

INSURABILITY OF DAMAGE CAUSED BY CLIMATE CHANGE:
A COMMENTARY

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INTRODUCTION

The article by Howard Kunreuther and Erwann Michel-Kerjan provides a powerful overview of changes in extreme weather-related events. Supported by empirical evidence, they show that in recent decades insurers have, more than before, been confronted with catastrophic losses resulting from weather-related events (e.g., hurricanes and flooding). Moreover, they also predict that it is very likely that these types of high-damage events will occur even more in the future. The authors' contention can hardly be debated; one could easily cite other studies that equally predict that as a result of climate change it is likely that in the (near) future more of these extreme weather-related events will lead to high losses. Much evidence in this respect is gathered in the studies prepared for the Third Assessment Report (TAR) of the Intergovernmental Panel on Climate Change (IPCC), which holds that it is very likely that in almost all land areas humans will experience higher maximum temperatures and that various extreme weather events can be the expected result.¹ The IPCC predicts heavy rainfalls in particular areas, and other extreme weather events like droughts and cyclones in other areas.² Even during the week of this Symposium, the Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) gathered in Nairobi,³ where a report was presented that argued that by 2040 it is

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¹ INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE [IPCC], WORKING GROUP I, CLIMATE CHANGE 2001: THE SCIENTIFIC BASIS 574-75 (J.T. Houghton et al. eds., 2001); see generally *id.* at 87-97 (providing an overview of the climate system, as well as natural and human-induced climate variations).

² For a discussion of the likelihood of an increase in tropical cyclones, see *id.* at 606.

³ November 6-17, 2006.

likely that the damage resulting from climate change might be as high as one trillion dollars annually.⁴

This study merits two comments. First, even though one could argue that these estimates often relate to total losses (which are by definition much higher than the insured losses), it is likely that (as the authors rightly argue) insurers will be confronted with more losses from weather-related events. Moreover, the amount of losses per incident will be higher as well. Second, although there is of course (as many contributors to the Symposium mentioned) still a lot of debate among scientists as to whether the predicted increase in these extreme weather events is actually the result of anthropogenic emissions, this does not matter from an insurance perspective. As Kunreuther and Michel-Kerjan rightly mention, for an insurer it is not directly relevant whether this increase in extreme weather-related events is the result of climate change.⁵ All that matters for the insurer is that empirical evidence suggests that an increase in extreme weather events is likely to occur in the future. Insurers and reinsurers have long understood the importance of climate change to their businesses and have devoted various studies to this topic.⁶

The central question discussed by Kunreuther and Michel-Kerjan is under what conditions insurers can play a role in covering the damage caused by these extreme weather-related events (whether or not

⁴ See UNITED NATIONS ENVT. PROGRAMME FIN. INITIATIVE CLIMATE CHANGE WORKING GROUP, ADAPTATION AND VULNERABILITY TO CLIMATE CHANGE: THE ROLE OF THE FINANCE SECTOR 14 (2006) (“[I]t seems very likely that the [sic] there will be a ‘peak’ year that will record costs over 1 trillion USD before 2040.”).

⁵ See Howard C. Kunreuther & Erwann O. Michel-Kerjan, *Climate Change, Insurability of Large-Scale Disasters, and the Emerging Liability Challenge*, 155 U. PA. L. REV. 1797 (2007) (tying insurers’ cognizance of climate change to the litigation of the liability of directors and officers for failure to prepare for the phenomenon).

⁶ For examples of these studies, see ALLIANZ GROUP & WORLD WIDE FUND FOR NATURE, CLIMATE CHANGE & THE FINANCIAL SECTOR: AN AGENDA FOR ACTION 25 (2005) (suggesting means by which insurers can offset exposure to the risks associated with climate change) and PARTNERRE, IS PARTNERRE AT RISK? CLIMATE CHANGE: IMPACTS ON REPUTATION, UNDERWRITING AND INVESTMENT RESULTS 11-22 (2003) (exploring the impacts of climate change on PartnerRe). The insurability issue also received attention from the Secretariat of the UNFCCC. See generally Joanne Linnerooth-Bayer et al., Insurance-Related Actions and Risk Assessment in the Context of the UNFCCC 1 (May, 2003) (Background Paper for UNFCCC workshops, commissioned by the UNFCCC Secretariat), available at http://unfccc.int/files/meetings/workshops/other_meetings/application/pdf/background.pdf (discussing the role of insurance as a risk-transfer mechanism in the context of catastrophes resulting from climate change).

they are caused by climate change).⁷ To answer this question, the authors focus on the central notion of insurability. They provide an overview of the classic criteria that are advanced in the literature to judge the insurability of certain risks. In my comments below, a few of these insurability criteria will be discussed in further detail, a few will be added, and Kunreuther and Michel-Kerjan's analysis will be extended by addressing some of its policy implications. Indeed, in their concluding remarks, the authors briefly address (mainly as a point for further research) the question of how policy should react to these threats to the insurability of damage caused by climate change—more particularly, they suggest a role for the government.

In this Commentary, I will suggest that it is difficult to discuss the insurability of the catastrophic losses that potentially will be caused by climate change without addressing these policy issues. The nature of the damage caused by climate change is indeed such that it poses serious problems both on the demand side as well on the supply side, as I argue in Parts IV and V. Hence, it may not be possible to judge the insurability of those risks without addressing the question of whether some intervention at the policy level is necessary to facilitate this insurability. Before addressing these more fundamental issues, I would first like to focus on two classic insurability conditions, which are of particularly more importance for judging the insurability of *liability* for climate change:⁸ (1) retroactive liability and (2) causal uncertainty.

I. RETROACTIVE LIABILITY

A. *Efficiency*

A classic source of worry for insurers, particularly in the area of environmental liability, has been the retroactive character of liability rules. In some cases, legislators explicitly opted for a retroactive liability regime;⁹ in other cases, judges held that a particular behavior (like

⁷ In the remainder of this Commentary, I will still refer to this type of damage as “damage caused by climate change,” although the reader should realize that from an insurability perspective, it does not matter whether or not it is climate change that causes the increase in these extreme weather-related events.

⁸ Indeed, it was the potential liability for climate change damage that was the central focus of the Symposium and the issue discussed by Professors Kunreuther and Michel-Kerjan. See Kunreuther & Michel-Kerjan, *supra* note 5, at 1841 (discussing the potential liability of firms for the harms visited upon the firms they insure).

⁹ See, e.g., Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. § 9607(a) (2000) (providing for retroactive liability). See *gen-*

dumping toxic waste) was already considered wrongful at the moment when the act happened (e.g., twenty-five years ago) even though it may be doubtful that this actually was the case.¹⁰ A retroactive liability rule has been heavily opposed in the law and economics literature for the simple reason that a finding of liability can only affect future behavior.¹¹ Thus, retroactive liability can never have any beneficial effect (in the sense of providing incentives for prevention) for a behavior that already occurred in the past.¹² If one were to consistently reject retroactive liability, however, and hold an injurer to comply merely with an “old” standard of care, the problem would arise that standards could never be adapted to changes in technology. Therefore, it has been argued that the fact that there may be liability *ex post* may give incentives to obtain information about risk to industrial operators.¹³ In order to have a dynamic adaptation of liability standards to evolutions in technology, a system of so-called “prospective overruling” has been suggested. This means that a new liability standard would only apply to future cases, but not to the current case that raises the issue before a court. This would still allow for a dynamic process of learning by courts whereby the standard of care is not static, but changes over time.¹⁴

erally Richard L. Revesz & Richard B. Stewart, *Introduction*, in *ANALYZING SUPERFUND: ECONOMICS, SCIENCE, AND LAW 3* (Richard L. Revesz & Richard B. Stewart eds., 1995) (providing critical analyses of CERCLA’s retroactive liability). A strict retrospective liability was laid down for the restoration of contaminated sites in the United Kingdom’s Environment Act of 1995. See B. Jones, *The Identification and Remediation of Contaminated Sites: The United Kingdom’s Environment Act of 1995*, *TJDSCHRIFT VOOR MILIEUAANSPRAKELIJKHEID* [Env’tl. Liability Review] 159, 159-63 (1995) (summarizing the Act’s main provisions).

