Editorial

Insurance Law and Economics Research for Natural Hazard Management in a Changing Climate

Reimund Schwarze^{a,b}

^aHelmholtz-Center for Environmental Research—UFZ, Permoserstraße 15, D-04318 Leipzig, Germany.
E-mail: reimund.schwarze@ufz.de

^bUniversity of Innsbruck, Innsbruck, Austria.

The Geneva Papers (2012) 37, 201–205. doi:10.1057/gpp.2012.17

Natural disaster risk is increasing globally as a result of socio-economic development and climate change. The Intergovernmental Panel on Climate Change (IPCC) has clearly highlighted this duality of causation in its latest special report on extreme events.¹ “The impacts of climate extremes and the potential for disasters result from the climate extremes themselves *and* from the exposure and vulnerability of human and natural systems. Observed changes in climate extremes reflect the influence of anthropogenic climate change in addition to natural climate variability, with changes in exposure and vulnerability influenced by both climatic and non climatic factors”. The IPCC emphasises that “Increasing exposure of people and economic assets has been *the major cause* of long-term increases in economic losses from weather- and climate-related disasters. Settlement patterns, urbanisation and changes in socio-economic conditions have all influenced observed trends in exposure and vulnerability to climate extremes”.² On the other hand, the IPCC strongly agrees that a role for climate change in the past and into the future cannot be excluded. Exposure, in this report, is defined as the presence of people; livelihoods; environmental services and resources; infrastructure; or economic, social or cultural assets in places that could be adversely affected. Vulnerability is defined as the propensity or predisposition to be adversely affected. Exposure and vulnerability, according to the IPCC, are dynamic; they vary across temporal and spatial scales, and depend on economic, social, geographic, demographic, cultural, institutional, governance and environmental factors. “High exposure and vulnerability are generally the outcome of skewed development processes such as those associated with environmental degradation, rapid and unplanned urbanization in hazardous areas or failures of governance”.³ On the other hand, resilience, defined as the ability of a system and its component parts to anticipate, absorb, accommodate or recover from the effects of a hazardous event in a timely and efficient manner, can be improved by transforming the fundamental attributes of a system, including value systems; regulatory, legislative, or bureaucratic regimes; financial institutions; and technological or biological systems. The IPCC

¹ IPCC (2012) (highlights in italics by the author).

² *ibid.*, p. 7.

³ *ibid.*, p. 8.

shares the view that risk sharing and transfer mechanisms at local, national, regional and global scales are important to increase resilience to climate extremes.³

Interdisciplinary research is needed to address this dual challenge in managing climate risks, incorporating studies of insurance economics, risk governance and integrated risk modelling and assessment. This was the motivation for the 14th *Seminar on Law and Economics of Natural Hazard Management* jointly sponsored by the European Association of Law and Economics (EALE) and The Geneva Association (GA), which was held in February 2011 in Innsbruck, Austria.⁴ This Special Issue of *The Geneva Papers on Risk and Insurance—Issues and Practice* follows up on this seminar approach of highlighting the interplay of natural disaster risk with developments in socio-economic vulnerability and resilience such as federal development spending, the government's role in funding of (extreme) damage, insurers regulatory constraints such as EU solvency rules, as well as advanced risk modelling and assessment of natural hazards.

Departing from the observation that in insurance economic terms “catastrophic risks” are usually characterised by fat tails, micro-correlations or tail dependence, Kousky and Cooke demonstrate how solvency constraints, that is regulations that require insurers to have access to enough capital to cover a particular percentile of their aggregate loss, can force insurers to charge a price that is many times the expected loss when insuring “catastrophic risks”. As a result, the decision to forego disaster insurance is quite rational for private homeowners or businesses. Insurers simply will have to charge a much higher price for truly catastrophic events than the government would. Is this supporting federal insurance? This argument has been made by Thomas von Ungern-Sternberg⁵ and has also been discussed in the above-mentioned EALE/GA seminar. It was discussed that a public insurance solution, despite comparative advantages in insuring “catastrophe risks”, would need a careful design to avoid moral hazard, x-inefficiency and other well-known deficiencies of the public sector.

