitude in Armenia. There, the death toll numbered 25,000. The main difference between these two outcomes is building codes. While California updated and enforced building codes, Armenia lacked earthquake-proof buildings in 1989 (Nelson, 2011). Depending on these factors and the efficacy of recovery efforts, earthquakes can devastate an affected region's built environment and infrastructure over long periods of time, slowing economic recovery from the quake. The quality of life of the affected population can thus still be diminished long after the event, as the 2010 earthquake in Haiti demonstrates.

Earthquakes have an immense capacity for destruction, but strong earthquake risk management can mitigate damages and loss of life suffered and, for this reason, deserves further investigation. Earthquake risk management practices and recovery efforts benefit

[19] At their most basic, earthquakes are the violent shaking of the ground resulting from movement within the earth's crust or volcanic action.

[20] The severity of an earthquake is measured by a magnitude rating based on the strength and duration of their seismic waves. A rating of 3–5 indicates a light earthquake, 5–7 is considered moderate or strong, 7–8 is serious and 8 and above is severe.

greatly from public and private coordination as the following cases show. Masaaki Nagamura describes the successful coordination of government and private sector recovery efforts after the 2011 Tohoku earthquake and tsunami. The second and third cases address California Earthquake Insurance and the Norwegian Perils Pool. These deal more broadly with issues of solvency and compulsory or quasi-compulsory insurance schemes.

There are a number of other interesting and valuable earthquake risk mitigation strategies that this report was unable to include. For example:

In 2009, the Government of Mexico sponsored a US$290m, multi-peril catastrophe bond under the World Bank's MultiCat Programme. This bond allows governments to further transfer risks from natural perils into the capital markets. More information at *http://www.oecd.org/finance/insurance/48443981.pdf*

The Turkish Catastrophe Insurance Pool (TCIP) was launched in 2000 as a result of the Marmara earthquake. It is a legally mandated pool that has a mandatory purchase requirement for residential buildings in municipalities. More information at *http://info.worldbank.org/etools/docs/library/114715/istanbul03/docs/istanbul03/11yazici3-n%5B1%5D.pdf*

New Zealand's primary provider of earthquake insurance is the Earthquake Commission (EQC), a Crown Entity that is owned by the government—though subject to public sector finance and reporting rules—and controlled by a board of commissioners. The government guarantees that EQC will meet all its obligations and EQC entirely administers the fund, processes claims, organises reinsurance and funds research while insurers aid in collecting premiums. More information at *http://www.oecd.org/daf/financialmarketsinsuranceandpensions/insurance/high-levelroundtableonthefinancialmanagementofearthquakes.htm*

The French Natural Disaster Compensation Scheme (CAT NAT) operates on principles of solidarity. Primary insurers are legally obliged to include natural perils coverage as a mandatory extension to fire insurance. It is voluntary to purchase and has high uptake. Moral hazard is mitigated by requiring insureds to retain a portion of the risk by paying a statutory deductible. Compensation is triggered by an inter-ministerial declaration. More information at *http://www.oecd.org/daf/financialmarketsinsuranceandpensions/insurance/high-levelroundtableonthefinancialmanagementofearthquakes.htm*

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Case study 5

Tohoku earthquake and tsunami

Masaaki Nagamura

Summary

The Tohoku earthquake and tsunami of March 2011, the most powerful ever known to hit Japan, provided the severest of tests for the Japanese Earthquake Insurance System, a public-private cooperation between the Japanese government and insurance industry established following the Niigata earthquake in 1964. The system is designed to provide prompt post-disaster financial relief, avoiding the kind of administrative congestion that attends more conventional indemnity-type cover. It is commonly recognised that the system proved its efficacy and contributed greatly to the recovery process: over 90 per cent of the reported claims were settled in the first three months and no insurance company ran into financial difficulty after the event.

Case description: the development and evolution of the Earthquake Insurance System

In Japan, earthquakes had long been considered uninsurable because of the difficulty of applying the law of large numbers, the overwhelming scale of economic consequences they generate and the concern for adverse selection, a situation where the system becomes unsustainable due to a heavy risk concentration in seismically active zones.

However, in 1964, shortly after the Niigata earthquake, the Japanese Diet voted to revise the existing insurance business law to consider the establishment of an earthquake insurance scheme. Based on the extensive study and series of debates that followed, the Earthquake Insurance Act was enacted on 1 June 1966, and the Residential Earthquake Insurance system was launched the same day. The system offered coverage for earthquake, tsunami and volcanic eruption perils.

The primary objective of the Act is "to contribute to the stabilisation of the lives of the affected people." Unlike typical non-life insurance policies, the system was not designed to offer indemnity-type coverage, but instead, prioritised the function of post-disaster financial relief to the affected residential property owners. One of the major reasons behind not adopting traditional indemnity-type coverage is the overwhelming number of claims an insurance company accepts in a catastrophic event. Indemnity-type coverage requires a thorough appraisal process for both the insured and the insurer to mutually agree on the amount payable. While the process works reasonably well under normal circumstances, it creates serious administrative congestion in an emergency situation,

where tens of thousands of policyholders demand an immediate response. Other than the administrative considerations, there were financial aspects which had to be kept in mind. Even with governmental support, the programme needed to begin by offering partial coverage in order to contain the exposure, while keeping the premium level affordable for property owners.

From the initial stages of discussion, the concept of "no-loss and no-profit" had been in place. Since the system is intended to fulfil public policy objectives, profit margin is not factored in the insurance rate-making.

The Earthquake Insurance System incorporated a number of features to cope with the concerns raised during the drafting stage. Firstly, it was agreed to have the government function as a reinsurer, to prevent private insurers from bearing excessive financial burden. The total limit of liability was set for the entire programme to restrict the collective financial responsibility of the government and the private sector. In order to distinguish the government's liability from the general account budget, a special purpose account was created. Secondly, the scope of coverage was set to focus on residential properties, to abide by the Act's intent to serve the affected people. Thirdly, to counter the concern on adverse selection, the drafters came to the conclusion that earthquake coverage should not be sold stand-alone, but as a rider to a comprehensive property policy. Offering the earthquake coverage as a rider also helps minimise the solicitation cost. To raise public awareness of the earthquake coverage, the insurance industry has implemented a practice to confirm a policyholder's refusal to purchase the coverage in case the applicant is not interested in it. This practice is especially important in Japan where resultant fire following an earthquake is excluded in standard residential property insurance policies.

In the system, the Government of Japan functions as a reinsurer. Primary insurers cede 100 per cent of the written earthquake insurance exposure to Japan Earthquake Reinsurance Co., Ltd. (JER), a special purpose reinsurance company managed by the leading Japanese non-life insurance companies, which retains a portion of the risk and retrocedes the remainder to the member companies and the government. The total payment limit from a single event has evolved over the years, and currently stands at JPY6.2tn (US$7.95bn), an amount considered sufficient to withstand a catastrophic event affecting the metropolitan Tokyo area. Burden sharing between the government and the private sector is defined under the relevant ordinances of the Earthquake Insurance Law. Based on the April 2012 revision, the public–private liability split is set in the following three layers depending on the scale of loss:

- the first loss up to JPY104bn (US$1.33bn): 100 per cent covered by the private sector,
- the second layer in excess of JPY104bn up to JPY691bn (US$8.86bn): 50/50 per cent split between public and private sectors,
- the top layer in excess of JPY691bn up to JPY6.2tn (US$79.52bn): approximately 98.4 per cent public versus approximately 1.6 per cent private.

In case of a loss, primary insurers take care of claims handling and payments, which in turn are compensated by the government through JER, pursuant to the above-mentioned criteria.

As a mandatory practice, the earthquake insurance premium, net of operational expenses, is reserved separately by both the private insurer and the government, under a special account. Investment income arising from premiums is also subject to the same

requirement. On behalf of the primary carriers, JER functions as the integrated manager of the reserve. After the launch, the programme underwent numerous revisions to respond to changes in consumer expectations. It resulted in an increase in the types of policies in which an earthquake coverage rider could be included, the relaxation of the requirements for policyholders to purchase the rider, an increase in the limits on both individual coverage and the entire programme, an improvement in the compensation scheme, and the revision of applicable premium rates. Notable revisions were made in 1980 and 1987 when payment methods to cover half loss and partial loss respectively were introduced. Those alterations responded to the needs of subdivided payment patterns.

The devastating earthquake that struck the port city of Kobe in January 1995 ignited another round of debate on the system, which matured in the substantial increase of coverage limits (from JPY10m [US$128,250] to JPY50m [US$641,293] for buildings, from JPY5m [US$61,425] to JPY10m [US$128,250] for contents). The coverage issue aside, the earthquake revealed that the public was not well-informed about the scheme, with a 9.0 per cent penetration ratio (the figure increased to 23.7 per cent by the 2011 Tohoku earthquake). This prompted the industry to better publicise the system. As part of the effort to attract more clients, the earthquake insurance premium became subject to income tax deduction beginning in the 2006 fiscal year. The General Insurance Association of Japan (GIAJ) has been running advertising campaigns in the hope of capturing public attention. Even though the system runs on the no-loss and no-profit principle, primary insurers find enormous value in selling the coverage, since it solidifies their relationships with their customers.

Case description: how earthquake insurance responded to 11 March 2011

Then on 11 March 2011, a magnitude 9.0 earthquake hit Japan's Tohoku region, which was followed by unusually strong tsunamis. The total insured loss is estimated at JPY3tn (US$38.46bn), which is currently the world's second most costly insurance loss since 1970. Of this loss, the Earthquake Insurance System will pay out an estimated JPY1.2tn (US$15.4bn). In order to expedite the payment process, insurance companies sent supporting staff to the affected areas while opening extra toll-free call centres. Meanwhile, member companies of the GIAJ made collaborative efforts to streamline the claims adjustment process by utilising aerial photos to designate the total loss area, adopting a simplified claims assessment standard, and agreeing to a common definition in adjusting tsunami claims. The collective action enabled the industry to settle over 90 per cent of the reported claims in the first three months after the event. Even with the high percentage of settlements, the industry continues its efforts to reach out to policyholders who may have suffered but have yet to recognise valid coverage under their policies.

The swift payment of earthquake insurance was among the first to reach the disaster-stricken area. According to the survey on the economic effects of the earthquake insurance conducted by GIAJ, more than 80 per cent of the respondents used the insurance money to either reconstruct damaged structures or purchase furniture or living appliances.

While contributing to the economic recovery of the Tohoku region, it should be noted that no insurance company ran into financial distress after the event. This is largely attributable to the Earthquake Insurance System in place.

The 11 March event raised the public's awareness of the system, and the number of applicants has increased by more than 10 per cent over the previous year. With the surge in the earthquake insurance exposure, the total programme limit has been increased from JPY5.5tn (US$70.54bn) to JPY6.2tn (US$79.52bn) as of April 2012.

Lessons learned

The key to quickly settling earthquake insurance claims was the simplicity in payment methods. Considering the number of claims reports expected from a catastrophic event, the simpler the reports are, the easier it is to enable clear-cut settlements. However, it is also true that policyholders who had claims substantially larger than partial loss designation yet short of half loss may end up receiving substantially less than his/her expectation. There are ongoing discussions on the pros and cons of introducing an extra layer of payment.

It may also be worth mentioning that the Earthquake Insurance System functioned as a platform from which the market players could work out industry-wide collaborative efforts to expedite claims payments.