¹⁰ For examples and a discussion of this “retroactive case law,” see Gerrit Betlem & Michael Faure, *Environmental Toxic Torts in Europe: Some Trends in Recovery of Soil Clean-Up Costs and Damages for Personal Injury in the Netherlands, Belgium, England and Germany*, 10 *GEO. INT’L ENVTL. L. REV.* 855 (1998).

¹¹ For a discussion of the economics of legal transitions with applications to tort law, see generally Louis Kaplow, *An Economic Analysis of Legal Transitions*, 99 *HARV. L. REV.* 509, 520-63 (1986).

¹² See James Boyd & Howard Kunreuther, *Retroactive Liability or the Public Purse?*, 11 *J. REG. ECON.* 79, 80 (1997) (arguing that retrospective liability “weaken[s] the incentive to take precautions against future environmental costs”).

¹³ See generally Steven Shavell, *Liability and the Incentive To Obtain Information About Risk*, 21 *J. LEGAL STUD.* 259 (1992) (modeling the relative efficacies of various negligence rules).

¹⁴ For examples of such a prospective overruling in German case law, see 5 *JAMES BOYD ET AL., TORT AND INSURANCE LAW: DETERRENCE, INSURABILITY, AND COMPENSATION IN ENVIRONMENTAL LIABILITY: FUTURE DEVELOPMENTS IN THE EUROPEAN UNION* 59-60 (Michael Faure ed., 2003). See also Claus Ott & Hans-Bernd Schäfer, *Negligence as*

In the case of liability for climate change damage, retroactivity may be a serious problem.¹⁵ If one is already willing to accept a causal relationship between anthropogenic emissions and damage caused by climate change, the problem will arise that many of these emissions may have taken place in the distant past, when information about such a causal link was lacking. Of course, it is debated whether information about (or suspicion of) such a causal link was available. Some reports suggest that even as early as the beginning of the nineteenth century there was already scientific evidence available on the effect of emissions by industry on the climate.¹⁶ From a legal perspective, however, the relevant question is whether at that time (even assuming that information on the causal link was indeed available) emissions would already have been wrongful in order to justify an action in tort.¹⁷ The precise time of that moment is debated. Roda Verheyen argues that since the IPCC published its first report in 1990, states have foreseen that greenhouse gas (GHG) emissions create a risk of damage. She argues that one could even hold that governments should have been aware of such a risk much earlier—in 1950 or even before.¹⁸

Whether one also wishes to accept liability for historic emissions will to a large extent depend upon the goals one wishes to achieve with tort law.¹⁹ If deterrence were the only goal, a retroactive liability rule may make little sense. If, however, one accepts other goals of tort

Untaken Precaution, Limited Information, and Efficient Standard Formation in the Civil Liability System, 17 INT'L REV. L. & ECON. 15, 16 (1997) (arguing that the collective court system can create more efficient determinations of negligence assessment than individual courts).

¹⁵ For related discussions, see, for example, Daniel A. Farber, *Basic Compensation for Victims of Climate Change*, 155 U. PA. L. REV. 1605, 1641-47 (2007) (asserting that injuries from climate change should be adequately compensated) and RODA VERHEYEN, CLIMATE CHANGE DAMAGE AND INTERNATIONAL LAW: PREVENTION DUTIES AND STATE RESPONSIBILITY 178-83 (2005) (discussing the retroactivity issue in the context of the requirement of foreseeability for establishing international climate change liability).

¹⁶ See Richard S.J. Tol & Roda Verheyen, *State Responsibility and Compensation for Climate Change Damages: A Legal and Economic Assessment*, 32 ENERGY POL'Y 1109, 1123-25 (2004) (providing data describing the share of industrial carbon dioxide emissions in the world).

¹⁷ Cf. Joni Hersch & W. Kip Viscusi, *Allocating Responsibility for the Failure of Global Warming Policies*, 155 U. PA. L. REV. 1657, 1665 (2007) (arguing that the debate on liability for climate change has a more prospective than retrospective nature).

¹⁸ VERHEYEN, *supra* note 15, at 183.

¹⁹ On these goals, see Gary T. Schwartz, *Mixed Theories of Tort Law: Affirming Both Deterrence and Corrective Justice*, 75 TEX. L. REV. 1801, 1801-02 (1997) (discussing the goals of retribution and deterrence, and then proposing a mixed theory of tort law that incorporates both).

law,²⁰ including distributional justice and compensation, liability even for historic emissions could become meaningful again.

B. *Insurability*

The assertion that climate change damage (at least partially) may have begun in the distant past, when CO₂ emissions originated, may have some bearing on the liability issue, but may not necessarily prevent climate change liability. The issue that Kunreuther and Michel-Kerjan address in their article is the insurability of climate change liability. No matter how one views the desirability of retroactive liability for climate change damage itself, we have to recall that retroactive liability is often considered to endanger the insurability of particular risks.²¹ If insurers are confronted *ex post* with their insured's liability for an act that was not wrongful at the time when it was committed, insurability is endangered for the following reasons: (1) no premium could be asked for this risk, (2) no reserves could be set aside, and (3) no preventive measures could be required.²²

Therefore, the conclusion from this literature is straightforward: if a type of liability for climate change damage²³ were to be accepted, it would be desirable from an insurability perspective to limit this liability. The liability should then be limited more particularly (assuming that this is technically possible) to the damage caused from the moment that the emitters knew or should have known that their emissions could have caused climate change, and thus that there was wrongfulness in tort.²⁴ From that moment insurers could also have

²⁰ See, e.g., Farber, *supra* note 15, at 1642 (arguing that "a rule that requires compensation for past emissions can provide a precedent for future liability schemes that cover other emerging environmental harm").

²¹ See Boyd & Kunreuther, *supra* note 12, at 82-83 (noting that retroactive liability reduces firm value, thus reducing in equal measure the firm's incentive to protect against future environmental costs).

²² See generally Michael Faure & Paul Fenn, *Retroactive Liability and the Insurability of Long-Tail Risks*, 19 INT'L REV. L. & ECON. 487, 490-93 (1999) (modeling the insurability of retroactive liability).

²³ The reference here is to the type of liability discussed in Kunreuther & Michel-Kerjan, *supra* note 5, at 1841.

²⁴ See Richard Zeckhauser, *19th Annual Lecture of the Geneva Association: Insurance and Catastrophes*, 78 GENEVA PAPERS ON RISK & INS. 3, 5 (1996) (arguing that retrospective liability may affect the predictability of the risk). For a similar conclusion on the insurability of retrospective (environmental) liability risks, see Kenneth S. Abraham, *Environmental Liability and the Limits of Insurance*, 88 COLUM. L. REV. 942, 957-59 (1988) (arguing that retroactive liability, such as the scheme established by CERCLA, frustrates the insurance function because its costs are unanticipated and it is very difficult

required a premium, set aside a reserve, and instituted preventive measures to reduce the risk. Limiting the liability to the moment that emitters²⁵ knowingly contributed to climate change allows liability to help prevent climate change and increases the insurability of climate change damage.