Johnston in his key note to the joint EALE/GA seminar demonstrated that the primary reason for escalating natural disaster losses in the United States is policy failure. Centralised, taxpayer-funded *ex post* disaster relief has encouraged development in risky jurisdictions and also weakened incentives for *ex ante* precautions in such jurisdictions. In his paper in this special issue, Johnston analyses the role played by centralised *ex ante* development subsidies—sometimes marketed as “protective investment”—in distorting incentives. He gives ample evidence that *ex ante* development subsidies received by U.S. jurisdictions did more to encourage new development and increase the amount at risk than they did to protect existing development. Overdevelopment in such jurisdictions occurred. Efforts at the local level to take precautions to lower *ex post* losses (so-called self-insurance) were crowded out by these programmes. Thus, at least in the U.S., effective precautions against harm from climate change hinges upon curbing the level and controlling the type of *ex ante* federal development subsidies.

⁴ See Proceedings in Etudes et Dossiers No. 373.

⁵ von Ungern-Sternberg (2002).

Given the complexity of insuring extreme risks, insurers and governments often cooperate in catastrophe insurance systems. *Paudel* in his paper presents a comparative study of the main components and a broad range of indicators of fully private, fully public, as well as public–private (PP) insurance systems for extreme events in ten countries. His comparative study results in a set of clear recommendations for policymakers, that is: (1) Require mandatory participation in insurance schemes to achieve a high market penetration rate; (2) Put in place adequate monitoring and enforcement mechanisms to ensure compliance with these requirements; (3) Governments should assume responsibility for a part of the (extreme) damage in order to keep an insurance system financially viable and affordable; (4) Private insurance companies should participate in a PP insurance scheme by selling and administering policies and by covering medium-sized losses; (5) Carefully analyse the interaction between the private and public layers of insurance to avoid contradicting incentives (e.g. “Charity hazard”); (6) Governments should stimulate the building-up of insurers’ reserves by providing tax exemptions; (7) Carefully integrate risk mitigation policies in a natural disaster insurance system; (8) Assess in detail and map the risks to provide the basis for an effective mitigation policy; (9) Insurance should provide financial incentives for policyholders to take risk mitigation measures. This “cook book” for resilient transfer systems, somewhat in contrast to the finding of Johnston, calls for an important role of central government. The risks and means to avoid ‘charity hazard’, i.e. the crowding-out of private risk mitigation and insurance incentives of a strong intervening role of central government, are discussed in many papers, for example in the paper by Raschky and Weck-Hannemann.⁶

Insurers, in designing weather insurance contracts, have relied on historical data. In the light of climate change, *Kapphan et al.* examines the effects of this practice on the hedging effectiveness and profitability of insurance contracts. Using synthetic crop and weather data for present and future climatic conditions, the authors derive adjusted weather insurance contracts that account for shifts in the distribution of weather and yields. In their paper, hedging benefits from adjusted contracts almost triple, and expected profits increase by about 240 per cent. They further investigate the effect on risk reduction (for the insured) and profits (for the insurer) from hedging future weather risk with non-adjusted contracts based on historical data. In this case, insurers generate profits that are significantly smaller than for adjusted contracts, or even face substantial losses. Moreover, non-adjusted contracts create higher profits than the adjusted counterparts, causing negative hedging benefits for the insured. The overall picture that emerges is that existing concepts and practices of weather insurance contracts need to be analysed and refined to cover climate change.

“Long-term contracts”, providing more than 3 and up to 25 years of coverage at a guaranteed price, have been prominently proposed as a tool for insurance to incentivise long-term investments in adaptation to climate change at the level of property owners.⁷ Based on risk theoretical considerations, simulations and empirical evidence, *Maynard and Ranger* demonstrate that the opposite is true: multi-year

⁶ Raschky and Weck-Hannemann (2007).

⁷ Jaffee *et al.* (2008).

contracts drive the price of insurance, especially when risks are uncertain and changing as in the case of climate risks, and make insurance less affordable. They demand a higher capital loading because of an increasing possibility that multiple claims have to be paid over the policy duration. Relaxing solvency constraints on insurers will reduce this price-driving effect but will, under realistic conditions, not be able to resolve this problem. The argument often heard in favour of multi-year insurance, that is, that it would enable property owners to have easier access to long-term investment in adaptation, is rejected based on empirical findings in the U.K. and Germany. Risk-based pricing is key for incentivising long-term investments in adaptation and the greatest challenge for insurers in Europe in approaching the problem of climate change adaptation.