From the financial perspective, no single player ran into insolvency despite the unprecedented size of the claims. It proves the effectiveness of the Earthquake Insurance System, which involves the Government of Japan as a reinsurer. The burden sharing between the government and the private sector is determined depending on the significance of loss. Furthermore, private insurance companies are mandated to reserve 100 per cent of the risks assumed under earthquake insurance from which the insurance payments are made, thus leaving no negative impacts on the participating insurers' bottom line.

The way the Japanese insurance industry withstood the 11 March event is indicative of an effective public–private partnership in the context of disaster risk resilience. The absence of the Earthquake Insurance System could have left many affected citizens uninsured, while primary insurance players would have been unable to write earthquake coverage due to the likely shortage in reinsurance capacity.

Conclusion

In light of the increasing intensity and frequency of natural disasters in many parts of the world, including the emerging economies, the Japanese Earthquake Insurance System is a good example of how the public and private sectors can make the most of each other's capabilities in withstanding catastrophic events.

With the Japanese government acting as a reinsurer, the insurers themselves were protected against crippling losses that might otherwise have arisen. The disaster itself served to raise public awareness of the system, with applications for cover increasing by more than 10 per cent over the previous year and an increase in the total programme limit as a consequence.

Some shortcomings were revealed that need to be rectified, calling for continued close cooperation between the parties involved to ensure that the undertaking remains sustainable. But the existing system proved highly effective in its response to the devastation caused by the March earthquake and tsunamis.

Case study 6

California Earthquake Authority[21]

Meghan Orie

Summary

The substantial damage caused by the Northridge earthquake in 1994 showed that both policymakers and insurers had underestimated California's risk exposure to earthquakes. The result was that many insurers pulled out of the market altogether, for fear of further claims on their exhausted resources. The void was filled in 1996 by the formation of the California Earthquake Authority (CEA) and the establishment of a publicly-administered, privately-funded insurance scheme that provides basic cover at "affordable" premiums. Although the scheme is solvent with high amounts of capital, there has been low market penetration, due to lingering perceptions that premiums are too costly, that the risk of earthquakes is low and that government will support reconstruction. Consequently there is concern that California remains substantially underinsured, given its considerable exposure to earthquakes.

Case description

Before the Northridge earthquake, policymakers and insurance companies had underestimated California's risk exposure to earthquakes. This underestimation and the substantial damages caused by the Northridge earthquake resulted in over-exposure of earthquake insurers. Consequently, insurance companies severely restricted or stopped writing earthquake coverage, as another significant earthquake would have quickly exhausted their claims-paying resources.

As a result, the California Earthquake Authority (CEA) was created in 1996 to fill this gap. CEA "natural perils" policies are sold through private insurance companies. The law requires insurers that sell residential property insurance in California to offer earthquake coverage to their policyholders as an optional extension. The natural perils portion of the policyholder's premium is then channelled into a government-administered pool for which the CEA is legally required to buy reinsurance.

The policy offered is a "basic policy", covering only dwellings and excluding non-essential structures like pools or patios. The policy covers the repair of earthquake damage, ensures that new construction conforms to current building codes, replaces personal property and provides for living expenses while a home is being rebuilt.

[21] Based on Lloyd's *Managing the Escalating Risks of Natural Catastrophes in the United States* (2011).

By law, the agency receives no money out of the state budget, nor is it allowed to go bankrupt. Claims that the agency cannot pay are prorated or provided in instalments to policyholders. That said, the CEA claims that insolvency is unlikely. It is financially sound with an "A-" rating (excellent) from A.M. Best. It has over US$9bn in claims-paying capacity, which comes from earthquake insurance premiums, contributions from and assessments on participating insurance companies, borrowed funds, reinsurance and the return on invested funds. It is able to maximise this growth with a federal income tax exemption. This status lets it set premiums at a lower rate than they would be able to otherwise.

Analysis

This public–private cooperation makes insurance available for extreme risks that would not often be insurable for a broad public at an actuarially sound price. In fact, the CEA's main mitigation strategy is to create risk awareness through risk delineation and financial incentives. Risk-based pricing and a cost-effective structure allow the CEA to do that, remain solvent and offer relatively affordable premiums.

The CEA provides financial incentives for risk mitigation and is implementing policies for adaptation, enhancing financial solvability and decreasing the costs of catastrophe insurance in the long term. For example, it recently adopted a building code for retrofitting existing structures to withstand earthquakes and is trying to develop a financial incentive rebate programme that would cover a portion of retrofit costs. The programme acts as a double incentive to buy the insurance and to install retrofits, thereby lowering the insured's premium. According to Paudel *et al*. (2012), premiums can also be kept more affordable in public–private partnerships like the CEA by using the insurance sector to sell and administer insurance policies and process claims. In the U.S., partnerships maintain lower premiums by minimizing fees.

This demonstrates that a public–private partnership can be effective and efficient when run with actuarially sound methods. In a case like this, the programme may benefit from tax exemption or government reinsurance to make premiums for disaster coverage more affordable while benefitting from insurance's expertise. That said, the programme may still suffer from certain pitfalls. Despite being widely available, the CEA has only a 12 per cent penetration rate. Swiss Re has said, "California's current level of earthquake insurance is insufficient for a region with such high seismic risk, high accumulation of property and high economic activity" (Swiss Re, 2012). The state is consequently attempting to double the current number of insureds in the next five years. A large pool of insureds and high market penetration can facilitate risk spreading and may reduce costs.

Even though the CEA's premium costs are reduced by many factors, it is legally required to purchase reinsurance, the costs of which are included in the premium, increasing its cost. Too many people may still consider the premiums to be too expensive for broad penetration. In fact, experts identify expensive premiums as a factor contributing to low market penetration in California. To lower the premiums, the CEA is lobbying Washington. Alberto Monti identifies another demand-side problem, namely, that most people may underestimate, ignore or forget the extensive losses that can be caused by earthquakes so that even reasonably priced catastrophe insurance coverage may be perceived by prospective policyholders as too expensive (Monti, 2011). Another reason could be a problem of moral hazard. If individuals or businesses assume that the state of California

will reimburse them for their losses from an earthquake, then they have a disincentive to buy earthquake insurance, an occurrence that Browne and Hoyte refer to as a "charity hazard" (Browne and Hoyte, 2000). This low market penetration rate is the reason why the state may, under political pressure, provide government relief after a disaster to compensate uninsured damage.[22] In this sense, the state of California has similar problems to the NFIP. Despite offering *ex ante* disaster programmes, both governments can rely on *ex post* funds because of a lack of policy uptake.

It is difficult to know why people are not buying CEA-offered insurance; however according to Paudel *et al.* (2012), the problem of low penetration could be resolved if the government were to establish and enforce strict mandatory purchase requirements. This is a more paternalistic strategy, as it assumes that the government should dictate what insurance people have. And, depending on enforcement mechanisms and how the insurance is distributed, it may not necessarily be effective, as we saw with NFIP's limited mandatory purchase requirement. A wider mandatory purchase requirement seems unlikely or is likely to be unpopular, if the benefits of the insurance are not effectively communicated to the general public.

Lessons learned

- Private insurance contributes to the scheme by selling and administering policies and by the knowledge and expertise in managing risk.
- Federal income tax exemptions can contribute to making premiums more affordable.
- Raising awareness about the value of insurance is essential for the CEA to achieve further market penetration.
- Implementing programmes that rebate retrofit costs for buildings in order to reduce policyholder premiums can encourage purchase of insurance.

Conclusion

As the Northridge event in 1994 indicates, earthquakes in urban areas may be infrequent, but their severity can stretch the financial reserves of the traditional insurance industry to its limits. The CEA successfully addresses this issue by mandating the private sector to offer cover, administration and processing of claims, while the public sector further transfers risks to international capital markets and provides the legal status and conditions for more "affordable" premiums.

However, low uptake remains a problem and it may not be enough simply to address the prevailing misconceptions that insurance is too expensive, the risk is minimal and that government compensation would be forthcoming.

Introducing a mandatory element to the purchase of catastrophe insurance could be the solution, but this limits autonomy and could be unpopular without clear communication of the benefits to the public. The challenge lies in determining the level of compulsion and this will need to reflect varying policy objectives and market conditions.

[22] The CEA website stresses the limits of government disaster-relief programmes to encourage the purchase of earthquake coverage (CEA, 2012).

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Case study 7

Norwegian Natural Peril Pool[23]

Meghan Orie

Summary

The Norwegian Natural Perils Pool (NNPP) was established in 1979 and has been much amended in subsequent years. It is a publicly-mandated, private insurance pool covering losses caused by catastrophes such as earthquake, landslide, storm, flood and volcanic eruption. The NNPP has a high degree of solvency, with substantial amounts of accumulated capital reserves and high rates of market penetration. The NNPP is based on the mandatory inclusion of natural catastrophe coverage in all basic property insurance policies.

Case description

The activity of the Norwegian Natural Peril Pool (NNPP) is authorised by the Act on Natural Damage Insurance No. 70, passed in 1989; by Law No. 98 in 2004 and by Rules for the Norwegian Natural Perils Pool, which was established by Royal Decree in 1979 and had subsequent amendments added by the Ministry of Justice. Among the natural catastrophes covered are losses caused by earthquake, landslide, storm, flood and volcanic eruption.

Insurance companies who cover fire risks in Norway must by law be members of NNPP (Norsk Naturskadepool, 2012). Since 1996, member companies have been allowed to reinsure a part of the programme that is equal to their share of the pool (Norsk Naturskadepool, 2009).[24]

Natural catastrophe perils are legally required to be included in all fire policies unless those perils are covered by another form of insurance. To ensure wide diffusion of policies, legally, mortgage lenders must require the purchase of fire policies for a property in order to issue a loan.

NNPP is managed by representative member insurers and administered by a separate office in the Norwegian Financial Services Association. At the end of 2010, the pool had 85 member companies. NNPP acts as a distribution pool, meaning that participating companies keep direct contact with their policyholders, and as an equaliser by spreading losses in the market (smoothing available funds over geographically diverse regions).

[23] Based on Lloyd's (2011) *Managing the Escalating Risks of Natural Catastrophes in the United States*.

[24] The Norwegian Financial Services Association handles the administration and daily management of the NNPP.

It also makes reinsurance arrangements and handles damage compensation among its members.

The premium is adjusted annually on the basis of a proposal by the NNPP after approval by authorities (Van Schoubroeck, 1997).

Damages covered are distributed between the member companies in proportion to the company's portfolio of fire insurance. The total loss NNPP can compensate per occurrence was limited to NOK1,800m in 1994. If the damage exceeds the limit, then NNPP will proportionally reduce the compensation (Van Schoubroeck, 1997). Currently the NNPP is solvent.

Analysis

Historically, the government helped those affected by natural perils events with earmarked funds, tax relief and help from the armed forces. This changed in 1918, when a Norwegian insurance company began offering voluntary coverage for damages to buildings caused by natural disasters. However, this was an unprofitable endeavour because only those living in areas exposed to natural perils bought insurance cover.

In 1938, the government systemised compensation by creating a national fund, and in 1961 it finally established a natural damage scheme with the Act on Natural Damage. To determine whether natural perils coverage could be offered through insurance, in 1971 a committee was appointed. The committee found that "…both with regard to the owner of the damaged property and also from a social point of view, the best solution would be to compensate damages caused by natural disasters through insurance" (Norsk Naturskadepool, 2009).