II. CAUSAL UNCERTAINTY

A. Possible Solutions

Another classic condition for insurability of (environmental) liability is that the insured injurer is only held to compensate for the damage caused by her activity. Kunreuther and Michel-Kerjan rightly argue that this problem of causation will be a major issue when assessing climate change liability. Uncertainty concerning the causal relationship is one of the major issues addressed in any paper discussing climate change liability.²⁶ If a classic “but-for” test were to be applied, it is clear that many actions in climate change liability would be doomed to fail. Most plaintiffs will not succeed in proving that, but for the defendant’s emissions, the damage resulting from climate change would not have taken place. Indeed, many uncertainties arise. The causal uncertainty playing a role in the case of climate change is, of course, primarily a question of whether there is a clear and certain causal link between anthropogenic emissions and climate change. Although the experts gathered in the IPCC seemed increasingly convinced of an effect of anthropogenic emissions on the likelihood of climate change, they also indicated that a large degree of uncertainty remains.²⁷ In addition, there can be uncertainty as to the contribution of one particular polluter (or state, in the case of international

to insure) and Martin T. Katzman, *Pollution Liability Insurance and Catastrophic Environmental Risk*, 55 J. RISK & INS. 75, 85 (1988) (discussing the difficulty of calculating risk and loss distribution of future chemical disasters).

²⁵ Here I only consider liability of emitters (given the focus on insurability). Similar questions related to the goals of climate change liability, however, also arise when addressing state liability under international law.

²⁶ See, e.g., David A. Grossman, *Warming Up to a Not-So-Radical Idea: Tort-Based Climate Change Litigation*, 28 COLUM. J. ENVTL. L. 1, 22-33 (2003) (providing an overview of causation and the determination of liability for climate-change-related damages); Jaap Spier, *Legal Aspects of Global Climate Change and Sustainable Development*, INDRET, Apr. 24, 2006, at 1, 9-10, http://www.indret.com/pdf/346_en.pdf (asserting that, “for the time being,” global warming is too complex an issue to attribute causality to a specific polluter).

²⁷ IPCC, WORKING GROUP I, *supra* note 1, at 59-61.

climate change liability) to the particular climate change damage at issue. Moreover, the relationship between a particular emission of GHGs and the damage that is suffered (e.g., property damage resulting from flooding) may be quite remote and the damage may be due to causes other than the CO₂ emissions. A plaintiff in such a case will therefore hardly be able to prove that her particular damage has been caused by the emissions of the particular defendant.²⁸ She can, at best, suggest that the defendant has (partially) contributed to the risk of climate change damage. Some scholars have therefore come to the assistance of plaintiffs by proposing the use of a so-called proportional liability rule,²⁹ which generally states that scientific evidence would have to determine the likelihood that the defendant's behavior contributed to the particular risk (expressed as a percentage, say 10%). The defendant would accordingly be held liable to compensate 10% of the plaintiff's losses. This proportional liability rule has been applauded in the law and economics literature, especially where it was compared with the threshold liability rule, which is inherent in the application of the but-for test. The straightforward argument is that the but-for test (requiring that there should be a likelihood of more than 50% that the defendant's behavior caused the plaintiff's loss) will often lead to underdeterrence (in cases where the probability is systematically lower than 50%) or to overdeterrence (in cases where the probability is systematically just over 50%).³⁰ The proportional liability rule has the advantage that it forces the defendant to compensate the plaintiff's loss in proportion to the way in which the defendant contributed to the risk.³¹

²⁸ A defendant could be either a particular state (in the context of international climate change liability) or a corporation (like an energy producer). For a discussion of the difference between the two types of liability, see Eric A. Posner & Alan O. Sykes, *An Economic Analysis of State and Individual Responsibility Under International Law* 5-31 (Univ. of Chicago Law Sch., John M. Olin Law & Economics Working Paper No. 279 (2d Series) and Stanford Univ. Law Sch., John M. Olin Program in Law & Econ. Paper No. 318, 2006), available at <http://ssrn.com/abstract=885197>.

²⁹ See Grossman, *supra* note 26, at 31-33 (noting the possibility—in the context of climate-change-related harms—of apportioning damages among the defendants on the basis of the relative sizes of their market shares).

³⁰ See Steven Shavell, *An Analysis of Causation and the Scope of Liability in the Law of Torts*, 9 J. LEGAL STUD. 463, 472-75 (1980) (providing examples illustrating this assertion); Steven Shavell, *Uncertainty over Causation and the Determination of Civil Liability*, 28 J.L. & ECON. 587, 588-90 (1985) (critiquing the “threshold probability” theory of liability).

³¹ For discussions of the proportional liability rule, see William M. Landes & Richard A. Posner, *Tort Law as a Regulatory Regime for Catastrophic Personal Injuries*, 13 J. LEGAL STUD. 417, 425-31 (1984), John Makdisi, *Proportional Liability: A Comprehensive Rule*

B. *Insurability*

Kunreuther and Michel-Kerjan discuss this proportional liability rule, but are critical of it. They argue, inter alia, that there can still be a high amount of scientific uncertainty. In addition, they hold that even under a proportional liability rule many practical problems will still remain for plaintiffs. All of that is undoubtedly true.³² Within the framework of a discussion of conditions for insurability, however, it must be admitted that the proportional liability rule has considerable advantages compared to the all-or-nothing approach inherent in a threshold liability rule. Many have indicated that an all-or-nothing approach (or shifting the burden of proof to the defendant) may make the defendant, and thus her insurer, potentially liable for the entire market. It has been indicated in the literature that this may cause serious insurability problems.³³ The litigation surrounding the damage caused by the drug DES exemplifies the debate: the application of joint and several liability amounted to one insurer (that of the defendant who was found culpable) having to compensate losses not necessarily caused by the policyholder.³⁴ Theoretically, the defendant (and her insurer) could still recover from others on the basis of their contribution to the risk in a recourse action; however, the costs of recourse actions may be huge and other defendants may be judgment-proof. A proportional liability rule has the advantage of limiting the exposure of the defendant (and thus of her insurer) to the proportion that the defendant contributed to the risk. I reach the same con-

to *Apportion Tort Damages Based on Probability*, 67 N.C. L. REV. 1063, 1067-75 (1989), Glen O. Robinson, *Probabilistic Causation and Compensation for Tortious Risk*, 14 J. LEGAL STUD. 779, 791-95 (1985), and Robert Young, Michael Faure & Paul Fenn, *Causality and Causation in Tort Law*, 24 INT'L REV. L. & ECON. 507, 516-20 (2004).

³² Problems of causal uncertainty and the potential benefits of a proportional liability rule to deal with climate change damage are also discussed in contributions to this Symposium by Kirsten Engel and Daniel Farber. See Kirsten Engel, *Harmonizing Regulatory and Litigation Approaches to Climate Change Mitigation: Incorporating Tradable Emissions Offsets into Common Law Remedies*, 155 U. PA. L. REV. 1563, 1584-92 (2007) (discussing causal uncertainty and possible legal responses); Farber, *supra* note 15, at 1629.

³³ See Abraham, *supra* note 24, at 959-60 (explaining that the risk calculations involved in assessing the likelihood of liability under CERCLA's joint and several liability regime were so difficult that insurers ceased to offer coverage); Katzman, *supra* note 24, at 89-90 (arguing that judicial decisions, such as the adoption of joint and several liability theories, have diminished the insurability of pollution liability).