Prettenthaler et al. develop a stochastic model to assess storm risk in Austria. Inland storm risks are a much under-researched field of natural disaster risk, despite being important for Europe as storm Kyrill in 2007 has powerfully demonstrated. By virtue of a building-stock-value-weighted wind index, the authors explore suitably normalised historical loss data of residential buildings over ten years and corresponding wind speed data to calibrate the model. Subsequently, additional wind speed data is used to generate further scenarios and to obtain loss curves for storm risk that give rise to storm insurance loss quantiles and corresponding solvency capital requirements both on the aggregate and on the regional level. They also investigate the diversification effect across regions and use tools from extreme value theory to assess the insurability of storm risk in Austria. Similar studies in Europe, for example a study by *Donat et al.*⁸ using data from the German Insurance Association (GDV), could be used to develop a richer set of wind scenarios and to enlarge the statistical sample. European cooperation of storm risk modellers and insurers seems well-advised to stand up to the challenge of climate change and its effect on coastal and inland storms. These efforts must go beyond pure meteorological aspects but again need truly interdisciplinary research.

Scheel and Hinnerichsen in their paper, apply a spatial regression model to link weather-related insurance losses of house owners in Norway to meteorological and hydrological covariates to assess realistic scenarios of future climate change-related losses. The results indicate a serious increase of climate risks in many parts of Norway. Regionalisation of downscaled climate data in combination with the systematic consideration of regional vulnerabilities could form the basis for a proactive natural hazard policy to reduce future risks by giving appropriate incentives and/or stipulate residential preventive measures. Risk differentiation of insurance policies is considered as another key ingredient to this future risks preparedness programme.

Petseti and Nektarios, in this spirit, develop a national earthquake insurance programme for homeowners for Greece to replace the current, inefficient *ex post* disaster relief by the State when an earthquake occurs. Greece is the most exposed region in the whole Mediterranean to seismic risk. By employing four different catastrophe models, it has been estimated that the economic loss to the residential stock of a 1-in-200 year event is likely to be greater than 22 billion euros; for a 1-in-100

⁸ Donat *et al.* (2011).

year event is about 14 billion euros; for a 1-in-25 year event is 5 billion euros; and for a 1-in-5 year event is 1.3 billion euros. This potential loss severity exposes the inherent limitations of the *ex post* funding approach to natural disasters and underscores the urgent need for establishing a National Earthquake Insurance Programme. In similarity to several papers in this special issue, they propose that the earthquake coverage should be compulsory and the management of the insurance programme be based on the principle of a public–private partnership. This would keep earthquake insurance affordable to all homeowners, on the basis of risk-based premiums. While this paper—for obvious reasons—neglects climate change as a risk driver in the future, it provides a rich exercise in transforming the fundamental attributes of a system to increase resilience to extreme events in the spirit of the IPCC’s dual approach of studying natural and socio-economic drivers of climate risks.

References

- Donat, M.G., Pardowitz, T., Leckebusch, G.C., Ulbrich, U. and Burghoff, O. (2011) ‘High resolution refinement of a storm loss model and estimation of return periods of loss intensive storms over Germany’, *Natural Hazards and Earth System Sciences*, 11: 2821–2833, advance online publication 25 October, doi:10.5194/nhess-11-2821-2011.
- IPCC (2012) ‘Summary for policymakers’, in C.B. Field, V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (eds.) *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation*, A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change. Cambridge, UK, and New York, NY: Cambridge University Press.
- Jaffee, D., Kunreuther, H. and Michel-Kerjan, E. (2008) ‘*Long Term Insurance (LTI) for Addressing Catastrophe Risk*,’ NBER Working Paper Series No. 14210, National Bureau of Economic Research, Cambridge: MA.
- Proceedings of the 14th Joint Seminar EALE/The Geneva Association (GA), 24–25 February 2011, Innsbruck, ‘Law and Economics of Natural Hazard Management in a Changing Climate’. Etudes et Dossiers No. 373, June 2011.
- Raschky, P.A. and Weck-Hannemann, H. (2007) ‘Charity hazard—A real hazard to natural disaster insurance?’ *Environmental Hazards* 7(4): 321–329.
- von Ungern-Sternberg, T. (2002) ‘*Gebäudeversicherung in Europa: Die Grenzen des Wettbewerbs*,’ Bern: Haupt.