In Norway natural perils coverage is considered to be a fundamental right of citizens and is based on principles of solidarity and mutualisation: NNPP insurers and insureds share losses and risks rather than insurers paying for their particular claims, and insureds for their particular risks.

NNPP is only involved in "compensating damage to goods that are excluded from coverage pursuant to the law" (Van Schoubroeck, 1997). Insurers offer a private solution in the NNPP but one which is heavily regulated by the government. They proportionally share both risk and compensation responsibilities, meaning there is a "solidarisation of loss" (Van Schoubroeck, 1997). And the programme benefits from insurer's technical expertise, marketing capabilities and claims payout processes. Indeed, the system functions efficiently, according to Van Schoubroek (1997). However, NNPP membership may make competition more difficult for start-up companies because their competitors have already been well established, aided by their pool membership (Haug, 2012).

Furthermore, NNPP encourages citizens to pursue private options by refusing to compensate damage if it is already covered by private insurance or if it had been possible to take out insurance against the damage by means of common types of insurance. These policies thus limit the government's exposure to losses from natural catastrophes.

In the case of the insured, those at greater risk of catastrophe are ultimately subsidised by those at lesser risk because NNPP does not distinguish the premium rate between geographical zones, class of risk or type of property. Premiums are priced at a rate of 0.07 per thousand of the sum insured in the fire policy. However, premium rates are stipulated by the Pool Board, a group of eight insurance company representatives, which takes into

account that the total premiums shall—over time—correspond to the NNPP's and the individual company's amount of loss and damage plus administrative expenses (Norsk Naturskadepool, 2009). The premiums are thus actuarially sound even if they are not strictly risk-based, that is to say calculated based on an insured's risk profile. Because the NNPP covers many risks, it can be difficult to accurately price individual policies. Given that Norway is not overly exposed to one risk in particular, the programme is able to cross-subsidise.[25]

To overcome one of the major difficulties of non-risk-based pricing—moral hazard—the Norwegian government has implemented certain policies to discourage such behaviour and encourage risk mitigation. These include incentives for retrofitting buildings and the right to reduce or waive indemnity if damage is caused by weak construction in relation to the item's anticipated stress exposure, by poor maintenance or supervision; or in cases where the claimant can be blamed for failing to prevent the damage or to limit its extent (Norsk Naturskadepool, 2009). Judgement is made on a case-by-case basis by a loss adjustor.

There are, however, still challenges to raising awareness of risk without risk-based pricing. It has been stated that flood risks are being poorly communicated to Norwegian society, and are poorly understood by government decision-makers (Krasovskaia *et al.,* 2009). For society, the government's solution to avoiding repetitive losses is legislation. Municipal governments may forbid people from building or repeat building in certain high-risk areas. To facilitate government identification of high-risk areas, there is currently a public debate occurring about the possibility of exchanging loss data between insurers and the government so that the government may better identify high-risk areas. An agreement has yet to be established for this possible partnership (Haug, 2012).

Last, the case of NNPP demonstrates the benefits of mandatory inclusion of catastrophe coverage in basic property insurance policies. To assure broad policy uptake, mortgage lenders are legally obliged to require that property owners purchase fire insurance, and therefore natural perils coverage, in order to issue a mortgage.[26] This system seems to be relatively popular and successful in Norway as the penetration rate for natural perils coverage is high (Lloyd's, 2011). This high penetration rate has facilitated risk spreading and may have reduced premium costs.

Today, the NNPP is solvent and ensures its continued solvency by collecting sufficient premium income to build reserves to be able to cover expected losses for the long-term future, reducing the risk of the mismatch between the size of annual premiums and the size of annual expected losses. It also buys reinsurance on the international market, further transferring risk. In 2011, the amount of claims was greater than premiums received, serving as a reminder of the value of the pool (Haug, 2012).

[25] In other words, those at less risk of certain natural catastrophes occurring subsidise those who are at a greater risk.

[26] According to Alberto Monti, linking different insurance products may distort competition because policyholders would have to choose the same company for both products; however, this is only problematic if the price, terms and conditions of the extension are *not* mandated by law (Monti, 2011). NNPP's extension, however, is mandated by law, limiting market distortions.

Lessons learned

- Attaching natural perils insurance to already existing insurance policies has allowed the Norwegian government to provide adequate cover at reasonable premiums.
- Private insurance contributes to the scheme by selling and administering policies and by the knowledge and expertise in managing risk.
- Actuarially sound premiums ensure the solvency of the programme.
- Risk-based pricing could help reduce moral hazard.

Conclusion

After historically relying on ad hoc post-disaster relief for natural perils, the NNPP evolved as the result of lengthy reconsideration of its risk management strategy by the Norwegian government during the 20th century. Ultimately, a public–private cooperation with insurers was decided upon, with the private sector mandated to offer cover and to administer and process claims, while the public sector manages the pool, makes reinsurance arrangements and equalises losses.

The NNPP's pricing is actuarially sound though not risk-based.

These policy measures demonstrate the NNPP's underlying principles of mutualisation and solidarity, which reflect the government's values as a welfare state. Indeed, the government plays a strong regulatory role which is based on principles of equitable distribution of losses and sharing of risks, while benefitting from the insurance industry's effective claims management and technical expertise.

To ensure diffusion of NNPP policies, the government made the inclusion of a natural perils policy mandatory in basic fire insurance policies and permits mortgage lenders to issue loans only to those who have purchased such insurance. This has resulted in a high penetration rate that facilitates risk spreading and reduces premium costs.

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Case studies
Topic III: Developing resilient communities

Introduction

According to the World Bank, resilience is "The ability of a system, community, or society exposed to hazards to resist, absorb, accommodate to, and recover from the effects of a hazard in a timely manner, including through the preservation and restoration of its essential basic structures and functions" (World Bank, 2012, p. 236). The term was originally coined in psychiatry, describing an individual's capability to "return to normal life" after a severe trauma.

Increased global climate risk and the increased frequency of catastrophic events pose new challenges to the resilience of global communities. Man-made acts or omissions, such as short-sighted land-use zoning policies, hamper resilience by increasing the number of untimely deaths and economic losses resulting from more frequent floods, landslides, heat waves, droughts and fires. Major components of absorbing, accommodating and recovering from these catastrophes are implementing *ex ante* risk mitigation measures and quickly reconnecting local communities to the economy post catastrophe.

Since the development of modern insurance in 14th century Italy, one of its major roles has been to develop means of resilience. Thus, it can contribute its knowledge and offer services to promote more resilient communities.

The following case studies demonstrate that economic reconnection and *ex ante* measures can benefit from local, regional, national and international actors. In the following case study, Andreas Spiegel and David Satterthwaite describe how an international public–private coordination between, insurance, international organisations and government can work to offer necessary financial support services to protect vulnerable communities from natural catastrophes.

The ease with which private and international actors are able to offer financial and other support services is greatly dictated by government policies and regulatory frameworks. Public policy, as Swenja Surminski describes in her case study, can decisively affect which types of insurance policies are purchased in China, where agricultural weather-index insurance is common, but catastrophe property insurance is not.

The insurance industry, in cooperation with many partner institutions such as governments, has substantially contributed to promoting resilient communities over the past years. Some other relevant projects are:

- Malawi's national index-based disaster insurance programme, a weather derivative crop insurance, for which the Malawi Meteorological Service's national maize yield assessment models are used to calculate the value of projected losses if rain falls are

less than certain benchmarks. More information at *http://www.gfdrr.org/gfdrr/sites/gfdrr.org/files/documents/DRFI_Malawi_WeatherInsurance_Jan11.pdf* and *http://www2.lse.ac.uk/GranthamInstitute/publications/Policy/docs/PP_sustainable-risk-transfer-initiatives.pdf*

- In Afghanistan, the "New Home, New Life" drama series has been used to promote flood and disaster risk reduction awareness by employing educational national radio dramas. More information at *http://www.gfdrr.org/gfdrr/sites/gfdrr.org/files/urbanfloods/pdf/Cities%20and%20Flooding%20Guidebook.pdf*
- Since roughly the 14th century, Alpine communities have fostered protective forests—triangles of forests uphill from villages to protect them from natural catastrophes such as mudslides or avalanches. The group has the incentive to protect common space for the common good rather than razing forests. Recently, the Swiss Federal Government has implemented an action plan for sustainable forest management. More information at *http://www.slf.ch/forschung_entwicklung/lawinen/lawinenschutz/index_EN* or see the *Swiss National Forest Programme (Swiss NFP): Action Programme 2004-2015* at *http://www.bafu.admin.ch/publikationen/publikation/00527/index.html?lang=en* for more information.

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Case study 8

The R4 Rural Resilience Initiative—protecting livelihoods in a changing climate

Andreas Spiegel and David Satterthwaite

Summary

Risk-taking is essential to economic growth and development, but the world's poorest communities struggle to afford the insurance cover necessary to mitigate those risks. One solution is to allow people to pay for their insurance with their own hard work. The R4 Rural Resilience Initiative is a project launched in 2011 by Oxfam America and the World Food Programme (WFP) with the support of Swiss Re. R4 builds on the success of the Horn of Africa Risk Transfer for Adaptation (HARITA) project in Ethiopia, giving poor farmers and rural households the option to pay for insurance by contributing their time and labour to useful local climate adaptation measures, such as crop irrigation and forestry projects.

Case description: building rural resilience

For the 1.3 billion subsistence farmers living on less than one dollar a day, vulnerability to weather-related shocks and climate change is a constant threat to their food security and well-being. As climate change drives an increase in the frequency and intensity of storms and droughts, the challenges faced by food-insecure communities struggling to improve their lives and livelihoods will also increase. The question of how to build rural resilience in the face of these risks is critical for addressing global poverty.

In response to this challenge, Oxfam America and the United Nations World Food Programme have launched the R4 Rural Resilience Initiative, R4 referring to the four risk management strategies that the initiative integrates, namely a combination of improved resource management (risk reduction), insurance (risk transfer), microcredit (prudent risk-taking), and savings (risk reserves).

Swiss Re is supporting R4 as a founding sponsor and exclusive technical advisor in the field of insurance and reinsurance. For quite some time, Swiss Re has been investing in the development of innovative microinsurance schemes, such as weather and yield index insurance products, to manage systemic risks. The company's knowledge of climate-related risk and agricultural insurance solutions plays a vital role in increasing risk transfer capacity across Africa and other parts of the developing world. Swiss Re and its R4 partners aim to facilitate access to credit that will help farmers finance better-quality seeds and boost food production.

Analysis: innovating in partnership

R4 follows in the footsteps of HARITA, an innovative project that brought together a network of public and private organisations, including Ethiopian farmers, the Relief Society of Tigray (REST), Nyala Insurance Share Company, Africa Insurance Company, Dedebit Credit and Savings Institution (DECSI), Mekelle University, the Government of Ethiopia, the International Research Institute for Climate and Society (IRI), Swiss Re, and Oxfam America. The project was funded by the Rockefeller Foundation and Swiss Re.

When it was launched in 2009, HARITA broke new ground in the field of rural risk management. Its central innovation was to allow Ethiopia's poorest farmers to pay for crop insurance with their own labour. In its three years of operation in Ethiopia, HARITA delivered an impressive record, with promising results for replication. The project scaled up the number of policyholders from an initial 200 households in one village in 2009 to over 13,000 households in 43 villages in 2011—directly affecting approximately 75,000 people.