³⁴ Some have argued that shifting the risk of proving causal uncertainty to a defendant has the effect of requiring the defendant's insurer to insure the entire market. See MICHAEL G. FAURE & TON HARTLIEF, *INSURANCE AND EXPANDING SYSTEMIC RISKS* 125-27 (2003) (reviewing pertinent literature).

clusion with respect to retroactive liability: no matter how one judges the usefulness of various instruments to deal with causal uncertainty, from an insurability perspective, a proportional liability rule certainly seems to be the preferred mechanism. Other rules that shift more risk to the insurer than is caused by her insured may endanger the insurability of the risk.

Perhaps equally important for the insurability issue are a few topics implicitly discussed in Part III of Kunreuther and Michel-Kerjan's article, dealing with the question of whether there will be a sufficient supply and demand for insurance covering damage caused by climate change, those being two crucial conditions of insurability.³⁵

III. SUPPLY

Kunreuther and Michel-Kerjan indicate that insurers understandably get nervous when damage results from extreme weather events—the principal reasons being the uncertainty of the risk involved and the lack of insurance capacity.³⁶ The magnitude of the damage even in the case of a single weather-related event may, as the authors also indicate, easily outweigh the capacity of the private insurance markets, even if possibilities such as pooling or coinsurance and reinsurance are taken into account.

A. Reinsurance

As far as possibilities to increase capacity for insuring against catastrophic losses are concerned, in Part IV Kunreuther and Michel-Kerjan discuss other stakeholders who may affect insurers' decisions, particularly reinsurers. These stakeholders may to some extent remedy the capacity problem and thus increase supply. Many scholars, led by Kenneth Froot, have demonstrated the limited financing of catastrophic risks through reinsurance.³⁷ This limited capacity, along with

³⁵ Kunreuther & Michel-Kerjan, *supra* note 5, at 1810-26.

³⁶ See Howard Kunreuther, *Mitigating Disaster Losses Through Insurance*, 12 J. RISK & UNCERTAINTY 171, 178-80 (1996) (contending that low-probability, high-consequence events lead individuals to ignore insurance options and cause insurers to avoid offering coverage in order to limit their exposure); see also Christian Gollier, *Some Aspects of the Economics of Catastrophe Risk Insurance*, in CATASTROPHIC RISKS AND INSURANCE 13, 17-18, 23 (OECD ed., 2005) (noting that imperfect scientific knowledge makes it difficult for insurers to gauge the risk involved and highlighting the increased transaction costs that insurers face in the event of a catastrophe).

³⁷ See Kenneth A. Froot, *The Market for Catastrophe Risk: A Clinical Examination*, 60 J. FIN. ECON. 529, 555-59 (2001) (citing capital market shortages as a potential explana-

high premiums for catastrophe reinsurance, prevents the reinsurance industry from providing a strong backup for catastrophic insurers.

B. Government

This finding inevitably leads to the question of how compensation can be awarded, given the apparent limits of the reinsurance market to cover catastrophic losses. One possibility is to look at alternative arrangements, such as capital markets, to cover the type of catastrophic losses caused by weather-related events.³⁸ Another possibility is to call on the government to provide ex post compensation, either ad hoc or through a compensation fund. Such government relief programs, however, have often been criticized by economists as being unable to provide incentives for prevention.³⁹ The question arises whether in fact a third solution could provide a remedy, whereby the government does not provide ad hoc compensation as “Santa Claus” but merely intervenes precisely to cope with the problem of lacking capacity for the mentioned low-probability, high-damage events. In practice, one notices that in many domains where losses are potentially large, state intervention exists, usually precisely to cure this problem of deficient insurance capacity. States (or a combination of states) often act as a kind of reinsurer of last resort or at least provide some guarantee of compensation in case the damage exceeds certain limits. Traditionally, this state action was merely a guarantee of an additional layer of

tion for limited reinsurance capacity); Kenneth A. Froot & Steven E. Posner, *The Pricing of Event Risks with Parameter Uncertainty*, 27 GENEVA PAPERS ON RISK & INS. THEORY 153, 154 (2002) (arguing that catastrophic risk pricing is determined by reinsurers rather than the market, the consequence of which is that reinsurance prices are inordinately high).

³⁸ See ERIK BANKS, ALTERNATIVE RISK TRANSFER: INTEGRATED RISK MANAGEMENT THROUGH INSURANCE, REINSURANCE, AND THE CAPITAL MARKETS 115-70 (2004) (discussing the use of capital markets, including catastrophe bonds, contingent capital, and catastrophe derivatives, to cover catastrophic loss); ERIK BANKS, CATASTROPHIC RISK: ANALYSIS AND MANAGEMENT 111-46 (2005) (same); Michael G. Faure, *Alternative Compensation Mechanisms as Remedies for Uninsurability of Liability*, 29 GENEVA PAPERS ON RISK & INS. 455, 456-57 (2004) (analogizing from the way capital markets could be used to provide coverage for nuclear power plants).

³⁹ See Louis Kaplow, *Incentives and Government Relief for Risk*, 4 J. RISK & UNCERTAINTY 167, 172-73 (1991) (concluding that government relief for risk creates inefficiencies because individuals do not bear full responsibility for their insurance decisions); George L. Priest, *The Government, the Market, and the Problem of Catastrophic Loss*, 12 J. RISK & UNCERTAINTY 219, 228-29 (1996) (arguing that effective risk reduction is achieved more easily by market discipline than by government intervention).

compensation and added little by way of facilitating insurability.⁴⁰ Already in the nuclear liability conventions of the 1960s, a compensation system could be found consisting of various layers. One layer of the compensation was provided by the liable licensee of the nuclear power plant (and covered through insurance); a second layer was provided through the state; and a third layer was provided by all the contracting parties.⁴¹

The literature is divided on the desirability of these types of facilitative strategies as a “third way” to support the functioning of private insurance markets. Anne Gron and Alan Sykes see several difficulties with the government providing reinsurance. Governments, so they argue, are unlikely to set premiums in an “actuarially sound fashion” (given political pressures for subsidies); therefore, they may not be able to play a constructive role in the insurance coverage market.⁴² Government involvement would thus distort the market as far as stimulating insurability is concerned. Gron and Sykes instead favor ad hoc solutions whereby compensation is provided to victims of catastrophes on an ex post basis. They concede that in such cases there may be “some degree of moral hazard,” but they argue that the effect may be modest since government compensation is likely to be “incomplete and uncertain.”⁴³ In the Netherlands, lawyers have made a similar criticism after the introduction of a government reinsurance program for terrorism risk.⁴⁴

Other literature has held that there is little objection against the government supplementing the market where (re)insurance capacity

⁴⁰ However, one could argue that the additional layer of compensation provided by the state reduced the amount of damages that had to be compensated through insurers, which in turn reduced the insurance capacity needed.

⁴¹ For details of these conventions and for an economic analysis, see, for example, Michael G. Faure, *Economic Models of Compensation for Damage Caused by Nuclear Accidents: Some Lessons for the Revision of the Paris and Vienna Conventions*, 2 EUR. J. L. & ECON. 21, 24-25 (1995) and Michael Trebilcock & Ralph A. Winter, *The Economics of Nuclear Accident Law*, 17 INT'L REV. L. & ECON. 215, 215-17 (1997).

⁴² Anne Gron & Alan O. Sykes, *A Role for Government?*, REGULATION, Winter 2002-2003, at 44, 51.

⁴³ *Id.*

⁴⁴ See Karin Ammerlaan & Willem van Boom, *De Nederlandse Herverzekeringsmaatschappij voor Terrorismeschade: en de rol van de overheid bij het vergoeden van terreurschaden*, 78 NEDERLANDS JURISTENBLAD 2330, 2335-36 (2003) (arguing that the Dutch government should not intervene in insurance markets by providing reinsurance for the terrorism risks).

fails.⁴⁵ The main argument in favor of this government intervention is that without such intervention, compensation through insurance markets may fail altogether. The government intervention could thus create a market (or enlarge capacity) in which private insurers are still able to compete: the state would not replace, but simply would facilitate, the market. Of course, a functional program would require first that the government charge an actuarially fair premium and second that the intervention be temporary. Hence, the government should withdraw the moment that reinsurers or other market alternatives are able to take over this function.

In practice, one can notice many examples of these public-private partnerships.⁴⁶ For instance, in the United States there are many insurance schemes whereby the (federal or state) government intervenes to act as insurer of last resort and in some cases even as primary risk bearer. The California Earthquake Authority (CEA) assumes primary risk-bearing responsibility for the earthquake risk. The primary insurer plays an exclusively administrative role and the risk is taken over by the CEA. A similar model has been developed within the National Flood Insurance Program.⁴⁷ Also, as far as the terrorism risk is concerned, many governments now provide reinsurance or a

⁴⁵ See Kunreuther, *supra* note 36, at 183 (noting the stability and security offered by the Florida hurricane catastrophe trust fund created by state legislation); Howard Kunreuther, Neil Doherty & Anne Kleffner, *Should Society Deal with the Earthquake Problem?*, REGULATION, Spring 1992, at 60, 68 (arguing in favor of the creation of a federal reinsurance agency as a reinsurer of last resort); Reimund Schwarze & Gert G. Wagner, *In the Aftermath of Dresden: New Directions in German Flood Insurance*, 29 GENEVA PAPERS ON RISK & INS. 154, 163 (2004) (contending that the government must be involved as the "final insurer," but only in the case of large damages). *But cf.* Scott E. Harrington, *Rethinking Disaster Policy*, REGULATION, Spring 2000, at 40, 40-46 (arguing that government intervention promotes inefficient risk management because political pressures lead temporary measures to become permanent, which distorts the private insurance market).

⁴⁶ See Kunreuther & Michel-Kerjan, *supra* note 5, at 1828 (discussing the National Association of Insurance Commissioners task force); see also Erwann Michel-Kerjan & Nathalie de Marcellis-Warin, *Public-Private Programs for Covering Extreme Events: The Impact of Information Distribution on Risk Sharing*, 1 ASIA-PAC. J. RISK & INS. 21, 41 (2006) (citing the terrorism risk insurance programs in Spain, Australia, France, the United Kingdom, and the United States).

⁴⁷ See Robert L. Rabin & Suzanne A. Bratis, *United States*, in FINANCIAL COMPENSATION FOR VICTIMS OF CATASTROPHES: A COMPARATIVE LEGAL APPROACH 303, 330-31 (Michael G. Faure & Ton Hartlief eds., 2006) (explaining the need for the government to take primary responsibility for flood insurance since adverse selection proved too great a barrier for private insurance companies).

third layer of compensation.⁴⁸ For example, in Germany, a reinsurance company called Extremus was erected to cover the terrorism risk with a state guarantee for amounts above three billion and up to ten billion euros.⁴⁹ Also, in the Netherlands, a reinsurance company for terrorism damage was erected as a reaction to 9/11.⁵⁰ In the United Kingdom, reinsurance for the terrorism risk is provided through Pool Re.⁵¹ In France, the *Caisse Centrale de Réassurance* (CCR) provides reinsurance with state involvement for natural disasters and so-called technological risks.⁵² For the terrorism risk, a pool has been created, the *Gestion de l'Assurance et de la Réassurance des Risques Attentats et Actes de Terrorisme*, which also enjoys an unlimited state cover through the CCR.

Of course, some of these constructions could undoubtedly be criticized. Gron and Sykes argue that, in practice, as soon as governments “become[] involved in the sale of insurance against disasters, [they] do[] little to classify risks or price policies in an actuarially sound fashion.”⁵³ Undoubtedly, the same may be the case for some of the reinsurance constructions for the terrorism risk. This type of government intervention, however, has the principal advantage that it facilitates market solutions and thus avoids the negative distribution inherent in

⁴⁸ See generally Bernhard A. Koch & Stefan Strahwald, *Compensation Schemes for Victims of Terrorism*, in *TERRORISM, TORT LAW AND INSURANCE: A COMPARATIVE SURVEY* 260, 260-81 (Bernhard A. Koch ed., 2004) (explaining in brief U.S. and European state compensation schemes designed to protect victims of terrorist attacks); Jeffrey Manns, *Insuring Against Terror?*, 112 *YALE L.J.* 2509, 2512-13 (2003) (commenting on the innovative approach of the Terrorism Risk Insurance Act, which puts the government in the role of reinsurer rather than direct insurer); Erwann Michel-Kerjan & Burkhard Pedell, *Terrorism Risk Coverage in the Post-9/11 Era: A Comparison of New Public-Private Partnerships in France, Germany and the U.S.*, 30 *GENEVA PAPERS ON RISK & INS.* 144, 146-57 (2005) (describing these different approaches to government involvement in terrorism insurance programs).

⁴⁹ See Michel-Kerjan & Pedell, *supra* note 48, at 149-53 (describing the German Extremus AG program).

⁵⁰ This company is called the Netherlands Reinsurance Company for Terrorism Damage (*Nederlandse Herverzekeringsmaatschappij voor Terrorisme Schade*).

⁵¹ See Michael Huber & Tola Amodu, *United Kingdom*, in *FINANCIAL COMPENSATION FOR VICTIMS OF CATASTROPHES*, *supra* note 47, at 261, 277-78 (explaining that the British government reinsures the pool of insurance firms and thus effectively acts as insurer of last resort).

⁵² For further information on the CCR, see CCR: Company Introduction, http://www.ccr.fr/gb/gb-1024/ent_presentation.jsp (last visited May 1, 2007).. See also Michel Cannarsa, Fabien Lafay & Olivier Moréteau, *France*, in *FINANCIAL COMPENSATION FOR VICTIMS OF CATASTROPHES*, *supra* note 47, at 81, 101-03 (describing the function of the CCR).

⁵³ Gron & Sykes, *supra* note 42, at 51.

ad hoc compensation. Of course, a government intervention as reinsurer should still leave the private insurer with the freedom to choose to rely on state reinsurance or not. A duty to call on the state-provided reinsurance (as is apparently the case in France) might be criticized from the perspective of competition law.⁵⁴

The question thus arises whether such government intervention could also be an attractive remedy to increase capacity problems in the case of weather-related events. If such a state-run program could be constructed so that it corresponds with economic starting points (such as charging a correct, risk-based premium for this temporary intervention), the disruptive effect of the government intervention could be minimized.⁵⁵ Moreover, this intervention may support the insurability of damage caused by extreme weather events resulting from climate change as discussed in this volume.