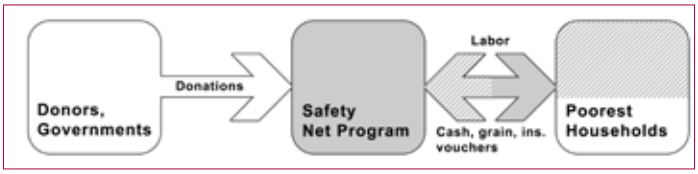
For this work programme, farmers are paying the same amount of premium through labour that one would pay to buy the product commercially, which happens in coordination with the government's work programme. In the case of Tigray Ethiopia, this programme is administered for the government by Oxfam's partner, REST. Elsewhere in Ethiopia and in other countries, WFP administers work programmes. This innovation is called "insurance for work" (IFW).

The work done in "for the work" programmes involves activities that reduce climate risk. Risk reduction activities promote resiliency by steadily decreasing vulnerability to disaster risks over time. Through participatory vulnerability assessments, called participatory capacity and vulnerability assessments (PCVAs), R4/HARITA farmers identify critically needed risk reduction activities for their community, like small-scale water harvesting, increasing soil moisture retention through improved agronomic practices, and other agricultural methods to improve crop production. These measures are designed to restore the fertility and hardiness of the degraded soil and its capacity to rebound after future shocks. Having identified the risk reduction strategies that can be performed on their land, farmers have the option of purchasing weather-index insurance from local insurers to address the risks that cannot be sufficiently reduced, like localised droughts that can erode farmers' coping capacities over time. This is accompanied by the project's unique IFW model whereby the poorest farmers who participate in a government and REST-run food-for-work initiative known as the Productive Safety Net Programme (PSNP) are also able to pay for the insurance through labour. What the work farmers do to pay for insurance includes long-term risk reduction measures as mentioned above, identified through the PCVAs. By allowing very vulnerable farmers to pay their premiums through risk-reducing labour, farmers benefit even when there is no payout—the risk reduction measures taken in their communities pay dividends, even during the wet years.

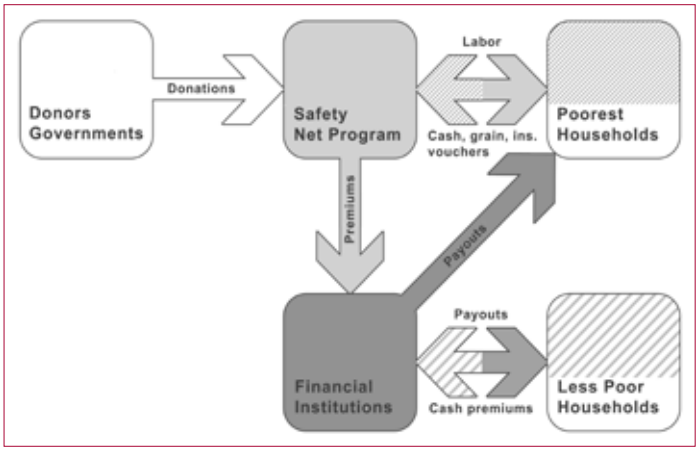
R4 represents a new kind of partnership, bringing public and private-sector actors together in a strategic, large-scale initiative to innovate and develop better tools to help the most vulnerable people build resilient livelihoods. R4 aims to leverage the respective strengths of its partners: Oxfam America's ability to build innovative partnerships and the WFP's global reach and extensive capacity to support government-led safety nets for the

most vulnerable people. This partnership will enable thousands more poor farmers and other food-insecure households to manage weather vulnerability through an affordable, comprehensive risk management programme that builds long-term resilience.

Safety Net Programme before R4



Safety Net Programme with R4



The R4 partnership will test and develop a new set of integrated tools that extend the risk management benefits of financial services, such as insurance and credit, to the most vulnerable populations. R4 focuses on mechanisms that can be integrated into social protection systems, including productive safety nets, so that the results can be applied at a much larger scale by governments and international organisations. For example, insurance for work—a key part of the R4 approach and an innovative food assistance tool—can help expand access to insurance for those who could otherwise not afford it. Beyond its use in agriculture, this model could also strengthen labour-based safety nets, reducing costs for governments and donors and protecting beneficiaries from the disruptions caused by climate disasters.

By combining the lessons from HARITA with the reach of the WFP, R4 will continue to test and scale up this innovative approach in Ethiopia, Senegal and two other countries in the next five years. R4 also constitutes a first step toward developing a sustainable insurance market for poor people, an essential factor in ensuring farmers' livelihoods and food security over the long term.

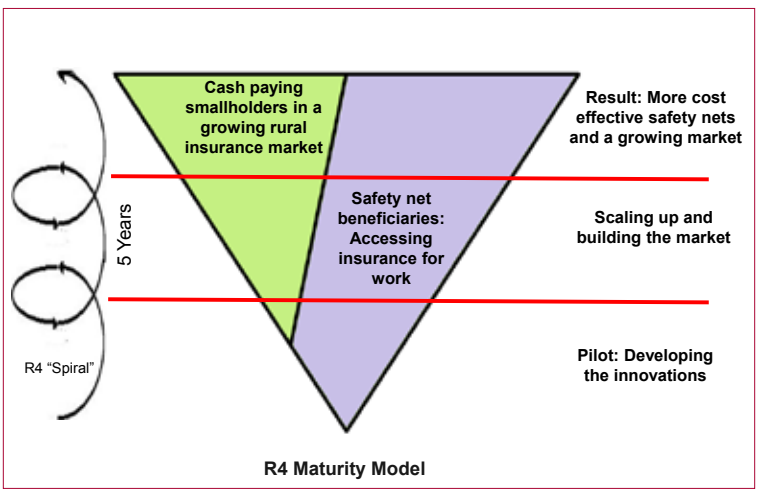
Expanding the reach of R4

The R4 Rural Resilience Initiative strives to empower half a million food-insecure people to improve their lives and livelihoods in the next five years. The overriding strategic objective of the Rural Resilience Initiative is to achieve long-term impacts well beyond the initial programme. This will be accomplished by building a sustainable commercial market for risk management and strengthening government support for rural resilience.

Still in its early stages, the programme is supported by subsidies from government and aid organisations to finance the "insurance for work" option. This is so because subsidies are the only way to establish an insurance scheme in the poorest regions of the world, and public-private partnerships play a key role in implementing such a scheme. The expectation, however, is that after a few years people will be able to cover the premium cost themselves if economic growth has increased.

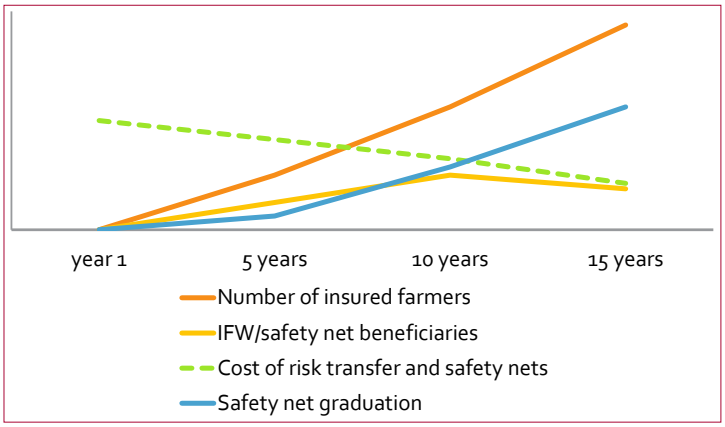
Risk diversification is crucial to ensure that insurance becomes a commercially viable option in the long term. The R4 country pilots, starting with the first expansion from Ethiopia to Senegal, play an important role in making this happen. By enlarging the participating risk community and spreading risk across multiple projects, R4 promises to develop the scale needed to strengthen community resilience in additional parts of Africa and indeed elsewhere.

Over time, R4 becomes sustainable, scalable, and cost-effective



In Senegal, programme implementation will begin in 2013. The R4 Senegal team, which includes members of Oxfam America and the WFP with technical support from Swiss Re, is now in the planning and assessment phase. During the joint planning phase, the team will look closely at a number of measurements that will help identify areas of improvement and future opportunities for expansion. These include relative food security, areas of high climate variability, population reliance on subsistence agriculture, suitable population density, and political stability of the region. Other factors for consideration are the availability of suitable crop insurance products, existence of adequate infrastructure, and access to appropriate distribution channels.

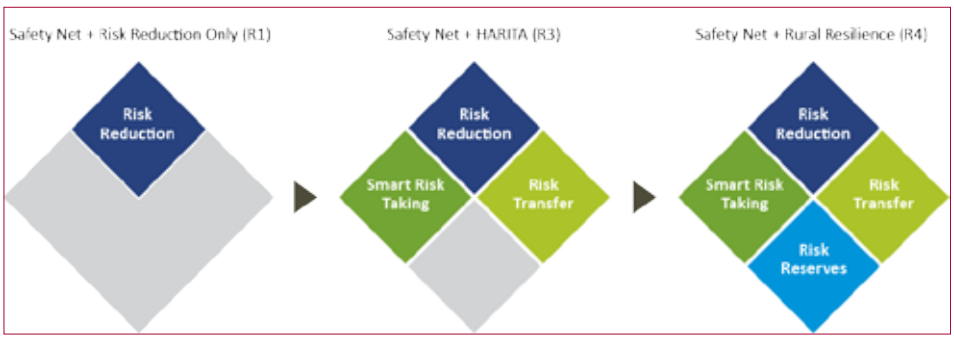
Sustainability



Overview of assessment and national planning

To ensure local ownership of the R4 process and strengthen community-level engagement, the R4 team will produce quarterly progress reports in close cooperation with national and local partners. Assessments will focus on four key areas:

1. National-level analysis and preliminary selection: this incorporates geographical selection of possible R4 regions within Senegal and initial engagement of national partners.
2. Detailed regional/local analysis and mapping: this includes detailed understanding of local conditions (infrastructure, livelihoods, markets, local capacity, rainfall, etc.), and validation of findings in consultation with regional/local authorities and partners.
3. Community assessment and identification: this includes community-based seasonal livelihoods assessment/mapping and market and value chain mapping, engagement of communities with regional/local authorities, and partners.
4. R4 programme design: this includes tailoring R4 tools to the Senegal context (technical design of community disaster risk reduction activities, design of risk transfer solution, and development of livelihoods and credit package).



Conclusion

R4 represents a new kind of cooperation to address the question of how the world's poorest and most vulnerable communities can afford and benefit from insurance. The main innovation behind R4—borrowed from HARITA—is to give participants the option to pay for their premiums by contributing their labour.

This model shows how creative approaches to risk management can be both effective and affordable. But it also underscores the critical importance of bringing together public and private sectors in a strategic, large-scale initiative to turn a groundbreaking idea into reality. While these projects help local communities to adapt to climate change, they also make economic sense and offer long-term business potential to investors and private sector participants.

By bringing together the participatory model established by HARITA and the global reach of the WFP, R4 promises to build the momentum needed to promote climate adaptation measures on a larger scale. This will enable thousands more poor farmers and food-insecure households to manage weather vulnerability through an affordable and comprehensive programme of risk management that builds long-term resilience and helps to secure livelihoods.