IV. DEMAND

A. *Willingness To Pay Risk Premium*

Kunreuther and Michael-Kerjan mention that one particular problem that arises for insurers when dealing with climate change damage is the uncertainty concerning both the probability of the occurrence and the magnitude of the damage. One way of dealing with this uncertainty, as indicated in earlier work by Kunreuther and others, is to charge a so-called “risk premium.” The risk premium would be the appropriate remedy to take account of the uncertainty regarding the probability of catastrophic losses.⁵⁶ In their article, Kunreuther and Michel-Kerjan provide an assessment of the different risk premiums that would have to be charged under various scenarios. The question arises, however, whether the insurers actually follow this advice. In practice, charging the additional risk premium is not always

⁵⁴ See Roger van den Bergh & Michael Faure, *Compulsory Insurance of Loss to Property Caused by Natural Disasters: Competition or Solidarity?*, 29 *WORLD COMPETITION* 25, 33-35 (2006) (delineating the ways in which the French system runs afoul of competition law).

⁵⁵ In the words of Christian Gollier, “[e]x-post, the social pressure for the public indemnification of the uninsured victims of a much publicized catastrophe will be strong. Solidarity kills market insurance.” Gollier, *supra* note 36, at 25.

⁵⁶ Howard Kunreuther, Robin Hogarth & Jacqueline Meszaros, *Insurer Ambiguity and Market Failure*, 7 *J. RISK & UNCERTAINTY* 71, 79-82 (1993) (citing surveys of underwriters, actuaries, and reinsurers that recommended premiums increase in the face of ambiguity).

the preferred solution to insurability problems. This is partially due to the fact that insurers are in some cases “systematically more ambiguity-averse than consumers.”⁵⁷ The result may be that the additional risk premium charged would be so high that consumers would be unwilling to pay. Another possible reason has to do with the well-known cognitive limitations and bounded rationality of consumers. This problem has two different aspects. Psychologists and behavioral law and economics scholars have indicated that low-probability events like natural hazards are systematically misjudged.⁵⁸ It is well known that as a result of this, individuals will often take an “it will not happen to me” attitude.⁵⁹

Moreover, other psychological experiments have also shown that, *ex ante*, people may prefer uncertain losses rather than the certain loss of having to pay a premium. Kunreuther showed that because insurance is considered an investment, some people will refuse to insure against low-probability, high-damage events (such as flooding) because there is a likelihood of never receiving any return during a lifetime.⁶⁰ These types of insurance provide a low expectation of a return on the “investment,” and hence, there is a correspondingly low demand. Indeed, all of these phenomena indicate that individuals will have a low demand for insurance coverage and will certainly not be willing to pay the additional risk premium charged by insurers to cope with the insurers’ ambiguity.

⁵⁷ Gollier, *supra* note 36, at 24.

⁵⁸ See Paul Slovic, Howard Kunreuther & Gilbert F. White, *Decision Processes, Rationality and Adjustment to Natural Hazards*, in *THE PERCEPTION OF RISK* 1, 7 (Paul Slovic ed., 2000) (describing a misperception about flood insurance).

⁵⁹ Kunreuther, *supra* note 36, at 175; see also Richard A. Epstein, *Catastrophic Responses to Catastrophic Risks*, 12 J. RISK & UNCERTAINTY 287, 293 (1996) (citing Kunreuther’s research); Richard Zeckhauser, *The Economics of Catastrophes*, 12 J. RISK & UNCERTAINTY 113, 115 (1996) (same).

⁶⁰ See HOWARD KUNREUTHER ET AL., *DISASTER INSURANCE PROTECTION: PUBLIC POLICY LESSONS* 248 (1978) (noting that consumers are a key source of catastrophic market failure because they view insurance as a poor investment); Paul J.H. Schoemaker & Howard C. Kunreuther, *An Experimental Study of Insurance Decisions*, 46 J. RISK & INS. 603, 612 (1979) (offering the possibility that people view insurance as an “investment aimed at maximizing claim payments in case the hazard occurs”); Paul Slovic et al., *Preference for Insuring Against Probable Small Losses: Insurance Implications*, in *THE PERCEPTION OF RISK*, *supra* note 58, at 51, 62-71 (noting that people are more willing to purchase insurance when they feel they cannot lose).

B. *Result: Low Coverage*

The result is the well-known phenomenon that, in countries where voluntary first-party insurance for catastrophic losses (such as the ones caused by flooding) is available,⁶¹ victims apparently do not insure, or insure only to a limited extent. The evidence in that respect is overwhelming; Kunreuther and others have already documented the low demand for earthquake insurance, even in areas that are vulnerable to earthquake risks.⁶² Well known is the example that after the Northridge earthquake in California in 1994, a high number of citizens decided to buy first-party disaster insurance as a reaction to the damages they suffered. One month later, however, when daily life took over, many of those new insurance policies were cancelled.⁶³ The underinsurance for flooding risks has also already been described in the literature.⁶⁴ Recently, the experience with Katrina showed once more that only a low percentage of homeowners purchase flood insurance.⁶⁵ Similar evidence comes from Europe. For instance, after the flooding of the river Elbe in 2002—referred to as the “flood of the century”⁶⁶—it appeared that only a very small percentage of victims had insurance coverage.⁶⁷

⁶¹ In some countries, insurance against natural hazards is available only to a limited extent, or not at all. This was the case in the Netherlands, where insurance for flooding and earthquake risks was for a long time excluded as a result of a cartel agreement between insurers who agreed not to cover the particular risks. As a result of intervention from the European competition authorities, these so-called “binding decisions” were abrogated. For details, see Michael G. Faure & Ton Hartlief, *The Netherlands*, in FINANCIAL COMPENSATION FOR VICTIMS OF CATASTROPHES, *supra* note 47, at 195, 203-06.

⁶² See Kunreuther, Doherty & Kleffner, *supra* note 45, at 60 (noting that Californians remained uninsured despite knowing that earthquake insurance existed).

⁶³ For details regarding a voluntary insurance scheme and the human proclivity to opt out, see Rabin & Bratis, *supra* note 47, at 328-29 and Slovic, Kunreuther & White, *supra* note 58, at 14.

⁶⁴ See, e.g., Kunreuther, *supra* note 36, at 173 (presenting statistics that only one-fourth of households in flood-prone areas had flood insurance in 1995); cf. Zeckhauser, *supra* note 59, at 135 (noting similar underinsurance regarding earthquakes).

⁶⁵ In Louisiana the percentage of homeowners with insurance ranged from 7.3% in Tangibahoa to 57.7% in St. Bernard's. In New Orleans only 40% had flood insurance. Howard Kunreuther, *Has the Time Come for Comprehensive Natural Disaster Insurance?*, in ON RISK AND DISASTER: LESSONS FROM HURRICANE KATRINA 175, 175 (Ronald Daniels, Donald F. Kettl & Howard Kunreuther eds., 2006).

⁶⁶ In Germany, the flood is referred to as the “Jahrhundertflut.”

⁶⁷ See Ulrich Magnus, *Germany*, in FINANCIAL COMPENSATION FOR VICTIMS OF CATASTROPHES, *supra* note 47, at 119, 130 (noting that only 50% of households during this flood had flood insurance); Schwarze & Wagner, *supra* note 45, at 156-60 (explaining insurers' financial troubles in the wake of this flood).

C. Mandatory Coverage

These findings of course lead to the question of whether, at the policy level, the factual availability of insurance should be made compulsory. If it seems desirable to grant victims of climate change damage compensation as a normative matter,⁶⁸ mandatory insurance has a certain appeal. Kunreuther already advanced this model for natural disasters in 1968,⁶⁹ and the suggestion was recently repeated after Hurricane Katrina.⁷⁰ The introduction of a regulatory duty to insure against the consequences of weather-related events has also received support from European legal scholarship.⁷¹

A well-known example of such a mandatory insurance for the consequences of natural hazards can be found in France, where all individuals who have taken out first-party property damage insurance policies are required by law to pay a supplementary premium for a mandatory coverage for natural disasters.⁷² There is, therefore, no general duty to insure, but a compulsory, complimentary coverage on voluntary property damage contracts. The system is financed through an additional premium of 12% on all property damage insurance contracts, which covers damage caused by natural hazards.⁷³ Of course, the details of the system are open to critique. For example, one could criticize the fact that the additional premium for the disaster coverage is fixed, which limits competition,⁷⁴ or the fact that coverage will only apply if an incident has been declared a catastrophe by the govern-

⁶⁸ See Farber, *supra* note 15, at 1607 (assuming such a normative preference while discussing the challenges of a compensation scheme).

⁶⁹ Howard Kunreuther, *The Case for Comprehensive Disaster Insurance*, 11 J.L. & ECON. 133 (1968).

⁷⁰ See Kunreuther, *supra* note 65, at 186-88 (proposing comprehensive disaster insurance in the wake of Hurricane Katrina); Howard Kunreuther & Mark Pauly, *Rules Rather Than Discretion: Lessons From Hurricane Katrina*, 33 J. RISK & UNCERTAINTY 101, 102-04 (2006) (advocating mandatory comprehensive disaster insurance instead of ex post relief).

⁷¹ For examples of European scholarship, see Michael Faure, *Financial Compensation in Case of Catastrophes: A European Law and Economics Perspective*, in TORT AND INSURANCE LAW YEARBOOK: EUROPEAN TORT LAW 2004 at 2, 13-15 (Helmut Koziol & Barbara C. Steininger eds., 2005) and Schwarze & Wagner, *supra* note 45, at 154-168.

⁷² For a description of the French system, see Olivier Moréteau, *Policing the Compensation of Victims of Catastrophes: Combining Solidarity and Self-Responsibility*, in SHIFTS IN COMPENSATION BETWEEN PRIVATE AND PUBLIC SYSTEMS (Willem H. van Boom & Michael Faure eds., forthcoming 2007).

⁷³ For details, see Cannarsa et al., *supra* note 52, at 85-89.

⁷⁴ Some competition is of course still possible with respect to the basic housing policy to which the mandatory disaster coverage is added.

ment, which may lead to undesirable political pressure. Notwithstanding these criticisms concerning details of the system,⁷⁵ the model of mandatory coverage in addition to voluntarily purchased insurance policies may be tempting for climate change damage as well.

This model also receives some support from behavioral law and economics scholars. It is argued that when disaster insurance is sold along with insurance against likely losses (such as housing insurance) at a reasonable extra cost, more people will purchase insurance against the low-probability loss for which they would otherwise have no demand.⁷⁶ This literature concludes that if it is in society's best interest for people to insure themselves against unlikely calamities (such as weather-related events), adding protection against a small but likely loss might help accomplish this purpose. The question therefore arises whether this model—which was advanced as a solution for damage caused by flooding and the like—may also be useful for the type of weather-related damage resulting from climate change, which is the central focus of this Symposium. The literature indicates that there are several potential dangers to this model, but there are advantages as well.⁷⁷

D. Dangers

This section provides a brief summary of potential dangers associated with the mandatory coverage model.

Paternalism. When introducing mandatory disaster coverage, there is always a danger that the legislature in fact forces potential victims to purchase an insurance policy even if there would be no demand. The problem is that the behavioral literature not only shows a lack of information (in which case the information asymmetry could constitute a reason for a regulatory duty to purchase insurance), but it also demonstrates that even when potential victims are well informed about the

⁷⁵ For an example of such criticisms, see Erwann Michel-Kerjan, *Insurance Against Natural Disasters: Do the French Have the Answer? Strength and Limitations* 7-14 (Ecole Polytechnique, Cahier No. 2001-007, 2001).

⁷⁶ See Slovic et al., *supra* note 60, at 71 (suggesting combining “low-probability hazards with higher probability threats in one insurance ‘package’”).

⁷⁷ It would of course go too far to discuss all of these in detail within the scope of this Commentary. For a more detailed analysis, see Michael G. Faure, *Financial Compensation for Victims of Catastrophes: A Law and Economics Perspective*, L. & POL'Y (forthcoming 2007) (manuscript at 12-17, on file with author), Kunreuther & Pauly, *supra* note 70, at 101-16; Michel-Kerjan, *supra* note 75, at 6-9, and Schwarze & Wagner, *supra* note 45, at 165-66.

risks, they prefer not to purchase insurance because they perceive the policy as an investment. In the case of low-probability, high-loss events, there is a great likelihood that people will be paying a large premium without ever having any return during a lifetime.⁷⁸ Hence, this research shows that it is not primarily poor information of potential victims that would cause the low demand, but rather the unwillingness of victims (even if well informed) to purchase coverage against low-probability, high-loss events. If this were the case, there is always a danger that the mandatory insurance in fact amounts to paternalism.⁷⁹

Risk Advertising as an Alternative: If lacking information would be the reason for a duty to insure, one could hold that regulation aiming at providing information might to some extent be a less interventionist remedy than mandatory insurance. Showing people the consequences of flooding with visual displays, for example, may help to persuade the public to view insurance as a potential remedy.⁸⁰ A weakness in this argument, however, is that behavioral experiments have shown that regulation is only marginally successful in curing the information deficiency.⁸¹

Overgeneralization: A generalized duty to purchase flooding coverage, for example, always entails the risk that the duty is also imposed on those who constitute no risk at all, such as the owner of an apartment on the tenth floor. This problem plays less when a generalized duty to provide coverage (for all type of risks) is imposed, such as in the French case. If one cannot be a victim of flooding, there can at least be other risks (such as heavy rainfall, winds, or tornados) to

⁷⁸ See Slovic et al., *supra* note 58, at 25-26 (describing the insurance premium as an estimate of risk); Slovic et al., *supra* note 60, at 62 (proposing to reimburse those who make no claims as a solution to the preference of insuring against high-probability, low-loss events).

⁷⁹ See Anthony I. Ogus, *Regulatory Paternalism: When Is It Justified?*, in CORPORATE GOVERNANCE IN CONTEXT: CORPORATIONS, STATES, AND MARKETS IN EUROPE, JAPAN AND THE U.S. at 303, 303-20 (Klaus J. Hopt et al. eds., 2005) (analyzing the benefits and risks of paternalist regulation).

⁸⁰ See Slovic et al., *supra* note 60, at 71 (noting the possibility that increased publicity may persuade the public that insurance is a matter of community well-being as opposed to a personal choice).

⁸¹ See Paul Slovic, Baruch Fischhoff & Sarah Lichtenstein, *Response Mode, Framing and Information-Processing Effects in Risk Assessment*, in THE PERCEPTION OF RISK, *supra* note 58, at 154, 166 (noting various problems standing in the way of effective informational programs).

which one can be exposed.⁸² This problem is more serious if the duty is limited to a specific risk, such as flooding. In that particular case one might be more inclined to limit the duty to specific risk areas, but the administrative (and, more particularly, political) costs of identifying those areas may be high. This was shown in the case of Belgium, where a new act of May 2003 introduced additional mandatory coverage on voluntary insurance policies, but proposed to apply this new solution only to persons living in specified risk areas. These risk areas were to be identified through regulation.⁸³ However, the attempt to identify the risk areas led to political disagreement and subsequently made it impossible to apply the act. The result was that in 2005 a new system was introduced, which imposed a generalized duty to purchase additional coverage for natural hazards in addition to fire insurance.⁸⁴ It seemed impossible to pursue the idea of limiting the mandatory coverage, given the high political costs of identifying the special risk areas where the duty to insure would apply.