Case study 9

Natural catastrophe insurance in China: policy and regulatory drivers for the agricultural and the property sectors

Swenja Surminski

Summary

While insurance cover against catastrophe and natural disaster has long been in place for agriculture in China, its availability remains limited for individuals and small to medium-sized businesses. In the case of agriculture, insurance is seen as an effective way to achieve overall public policy aims; no such driver has yet developed for the property-owning sector. The rapidly growing urbanisation of the Chinese population and its concentration along the eastern coastal regions, which are particularly exposed to the potential effects of sea level rise and extreme weather events such as typhoons, has greatly increased exposure to risk and this may trigger more public policy support for new risk management measures in the property sector. The liberalisation of the Chinese economy could encourage the greater participation of the private insurers, but an optimal balance between public and private involvement has yet to be found.

Case description: the insurance dimension

China is exposed to a range of natural hazards such as earthquakes and typhoons, causing large-scale human tragedy and significant economic losses. Some of the meteorological hazards such as floods and droughts are expected to grow in intensity and frequency due to climate change, while at the same time exposure levels are also increasing, mainly driven by economic growth and rapid urbanisation.

The country became the world's second largest economy in 2010 and is increasingly playing an important role in the global economy. Almost 1.5 percentage points of the projected growth of 4–4.5 per cent of the world economy in 2011–12 is accounted for by China. Nonetheless, in terms of GDP per capita and economic structure, China remains a middle-income developing country (OECD, 2011). It is widely predicted that among other emerging markets China will experience the largest growth in insurance penetration and premium volume (Ranger and Williamson, 2011). But despite these economic growth trends, the provision of catastrophe insurance is still underdeveloped: while agricultural catastrophe insurance cover is available and supported by government policy, there is only limited catastrophe insurance outside the agriculture sector. Organisations such as the World Bank, the Asian Development Bank and private companies have developed risk assessments and models that could contribute to the first steps of setting up a national catastrophe insurance system in China. While a range of proposals and suggestions for catastrophe insurance schemes have been discussed recently by the government, no

progress has been made in terms of implementation. In contrast, the agriculture sector has seen a range of reforms of the provision of catastrophe insurance, with strong political support and significant subsidies being paid to encourage take-up among the rural population. How can these differences in the use of insurance for risk governance be explained?

Although several studies (Feyen *et al*., 2011; Enz, 2000; Zheng *et al*., 2008, 2009) have found that one of the most significant historic drivers of non-life insurance demand in emerging economies is income per capita, this alone cannot wholly explain the long-term evolution of insurance penetration at a country level. Exploring the range of demand drivers in the light of expected climate change, Ranger and Surminski (2011) conclude that "the most significant influence on growth is likely to come through firstly, public policy and regulatory responses to climate change and secondly, new opportunities related to GHG mitigation and adaptation policies." This case study looks at the policy and regulatory drivers of catastrophe insurance in China and explores why catastrophe risk transfer has been introduced in the agriculture sector, but not for general property risks in China. The analysis concludes with an assessment of the potential role of climate change for the provision of catastrophe insurance in China.

Analysis: comparison of natural catastrophe insurance for crops and property in China

The starting point of our analysis is a comparison of the governance arrangements of two different natural disaster risks in China: crop damage in the agricultural sector and property damage to individuals. The first observation is the difference in the utilisation of insurance to manage these risks: while coverage of natural disaster risks under agricultural insurance, is relatively common and has been available for some time, there is very limited natural disaster insurance available outside the agricultural sector. We base our analysis on findings from the *ClimateWise Compendium of disaster risk transfer initiatives in the developing world* (ClimateWise, 2011). This database contains five entries for China: two proposed, but not yet implemented schemes for property insurance, and three existing schemes for agriculture.[27] By comparing the key characteristics of the two areas we can look for explanations for these differences in governance approach.

While the People's Insurance Company of China (PICC) was established in 1949, the provision of domestic property insurance in China was virtually non-existent until the 1980s due to restrictions in private ownership of property. Agricultural insurance in China started in 1982 with the introduction of both livestock and crop insurance. There have been two main phases to the programme; each of them characterised by different operational models and different degrees of success. The first phase took place from 1982 to 2002, when policies were developed and underwritten by the state-owned PICC. Insurance was extended into rural areas through local government, and was operated as a social welfare mechanism to protect farmers against natural disasters. During this period, underwriting results were poor (total premiums gradually declined from US$98m in 1992 to US$40m by 2002), and PICC reduced its involvement in the lead-up to its partial privatisation (Mahul and Stutley, 2010). The second phase started in 2003. It is characterised by the introduction of new agricultural insurance programmes as part of an overall policy to boost agricultural production. A major component of the cover is

[27] See Annex page 78 for more details.

insurance against weather-related catastrophic events, supported by a considerable level of government subsidisation. In 2007, six Chinese provinces were chosen to participate in a new agriculture insurance trial, which was then extended to 25 provinces and autonomous regions (Wang *et al.*, 2011). The most common form of crop insurance is Multi-Peril Crop Insurance (MPCI), which acts as a loss-of-yield guarantee against a variety of climatic perils (drought, flood and sometimes diseases) and receives subsidies from the central and provincial government (Mahul and Stutley, 2010). The government is significantly involved in the agricultural insurance programme, its most important inputs being the provision of premium subsidies (shared between the central and the provincial governments), reinsurance of last resort by some of the provincial governments in the event that reinsurance limits are exceeded, and provision of support by government technical agencies in tasks such as loss assessments. There are no public sector agricultural insurers in China, and the market is dominated by domestic insurers and increasingly by international reinsurers that provide layers of stop-loss cover for specific lines of crops or livestock (Mahul and Stutley, 2010). Underwriting results have tended to be positive on the whole, mainly due to the large degree of geographic diversification (Wong, 2011).

Property catastrophe insurance in China has a much shorter history compared to the agriculture sector and is not widely available. Efforts to provide this type of cover has been on earthquake risks. After some cover becoming available in the late 1980s, loss experiences and concerns about rising risk levels led to earthquake risks being excluded from most property policies. In late 2003, the China Earthquake Administration, with the support of the China Insurance Regulatory Commission (CIRC) and a number of other government ministries, pushed for a national earthquake insurance pool. Although the proposal passed through the State Council, it did not successfully win the endorsement of all relevant agencies due to unclear funding arrangements. The 2008 Wenchuan earthquake contributed to reinforcing the trend of limiting and excluding cover (Wang *et al*., 2009). On the other hand, a number of separate pilot studies of government-based flood insurance schemes have been undertaken since 1992 in China (Wang *et al*., 2009). The nationwide penetration rate of earthquake insurance is very low at around 3 per cent (Wang *et al.,* 2009); and that relating to earthquakes, typhoons and floods stands below 5 per cent (Swiss Re, 2008). As a result, even when economic losses from catastrophes are high, insured losses tend to be quite low. For example, the flooding of the Huaihe and Yangtze rivers in 2007 caused an estimated US$1.7bn in economic loss. Insurance claims, however, only reached US$90m which amounts to only 6 per cent of the total loss. During the 2008 Wenchuan earthquake, the total payout made by the insurance industry reached around US$147m by the end of August 2008, being equivalent to much less than 1 per cent of the total amount of losses (Lloyd's, 2007).

Table 1 provides a summary of the key characteristics of natural catastrophe insurance in the agriculture and property sector in China.

Table 1: Summary of the key characteristics of the two natural catastrophe (NatCat) insurance areas

	NatCat insurance Agriculture	NatCat insurance Property
Current status	Available since 1982	Very limited availability to private individuals and small and medium-sized enterprises; several unsuccessful pilot schemes; some cover available to commercial insurance clients as part of their insurance package; several proposals discussed by government and industry over last decade to increase penetration and offer broader coverage, have not been implemented yet.
Who + what is insured?	Individual farmers, cooperatives, agro-businesses, covering crop and livestock losses.	Proposed for individual home owners and small and medium-sized enterprises; covering residential homes and private assets.
Who is insuring?	Initially operated by the state-owned PICC as a social welfare mechanism; as part of market liberalisation efforts now provided by private domestic insurers with growing foreign involvement via reinsurance.	Proposals range from private insurance provision, state schemes and insurance pools—with varying degrees of public/private involvement.
Size of the scheme	Premium volume in 2010: US$2bn (in 2003: US$58m)—no overall exposure estimates.	Mixed exposure estimates—70 per cent of land area at risk; average annual property damage from NatCat: US$15bn.
Key challenges	Lack of risk data; lack of reinsurance; highly dependent on government subsidies; provision of cover for small-scale farming operations.	Underdeveloped domestic insurance market, with small-scale companies not being able to offer catastrophe cover; lack of risk data; lack of industry risk analysis.
Regulatory approach	Under agricultural law, not under insurance law.	Proposed under insurance law; China Insurance Regulatory Commission (CIRC) is leading efforts to develop new regulatory system.

Political support	High—government regularly confirms importance of agricultural insurance as a core part of its agricultural development policy. The most important inputs from government are: • premium subsidies, • support from government technical agencies (e.g. in loss assessment), • government reinsurance as a last resort, • financial assistance for new provincial agricultural insurers, and • no premium tax for agricultural insurance.	Mixed—official support, but delay in implementation indicates lack of commitment. In late 2003, the China Earthquake Administration, with the support of CIRC and a number of other government ministries, pushed for a national earthquake insurance pool. Although the proposal passed through the State Council, it did not successfully win the endorsement of all relevant agencies because of lack of funding. The CIRC's current 12th five-year plan includes the creation of a national natural disaster risk transfer programme as well as the improvement of loss models and underlying data.
Climate change link	National Adaptation plan refers to insurance—concerns about growing drought and flood risks; public announcements on climate risks are made with references to insurance.	Main discussion focused on earthquake risks so far. General concerns about rising risk levels are a key challenge. Climate change is seen as a potential aggregator of risks.

Lessons learned: public policy, regulation and climate change as drivers of risk governance arrangements?

While a range of factors such as demand and supply, risk culture and risk perception all play a part in the selection of a risk governance approach, we focus our analysis on three core areas, deemed to be most relevant in the context of NatCat insurance: the public policy environment, regulatory set-ups and the likely implications of climate change for both areas.

- Public policy drivers: public policy is widely credited with creating growth impulses for insurance in emerging markets (see for example Hussels *et al.*, 2005). The most obvious form of influence is via insurance regulation (see below). But

  > public policies not linked with insurance can also remove constraints and provide the building blocks for increasing demand by, for example, encouraging investment in insurable assets (such as property, through property rights), facilitating a stable economic environment, enhancing financial literacy and risk awareness, building human capacity (including professional actuarial education), the dissemination of risk information, enhancing capital markets, creating stable and effective legislative regimes and consumer protection. (Ranger and Surminski, 2011)

  In China the two sectors considered show different degrees of public policy relevance. Support for agriculture and for the rural population has been a constant key public policy driver in China, with insurance seen as an instrument to fit in with these wider rural policy plans. The protection of private property and compensation for damages caused by natural disasters is part of China's overall disaster risk strategy, but it does not appear to be directly linked to such a constant key public policy driver. While there are policy signals that indicate support for insurance solutions—often

after an event—these are insufficiently strong enough to trigger implementation. In the context of risk governance it is important to recognise the two dimensions of insurance: it can be considered as a public policy instrument supporting the achievement of policy goals such as social security, health and safety, and particularly in the context of agricultural insurance—food security. At the same time, insurance can take the form of privately sold financial products, ranging from pet insurance to business interruption cover and private home insurance, signalling a private choice rather than a public tool.

Interestingly, in the case of agriculture, insurance is seen as an effective way to achieve overall public policy aims, while there is no such driver for the property sector. In China the growing trend of urbanisation could have implications for these policy drivers. A gradual and ongoing change in the quality of the Chinese labour force has entailed its reallocation away from (low-productivity) agriculture towards services and manufacturing, leading to a rapid urbanisation and concentration of economic activity in urban areas (Herd *et al*., 2011). In 2010, the industry sector accounted for 48.6 per cent of total GDP and the services sector for 40.5 per cent on total GDP (Economy Watch, 2010). Today, 600 million urban Chinese constitute 44 per cent of the country's population (Kamal-Chaoui *et al*., 2009), and China's urban areas now generate over 60 per cent of GDP (World Bank, 2011). These trends lead to increased exposure and higher risk accumulation in urban areas, which might trigger more public policy support for new risk governance arrangements for the property sector.

- Regulation and market set-up: in China the overall rule-setting in terms of law and regulation remains with the government (provincial and national) for both considered sectors. Most insurance types are governed by insurance law, which has a clear commercial focus on insurance. This would also apply to the proposed property insurance schemes. But agriculture insurance is not formally regulated via insurance law and is in fact mainly based on agriculture law, which contains key references to the role of state.

  The rapid growth in agriculture insurance has led to calls for a law to standardise and to protect the activities of the stakeholders in the agriculture insurance area, and there appear to be public plans to create a new set of rules and codes for agriculture insurance. The analysis also highlights different degrees of private and public involvement in agriculture and property insurance. On a general level, the overall trend of greater liberalisation of the Chinese economy has implications for the insurance sector. While the government continues to play a dominant role in agricultural insurance, there is a growing involvement of private sector players. An interesting aspect in this context is the question of who governs entrance to the market and who sets the terms and conditions of products as well as the price? The decision over entrance to the market rests to a large degree with the government, in the form of regulation. At the same time, there is also the decision by the private insurer to apply for a licence, enter a market and provide a certain product.

  There is evidence that in both risk areas, the private sector is concerned about rising risk levels and a lack of risk information. In fact some agriculture insurers ceased their underwriting in response to high claims levels. This highlights the relevance of commercial viability, which governs the private sector's decision-making. For the

property sector, the proposals for pools and new insurance schemes appear to have backing from private sector players—but the optimal balance between public and private involvement seems unclear. Similar to the agriculture risks there are concerns about rising risk levels and cost effectiveness for private sector players. There is evidence that insurance regulation can be influenced by changing risk levels:

> for example: where concerns about government exposure to reconstruction costs after a disaster or social protection against loss have led to changes in the conditions for insurance, such as market liberalisation, tax incentives or subsidies for insurance, mandatory insurance lines, the introduction of public insurance or investing in pilot programmes and improvements in risk data. (Ranger and Surminski, 2011)

- The role of climate change: risk governance arrangements can be impacted by changing risk levels—for example due to socio-economic factors, demographic change, changes in risk perception or climate change. For China, there is evidence of the implications of recent loss events on demand, supply and public support for insurance, but these impulses are often short-lived, fading with the memory of specific events. This is evident in the context of earthquake risks, but also for climatic hazards, such as floods While there is uncertainty about the size and type of impacts from a changing climate, studies expect more extreme events, with consequences for both property and agriculture (for example, Dailey *et al*., 2009).

  Economic development is mainly concentrated in the densely populated eastern coastal regions, which are particularly exposed to the potential effects of sea level rise and extreme weather events such as typhoons. The greatest exposure is in the southeast provinces of Guangdong, Fujian and Zhejiang, which frequently find themselves in the path of typhoons (Munich Re, 2010). It is estimated that the sea level along the Chinese coast will continue to rise and that the frequency of typhoon and storm surge will increase (National Development and Reform Commission, People's Republic of China, 2007), with an associated potential for significant losses affecting these thriving economic centres. Despite the fact that the relative magnitude of these impacts is still under debate, there is general consensus that China's agriculture sector will be affected significantly and that the impact on agricultural production and prices is likely to be particularly important, with associated implications for both domestic and international markets.

  Economic studies show that climate change will affect not only agricultural production, but also agricultural prices, trade and food self-sufficiency in China (Wang *et al*., 2010). Agriculture is in fact one of the sectors most affected by natural hazards, and climate-related hazards such as droughts, floods, low temperature stress, and hail are responsible for 71 per cent of the losses caused by natural hazards annually in China (Huang *et al*., 2005). There are currently no studies that have shown empirically that climate change has already begun to affect insurance demand. But theory and evidence from existing insurance markets suggests that a "riskier and more uncertain world would be associated with an increase in insurance demand, at least until some local threshold were reached where the affordability of insurance or the insurability of risk were threatened" (Ranger and Surminski, 2011). The influence of climate change on insurance provision will be multifaceted, complex and regionally variable.

  In China there are signals for changes in public policy towards insurance in response to concerns about climate change. China's National Climate Adaptation refers to

insurance as a tool to increase China's climate resilience. While this could lead to a greater political recognition of insurance as one of the many tools needed, it is difficult to predict the overall direction of these trends: will it coincide with market liberalisation and lead to a greater role for the private sector? In the wake of rising risk levels the public sector role is likely to remain important because of the affordability/availability challenge of insurance cover—which means that the private sector alone is unlikely to provide the solutions.

Conclusion

Climate change has already had an impact on the formation of policy commitments to insurance by the Chinese government in their national adaptation strategy. There may be a trend towards greater private sector engagement, but the challenges of affordability and availability of private insurance cover make it unlikely that the private sector will be able—or willing—to provide the solution on its own.

While this case study has focused on the risk management drivers, it is important to recognise the overall effectiveness of any of the approaches under consideration. The benefits of risk transfer are widely understood, but history has shown that risk transfer alone is not a silver bullet for catastrophe risk management. Rather, it is necessary to consider what role risk transfer instruments can play in the design and structure of a wider risk-management framework.

Annex

China entries in ClimateWise *Compendium*

Existing schemes:	
No. 5 Index insurance pilot in China (Shanghai)	Agricultural insurance (index-based)
No. 49 Chinese agriculture risk insurance Boosting grain production in Beijing	Agriculture insurance (indemnity-based)
No. 84 National subsidized agricultural insurance scheme in China	Agriculture insurance (indemnity-based), agricultural insurance pools
Proposed schemes:	
No. 89 Earthquake microinsurance in China (RMS)	Disaster microinsurance
No. 100 China Catastrophe Risk Assessment	Property Catastrophe Risk Insurance Pool

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Topic IV:
Liability litigation as a tool for disaster remediation and deterrence—a tale of two sharply differering outcomes

Introduction

We live in a compensation culture. The assumptions that injuries must receive financial healing and that available assets bearing even the most remote connection to the injury must be made to pay are embedded in the developed world and becoming a tenet of the responsibilities of the developed to the developing world. These principles are admirably humanitarian but raise significant issues of wise social policy and long-term sustainability.

It was not always thus. Responsibility and compensation for injuries was not contemplated for the 12,000 or so years of human existence, arising only 300 years ago out of the Industrial Revolution. Compensation as a significant economic and sociological event has emerged only in the past 50 years. It operates today through tort liability principles in the private sector and regulatory requirements in the public sector.

But with injuries of mass scale growing in frequency and severity as a result of changing climate conditions, environmental hazards and the effect of new technologies and products, there are signs that other mechanisms will be added to the tools of compensation. These case studies explore the emergence of applications of criminal law as a means of motivating or facilitating compensation.

Some other cases of interest are:

- Six Italian scientists were found guilty of manslaughter and sentenced to six years in prison for having provided "inaccurate, incomplete and contradictory" information on the danger of the 2009 deadly earthquake in L'Aquila, Italy. More information at *http://www.bbc.co.uk/news/world-europe-20025626*
- Swiss billionaire and sustainability pioneer, Stephan Schmidheiny, was sentenced to 16 years in prison in Italy for partial responsibility of asbestos-related deaths at his former company, Eternit AG, even though he was responsible for ending Eternit's use of asbestos before it was legally banned. More information at *http://www.bloomberg.com/news/2012-02-13/sustainability-pioneer-sentenced-to-prison-over-asbestos.html*

Case study 10

The Bhopal environmental disaster

Richard H. Murray

Summary

An explosion in 1984 at a chemical facility operated by Union Carbide in Bhopal, India resulted in toxic emissions that killed or severely injured thousands of residents of the surrounding area. Litigation instituted by the Indian government and other parties in India and in the U.S. resulted in a final settlement by Union Carbide of US$450m. It was never clear whether the explosion was caused by any negligent behaviour by the company. After Union Carbide was acquired by Dow Chemical in 2000, Dow sought to avoid damage to its reputation by making a further settlement estimated at US$300m.

Case description

Worldwide attention to the Bhopal disaster was immediate and intense, with inevitable tensions between the Indian government and Union Carbide. The company was presumed to be at fault, and vengeance as well as compensation was demanded. The CEO of Union Carbide denied fault by the company but went immediately to the site to take personal control of the clean-up and response. On arrival he was arrested and jailed for an extended period of time. The elements were in place for a massive and long-term conflict that could have delayed the recovery of compensation for decades and involved international political and legal disputes.

However, within a few months nearly all of the principal parties were focused on developing solutions that would speed substantial funds to aid the victims, all of them in a deeply impoverished area:

- The company began to distribute aid almost immediately.
- The Indian government sought to have the litigation conducted in Indian courts with governmental oversight.
- Opportunist groups and legal interests more concerned with self-gain than victim compensation brought suit in the U.S. courts, where excessive recoveries and contingent legal fee awards are an incentive in all such events. But the U.S. judiciary ruled that the issues should be tried in India.
- Within a few years, settlement was reached between the company and the victims in the amount of US$450m, a settlement that was approved by the Indian government as fair and final.

- When Dow acquired Union Carbide in 2000, it had no technical legal exposure, but knew that the proliferating recognition of expanding hardship from the 1984 event would likely generate reputational pressure. That occurred with the assistance of NGOs and produced a further settlement believed to be in excess of US$300m.
- While tragic conditions continue for the Indian population, over US$750m has been recovered for the victims.
- It is widely believed that the Bhopal experience has enhanced the safety record of the chemical power-generating industry worldwide.

Case study 11

The Ecuadorian rainforest oil exploration claim

Richard H. Murray

Summary

Exploration for oil in the Ecuadorian rainforests during the 1970s and 1980s jointly by Texaco and the national oil company Petroecuador allegedly polluted local water sources. The companies were also accused of failing to remediate polluted drilling sites. After Texaco was acquired by Chevron in 2001, a class action suit was filed in Ecuador against Chevron on behalf of 30,000 indigenous Indians. That suit resulted in a 2011 judgment against Chevron for more than US$18bn. Although the judgment is on appeal in Ecuador, collection lawsuits have been started in different countries seeking recovery from Chevron. An appeal from the collection litigation is pending before an international tribunal in The Hague.

Case description

When the joint government-owned and Texaco drilling operations were shut down in the 1990s, a clean-up operation was conducted by both parties. That effort resulted in a formal determination by the Ecuadorian government that the clean-up was satisfactory with a final release of responsibility.

At the time of that release, the Ecuadorian government had tested water supplies in the region and found no contamination.

But this did not deter a consortium of Ecuadorian and U.S. attorneys from convincing 40 of the indigenous Indians to "sign" an agreement to act as lead plaintiffs in a class action against Chevron. The signatures were by thumbprint. That began a tangled web of litigation that is far from completion, and after 12 years in the courts has yet to provide any victim compensation. But there have been numerous widely publicised and bizarre developments along the way.

- The class action attorneys sought recovery of US$60bn for their 30,000 "clients" in the Ecuadorian legal system widely recognised to be vulnerable to corruption.
- There is significant evidence that the expert opinion supporting the damage claim, and the trial judge's decision, were both written by the claimants' attorneys.
- This assertion of legal fraud by Chevron might be discounted as advocacy. However, the claimants' attorneys were so brazenly proud of their ability to bribe and intimidate the court that they had a film crew videotape their planning and executing of the fraud. Those tapes and other evidence have been publicly disclosed.

- The result of these actions was the entry of a judgment in 2011 by the trial court in Ecuador, awarding the claimants US$18.1bn. That judgment is now on appeal to the Ecuador Supreme Court.
- Without waiting for the decision on appeal, claimants' counsel filed suits in many countries, including the U.S. and most recently Canada, seeking to collect the judgment by seizing Chevron's assets and operations in those countries.
- The collection litigation is far more expensive for claimants counsel than the manipulation of the trial court. To finance these costs, they had their 40 representative clients enter into a litigation funding agreement with a specialist funding organisation in the U.S. The 86-page agreement is also signed by thumbprint. It provides for a scaled sharing of any ultimate recoveries for Chevron, divided between the funding company and the claimants.
- If the 30,000 claimants receive approximately the same total recovery as the Bhopal victims, all of the amount will be consumed by the funders and the attorneys, with virtually no benefits paid to the claimants.

Cases 10 and 11 analysis: a tale of two differing outcomes

Liability litigation as a means of compensating the victims of mass suffering can be a useful tool for remediation and a beneficent motivator for others to take maximum precautions to avoid other disasters. The Bhopal case is an illustration of salutary effects of responsible use of the litigation tool.

Liability litigation can also be a formidable obstacle to victim recoveries and, in the Chevron situation, it can become the disaster that creates disincentives for responsible business operations in the future. If the truth and the facts have nothing to do with the outcome of a claim, why bother with best safety practices in the future?

What are the differentiating characteristics that make these two cases such powerful demonstrations of the helpful or harmful role that liability litigation can play?

First, in nearly all cases of mass disasters, the interests of one or more sovereign governments are invoked. The potential for intergovernmental conflicts are high, and multi-national litigation is a fuse that can ignite those conflicts.

In Bhopal, the Indian government is to be commended for quickly recognising that it had to behave calmly to cope with the national anger and to focus on achieving a fair and speedy recovery for the victims. The Indian government established an unwritten but clearly understood form of public–private partnership with Union Carbide. This is clearly a non-traditional public–private sector relationship, but it is essential if the interests of the victims are to be the paramount objective of all key parties. Bhopal should be a lesson studied by all governments for coping with future mass disasters.

The Ecuadorian government was part of the Chevron problem and an obstacle to its solution. If one assumes that the 30,000 citizens affected had some right of recovery (an amount clearly less than was appropriate for the millions of Bhopal victims) the government has done nothing to help achieve that goal. It has also done much to create obstacles, beginning with the failure to enforce its own settlement agreement and release with Texaco. Tolerating lawlessness in its judiciary is not just added governance, but it is an obstacle to the management and resolution of mass disaster challenges. The failure

to prevent the use and abuse of its citizens by third-party greed is worse, especially when played out so visibly on the world stage.

Second, adult behaviour and responsibility must also dominate the actions of lawyers and the judiciary. It was of vital importance in Bhopal that the U.S. Courts refused to allow the case to proceed there. Multiple jurisdictions handling the same vast claim is nearly always a recipe for chaos. It is equally important that the controlling legal system and the participating attorneys place their clients' interests above personal gain. There is no single formula for how to do this, and ethics rules are of little help in the midst of disaster recovery. Maturity of understanding and quality of character are required. Those conditions prevailed in Bhopal but seem totally absent in the Chevron situation.

Third, the economic motivations must be aligned with the responsible behaviours desired. There is little public data about the economics of the Bhopal resolution process, but it worked well.

Cases 10 and 11 lessons learned: a tale of two differing outcomes

There are three perverse economic incentives that have made the Chevron litigation into a disaster of mass proportions.

- Tolerance for judicial corruption is a self-evident perversity of economic motivation.
- The class action contingent fee system, as applied in the U.S. and now beginning to spread globally, is not intrinsically perverse. But its tolerance for excessive attorney rewards and the absence of regulation that protects the interests of powerless clients are noxious diseases that must be contained from exploiting the victims of mass disasters.
- Litigation funding practices are a new phenomenon, arising primarily in this century. Litigation funding may well have a useful role to play in assuring access to justice. But the very recent practices of investments in litigation that are seen in the Chevron situation are abominations for disaster relief and for future disaster avoidance motivations. To perceive the problem, one need only contemplate how claimants counsel explained the terms and effect of the 86-page funding agreement to their illiterate clients.

Conclusions

When a corporation or public body is found liable for causing suffering to individuals or harm to the environment today, society expects financial compensation to be made. Liability litigation is often a useful and necessary tool for remediation and it also serves to encourage others to take the necessary precautions to avoid disasters.

But handled badly, liability litigation can be a serious obstacle to genuine victims' recoveries, prolonging suffering or harm and even disincentivising corporations from undertaking best practice in their operations. Even greater problems can arise if there is poor governance within a country's judiciary, as it can lead to complex multi-jurisdictional litigation, as happened with the Chevron case.

Clearly understood private-public cooperation is the best route to resolving post-disaster conflicts where potential exists for large scale, long running, and complex class litigation.

In the Bhopal case, the Indian government worked with Union Carbide while at the same time the U.S. courts did not allow the case to proceed there.

About the authors

Robert Muir-Wood, M.A. Ph.D., Chief Research Officer, Risk Management Solutions (RMS).

After a first degree in Natural Sciences and a Ph.D. in Earth Sciences from the University of Cambridge, where he was also a Research Fellow, since 1992 Robert has worked on the development of methodologies for catastrophe loss modelling of earthquake, tropical cyclone, windstorm and flood perils in Europe, Japan, North America, Caribbean and Australia. He has been head of research at RMS since 2003 with a mission to explore enhanced methodologies for natural catastrophe modelling and develop models for new areas of risk. He has been technical lead on a number of catastrophe risk securitisations, was lead author on insurance, finance and climate change for the 2007 4th IPCC Assessment Report and Lead Author for the 2011 IPCC *Special Report on Managing the Risk of Extreme Events and Disasters to Advance Climate Change Adaptation*. He is Vice-Chair of the OECD High Level Advisory Board of the International Network on Financial Management of Large Catastrophes and has worked with The Geneva Association in the development of their policies and actions around climate change and insurance. He has published six books, written scientific papers on earthquake, flood and windstorm perils and published more than 200 articles.

Richard H. Murray, J.D. has pursued his interest in legal liability as a broadly influential social, political and economic force throughout a career of unique responsibilities. His appointments have included 15 years as General Counsel for Touche Ross, one of the Big 8 audit firms, five years as Chairman and CEO of the London-based Minet Group (now part of Aon), eight years as Global Head of Legal and Regulatory Affairs at Deloitte and Touche and eight years as Chief Claims Strategist at Swiss Re.
Mr Murray's interests include corporate governance and sustainability issues, including an advisory role to the International Institute for Management Development (IMD), leadership of the Corporate Responsibility programme of the World Economic Forum for three years and as a founding Director of the Climate Disclosure Standards Board.

Mr. Murray serves on the Boards of the Center for Strategic Financial innovation in London, Oxford Analytica in the U.K. and was a member of the U.S. Treasury Committee on the Audit Profession. He was educated at Harvard, practised as a trial lawyer in the U.S. and served for 10 years on the Board of IMD in Lausanne.

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David Satterthwaite is a manager for R4–Rural Resilience Initiative for the Private Sector Department at Oxfam America. In this role, he is the global lead on a public-private partnership that delivers a comprehensive risk-management package (disaster risk reduction, credit, savings, and weather insurance) to farmers in remote Ethiopian villages. The project improves rural resilience through a community-driven, market-based approach to climate change adaptation that enables poor farmers to reduce their vulnerability to severe weather shocks, improve their livelihoods and graduate from food insecurity. David serves as the project's technical advisor, manages external relations and fund-raising, and oversees broader strategic development. Under his leadership, the project grew from serving 200 households in 2009 to over 13,000 households across 43 villages in rural Ethiopia in 2011. The project's success led, in 2010, to Oxfam and the UN's World Food Programme (WFP) reaching a five-year agreement with WFP to launch the programme across additional areas of Ethiopia and three new countries.

Prior to joining Oxfam, David founded Prisma MicroFinance, a financial services company that has provided millions of dollars in micro-loans to entrepreneurs in Nicaragua and Honduras. For his work with Prisma, David was recognised with several national awards, including "Best Social Return on Investment" in the National Service Venture Competition and the Compaq Leadership Award. David has served on the boards of several social enterprises including Fonkoze, a micro-lender in Haiti, First Immigrants Funding, a mortgage company in Seattle, Bridges to Business, a job placement agency in Boston, and Kiva, a "person to person" lender in San Francisco. He also founded MicroCapital, a non-profit organisation which serves as the trade media for the microfinance community. David is a graduate of Haverford College with degrees in philosophy and feminism.

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Andreas holds a Master of Science (M.Sc.) degree in Environmental Sciences from the Swiss Federal Institute of Technology (ETH), with a main subject in environmental micro-biology and energy technology. In his previous roles as project manager in the consulting industry and as climate change expert for UBS he gained a comprehensive insight into the environmental risk landscape of financial institutions.

Walter R. Stahel has been Vice-Secretary General and Director of risk management research of The Geneva Association since 1986. He has been Visiting Professor at the Faculty of Engineering and Physical Sciences, University of Surrey, and Guest Lecturer at Tohoku University, Japan, on business models for sustainable development, since 2003.

Since 1986, he has been in charge of the Research Programme on Risk Management and responsible for the M.O.R.E. seminar series (Managing Risk in the Economy) and also in charge of editing and publishing the Risk Management Newsletter of The Geneva Association. In June 2008, the new Climate Risk and Insurance (CR+I) Project was started under Stahel's direction, who then initiated the new CR+I Seminars, which are held annually in the Southern hemisphere.
He was made Doctor *honoris causa* by the University of Surrey in January 2013.

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Swenja is a member of The Geneva Association's Climate Risk working group, and served on the management committees of the industry's ClimateWise initiative, of the European Insurance Industry Climate Change Taskforce (CEA) and of the London Climate Change Partnership. She has been advising on climate change risks at the United Nations, EU and U.K. level and is the author of several papers on these topics.

Publications of The Geneva Association

For a complete list of our publications and how to get them, consult our website at www.genevaassociation.org

Recent books and monographs

Group-Wide Risk and Capital Management of Internationally Active Insurance Groups—Current Practices and Challenges

edited by Dr Panos Charissiadis and Kathrin Hoppe, April 2013

As IAIS' project to develop their "Common Framework for the Supervision of Internationally Active Insurance Groups" (ComFrame) takes shape, The Geneva Association has interviewed IAIG CROs and senior risk management staff about their group-wide risk and capital management practices and challenges. The report is a contribution to the ongoing discussions on the IAIS common framework.

The survey showed that internal models are considered to be an integral component of the business steering processes. The large majority of internationally active insurance groups perform group capital calculations as part of their own value-based management. Furthermore, they have processes in place, or are taking measures, to ensure an effective link between their risk and capital management.

The report explains the different regulatory changes IAIGs are confronted with and which have an impact on group-wide risk and capital management.

Variable Annuities—An Analysis of Financial Stability

edited by Daniel Haefeli, March 2013

As a wave of ageing baby-boomers is reaching retirement, variable annuities (VAs) fulfil a compelling social need for certainty of income in retirement. Questions surrounding the sustainability of current state pension systems and the shifting of responsibility for income security in retirement to the individual have added to this need. As a result, the market for VAs has increased significantly since their inception with sales, in 2011 reaching nearly $160bn in the U.S. Whilst VAs share many of the features of other life insurance products, they can be more complex and require more sophisticated risk management tools. As a result, they have become an area of discussion between the industry and regulators in the development of a global regulatory architecture to tackle systemic risk.

The Geneva Association has published this report on variable annuities to inform those discussions by providing a clear analysis of the functioning of VA products and the activities of insurers in providing them.

Cross industry analysis—28 G-SIBs vs. 28 Insurers: Comparison of systemic risk indicators

by John H. Fitzpatrick, February 2013

The Financial Stability Board (FSB) intends to designate Global Systemically Important Insurers (G-SIIs) in early 2013. The International Association of Insurance Supervisors (IAIS) has suggested a methodology to determine which insurers are designated as G-SIIs.

Most policymakers acknowledge and believe that insurers are different from banks and carry less systemic risk. However, no quantitative comparison of insurers to banks using the relevant criteria of the FSB/IAIS has been available to date.

This benchmarking study is the first ever comparison between the 28 named Global Systemically Important Banks (G-SIBs) and 28 of the largest global insurers.

Institutional Framework for Global Insurance Regulation and Supervision

by Jan Monkiewicz and Patrick M. Liedtke, December 2012

The aim of this report is to map out and review the changes that are taking place or are likely to take place in the global institutional framework for financial regulation and supervision and to discuss their likely consequences. It makes three main observations: Firstly, the major observation of the report is that the global institutional framework for insurance regulation will in the future remain even more dependent on network bodies rather than treaty organisations. The recent financial crisis substantially expanded the perimeter of institutional set up by upgrading the role of the G20 in the context of the financial systems. The second major observation of the report is that the insurance industry is going to remain in the shadow of the banking industry and will be faced with the problem of the recognition of its specificities. In this new paradigm, banking will receive even more attention and powers due to expanding role of the central banks in macroprudential supervision—a key tool to mitigate the systemic risk. The third major observation is about the growing role of the International Association of Insurance Supervisors (IAIS) in the years to come, which, in the aftermath of the financial crisis, reinforced its position as a prime source of global insurance expertise and the reliable partner of other relevant bodies, in particular the Financial Stability Board (FSB) and the International Monetary Fund (IMF).

The Social and Economic Value of Insurance

September 2012

Insurance is a vital social protection mechanism that promotes financial and economic stability as well as growth. This paper seeks to highlight the role of insurance in society, expounding upon the very real value that it offers individuals, institutions and the economy by providing a sense of security and peace of mind, mitigating loss, increasing prosperity, and making people more aware of the reality of risks and their consequences. It also examines some of the misunderstandings about insurance coverage, in particular those areas where they have led to disappointment or disillusionment about the industry.

The Geneva Reports—Risk and Insurance Research

No. 6: Addressing the Challenge of Global Ageing—Funding Issues and Insurance Solutions

Edited by Patrick M. Liedtke and Kai-Uwe Schanz, Geneva Report No. 6, June 2012

Increasing life expectancy and falling fertility rates are creating a demographic situation that has become one of the greatest economic and societal challenges of the 21st century.
No doubt, the drivers behind these challenges are major successes such as longer life-times reflecting better health and increasing affluence and education.

However, funding these longer lives will become increasingly difficult under current schemes. The sustainability of public and corporate pension schemes is at risk. Indeed, the cost of funding state pension benefits its set to rise dramatically—by more than double in some countries. This poses a considerable political and economic dilemma about how to keep the burden on the working population bearable while not sacrificing the standard of living for those drawing pensions.

Against this backdrop, governments and employers tend to shift responsibility for old-age security to individuals. The financial crisis has further accelerated the underlying shift in responsibility as governments face mounting fiscal pressures and employers contend with a low-growth environment. Insurers can make a meaningful contribution to old-age security if a conducive legal and regulatory framework is in place. So too can they devise and implement innovative solutions appropriate for the broadest possible spectrum of society.

With papers from old-age security experts, industry practitioners as well as the IMF and Center for Strategic and International Studies, this report provides a concise and authoritative overview of the global ageing challenge, its funding and the insurance role among the solutions available for its resolution.

No.5: ***Extreme events and insurance: 2011 annus horribilis***

Edited by Christophe Courbage and Walter R. Stahel, March 2012

2011 has been the most expensive year in recorded history both for the national economies and the insurance sector, with an estimated direct economic cost of US$380bn and original insured losses of approximately US$105bn.

It also showed an increasing severity arising from natural catastrophes, with a series of extreme events including the 11 March Japanese earthquake, the Australian and Thai floods, the New Zealand earthquakes, and the U.S. tornadoes.

These extreme events entail huge consequences in terms of human and economic losses but they also have important repercussions for the insurance industry.

This report presents the insurance' s role in managing extreme events and the mechanisms that make these insurable, both by the public and private sectors. In this context, it provides a detailed picture of the main extreme events that occurred in 2011 and analyses their impact on local insurance markets as well as the lessons learnt to efficiently manage these risks.

No.4: ***September 11—Ten Years On: lasting impact on the world of risk and insurance***

Edited by Patrick M. Liedtke and Kai-Uwe Schanz, September 2011

Ten years after the terrorist attacks of September 11, 2001 The Geneva Association has initiated a comprehensive research effort focusing on the lasting impact of an event which was the most expensive man-made disaster for insurance ever and which in its immediate aftermath was widely viewed as heralding a new era in global politics, economics and business. This effort builds on The Geneva Association's seminal special monograph which, written and published in 2002, has proven remarkably prescient in many respects.

With the following collection of eight essays from leading industry economists, underwriting specialists and Geneva Association researchers, we intend to make a meaningful contribution to establishing the event's permanent relevance for the world of risk and insurance. We also hope to stimulate our readers to consider the long-term development of the insurance industry and the various ways in which it is intertwined with human lives and activities.

No.3: ***Anatomy of the credit crisis—An insurance reader from The Geneva Association***

Edited by Patrick M. Liedtke, January 2010

In this special Geneva Report, The Geneva Association has assembled a series of key articles written during and on the subject of the credit crisis, compiling them into an insurance "reader". This reader provides an insight into the credit crisis from an insurance point of view, looks at its impact on the insurance industry and finally examines the episode for lessons-learned and concerns that remain. The majority of the articles were written during the crisis and have been published unchanged in order to give a true insight into how thinking developed as the crisis unfolded.

With articles unchanged from the time of writing accompanied by a highly detailed timeline, the Geneva Report No 3 provides a very real anatomy of the credit crisis, the lessons learned from it and the implications it has for the insurance industry in future.

No. 2: ***The insurance industry and climate change—Contribution to the global debate***

The Geneva Association, July 2009

Climate change brings new risks but also new opportunities for the insurance sector.

The insurance industry is forward-looking by nature and has a long-term comprehensive approach shared by few other economic actors.

In the context of insurance and climate change, two main issues are addressed in this report:

- Climate change is happening and calls for mitigation and adaptation measures. These differ between industrial countries and developing countries. From an insurance perspective,

specific weather-related hazards will need to be identified, quantified and prioritized on a local level.
- A low-carbon economy is the agreed societal vision, and a transition to a more sustainable economy is inevitable for industrial countries to reach a low-carbon future. The transition to these low-carbon approaches will change the economic structure of industrial countries, hence the risks and opportunities for the insurance industry as well as its relationship with the economic actors involved.

The report shows that climate change is about more than just extreme weather events. It analyses what insurance companies are already doing, what they could do in the future and where they need the cooperation of governments and other partners to succeed.

No.1: ***Regulation and intervention in the insurance industry—fundamental issues***
E. Baltensperger, P. Buomberger, A.A. Iuppa, B. Keller and A. Wicki, February 2008

Financial markets belong to the strongly supervised and regulated sectors of most modern economies. This applies to both banking and insurance. Traditional motives and justifications for regulation in these two industries overlap to some extent, but differ also in many ways.

Financial markets have undergone extraordinary growth and structural change in recent decades, due to a variety of developments (worldwide integration of capital markets, revolution in information technology, shifting attitudes towards competition and protection in the financial services area). Along with this, existing approaches to regulation have been increasingly questioned and regulatory frameworks modified in a multitude of ways, a process very much still going on.

While a very substantial body of literature concerned with the regulation of banking has developed over recent years, dealing with both its fundamental motivation and specific forms and applications of such regulation, a similar intellectual effort concerned with insurance regulation is lacking to a considerable extent. It is the aim of this paper to work towards closing this gap.

E-newsletters

- ***Insurance and Finance*** deals with research activities in the fields of finance where they are relevant to the insurance and risk management sector.
- ***Regulation and Supervision (Progres)*** contributes to the exchange of information on studies and initiatives aimed at better understanding the challenges in the fields of insurance regulation, supervision as well as other legal aspects.
- ***Risk Management*** summarises The Geneva Association's initiatives in the field of risk management and is open to contributions from any institution or company wishing to exchange information.
- ***Insurance Economics*** which serves as an information and liaison bulletin to promote contacts between economists at universities and in insurance and financial services companies with an interest in risk and insurance economics.
- **Life and Pensions** ***(Four Pillars)*** provides information on research and publications in the field of social security, insurance, savings and employment.
- ***Health and Ageing*** brings together facts and figures linked to health issues for people aged 50-80 and productive ageing, to try to find solutions for the future financing of health.
- ***World Fire Statistics.***

Other publications of The Geneva Association

Journals

(published by Palgrave Macmillan for The Geneva Association)

- ***The Geneva Papers on Risk and Insurance—Issues and Practice***
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The frequency and severity of natural catastrophes (NatCats) has radically increased since the turn of the century, causing major economic losses and gross human suffering. Mitigating losses and protecting populations has become one of society's greatest challenges. The magnitude and scope of these events require the involvement and cooperation of multiple actors to strengthen societal resilience.

The impacts of man-made disasters (technical failures) have also increased, leading to higher numbers of casualties and bigger economic losses. As a result, liability claims against the economic actors perceived as guilty have grown in numbers and complexity.

Through a series of case studies, this report examines the cooperation between governments, insurers and citizens in their endeavours to mitigate extreme events, which are worsened as much by poor risk management as by effects of climate change. Given insurance's unique capacity for mitigating the losses resulting from extreme events, this report focuses on the arrangements, regulation and conditions that best exploit its deep knowledge of risk management. The ultimate goal is to draw lessons learned–from obstacles faced and successes achieved in specific circumstances–for broader use in the domain of disaster risk reduction.

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