Anti-Competition: The duty to purchase mandatory disaster coverage in addition to voluntarily purchased property damage contracts may cause problems from the angle of competition law. It is a so-called tie-in agreement forcing a consumer to buy a specific service or product together with another product, which may restrict competition.⁸⁵

Availability: Mandatory coverage is of course only a solution where insurance markets are available. As Kunreuther and Michel-Kerjan⁸⁶ show in their article, in many instances today, catastrophic losses are suffered in developing countries, and a large part of these losses is not covered under insurance at all. Where insurance markets are not available to a large part of the population, imposing mandatory disaster insurance will of course not be the miracle solution.

⁸² But see Schwarze & Wagner, *supra* note 45, at 165 (critiquing the French system's "dual approach" in which people must insure separately for "storm guarantee" and against natural hazards).

⁸³ Isabelle Durant, *Belgium*, in FINANCIAL COMPENSATION FOR VICTIMS OF CATASTROPHES: A COMPARATIVE LEGAL APPROACH, *supra* note 47, at 37, 66-69 (describing the key provisions of the Act of 21 May 2003).

⁸⁴ Philippe Colle, *De wet van 17 september 2005 betreffende de verzekering van natuurrampen*, 69 RECHTSKUNDIG WEEKBLAD 881, 881-85 (2006).

⁸⁵ For more on this issue, see Van den Bergh & Faure, *supra* note 54, at 25-54.

⁸⁶ See Kunreuther & Michel-Kerjan, *supra* note 5, at 1803-04.

E. *Advantages*

Noted below are the positive aspects of the mandatory coverage model.

Efficiency: Given the high number of voters involved, one has to realize the politicians will always have the tendency to provide some form of compensation after a large number of victims is affected by a disaster. This will undoubtedly also be the case when damage is caused by climate change. In that respect, the solution of some form of mandatory coverage for those who are actually at risk seems preferable to the alternative of government intervention through ad hoc or structural fund solutions.

Market Failure: As already indicated above, the ex post, ad hoc, and fund solutions are criticized from both legal and economic perspectives. Law and economics scholars consider ad hoc compensation a “catastrophic response[] to catastrophic risk.”⁸⁷ Many economists fear that the government intervention will dilute incentives of parties and insurance markets to develop solutions themselves. The failing of insurance markets is, so it is held, a “self-fulfilling prophecy that propels us into another round of misguided regulation.”⁸⁸ Kunreuther on the other hand indicated that there is no evidence that, ex ante, individuals have no demand for insurance coverage merely because they would count on ex post compensation through the government.⁸⁹

Distributive Justice: The insurance solution also has the advantage that potential victims of climate change damage can (where insurance is available) pay a premium ex ante for a loss that they may suffer themselves. Hence, victims pay in a way for a protection they may receive ex post. From a distributional perspective, the solution is clearly preferable to a generalized compensation through government whereby taxpayers pay at random for some losses suffered by particular victims.

Accurate Pricing: The advantage of the insurance solution is that insurance can play an important role in the prevention of risk. Kunreuther and Michel-Kerjan rightly argue in their article that insurers can require an adequate risk differentiation and thus contribute to

⁸⁷ Epstein, *supra* note 59, at 287-88.

⁸⁸ *Id.* at 305; see also Gollier, *supra* note 36, at 25 (arguing that “if citizens believe that the state will compensate them for their damages, they will prefer not to insure the risk”).

⁸⁹ Kunreuther, *supra* note 36, at 177.

adequate prevention, wherever this is possible.⁹⁰ Again, this proposal receives support from behavioral law and economics. It is argued that compulsory insurance is a good example of a policy that can play a role in improving hazard perception. Insurance requires “explicit, conscious attention to the risk by the individual concerned,” expressed through the premium charged.⁹¹ Many examples exist of risk differentiation applied by insurers as far as the flooding risk is concerned. For example, in Germany insurers apply a model whereby regions are divided into various risk areas depending upon the probability of flooding. Depending upon the category to which the particular property belongs, premiums will be differentiated and, in the case of high flood risk, coverage may only be provided after strict individual checks.⁹² Of course, applying these relatively straightforward principles of risk differentiation may be possible in the case of more-or-less traditional natural hazards like flooding, but may be far more difficult to apply when risks seriously increase as a result of climate change. The underlying reason behind the premium differentiation is to give incentives to potential victims to relocate to safer areas. The question of course arises as to whether that is always an option for potential victims who may lack resources to move to safer (and potentially more expensive) areas. A far-reaching differentiation of risks in cases where potential victims have no alternative may thus lead to adverse distributional consequences.

Efficient Regulation: Generally, if there should be any government intervention at all, it seems more appropriate for the government to focus on measures to facilitate the functioning of insurance markets rather than playing “Santa Claus” (e.g., through ad hoc or ex post compensation, or through compensation funds). The latter does not positively contribute to the functioning of insurance markets, whereas an intervention through government-provided reinsurance would.

⁹⁰ Kunreuther & Michel-Kerjan, *supra* note 5, at 1824. This point is also stressed by Priest, *supra* note 39, at 219.

⁹¹ See Slovic et al., *supra* note 58, at 25.

⁹² See Schwarze & Wagner, *supra* note 45, at 159-60 (explaining the zoning regions in Germany’s coverage plan); CORNELIA R. KARGER, WAHRNEHMUNG UND BEWERTUNG VON “UMWELTRISIKEN”: WAS KÖNNEN WIR AUS DER FORSCHUNG ZU NATURKATASTROPHEN LERNEN?, ARBEITEN ZUR RISIKO-KOMMUNIKATION (Forschungszentrum Jülich, Arbeiten zur Risikokommunikation Heft 57, 1996) (discussing the observation and valuation of environmental risks and analyzing the extent to which the experience with natural catastrophes can provide an example for risk differentiation in the case of environmental damage).

F. Evidence

The French model—which provides mandatory disaster insurance in addition to voluntary housing insurances—seems to have become increasingly popular in practice. Several European countries now follow the French example; for instance, as a result of a legislative change in Belgium, compulsory flood coverage in addition to the voluntary fire insurance has been introduced.⁹³ In Italy, a legislative initiative aimed at some form of mandatory coverage against damage caused by disasters is under discussion as well,⁹⁴ and the same has recently been proposed in German legal doctrine.⁹⁵

However, in each of these models, one can notice that there is some form of additional reinsurance provided through the state to cope with large losses. It is a form of public-private partnership to which Kunreuther and Michel-Kerjan refer in their article.⁹⁶ Apparently this model is now preferred at the policy level over the traditional “Santa Claus” model, whereby governments provide random compensation to some victims *ex post*. These *ad hoc* solutions are thus also criticized by lawyers from the perspective of the equality principle: some victims of particular catastrophes may enjoy generous government relief, whereas other victims of other accidents may not enjoy this *ad hoc* generosity.⁹⁷ The appeal of the insurance model supported by government is clear: the government intervention now focuses on supporting insurability, some form of risk differentiation (which is usually absent in any government compensation program) is still possible,⁹⁸ and those who may benefit *ex post* from the compensation also pay *ex ante* for their protection through insurance premiums. The question thus arises whether this model may also have some appeal if one wishes to provide compensation for climate-change-related damage as well.

⁹³ For a description of the changes in Belgium, see Durant, *supra* note 83, at 37-39.

⁹⁴ See Alberto Monti & Filippo Andrea Chiaves, *Italy*, in FINANCIAL COMPENSATION FOR VICTIMS OF CATASTROPHES, *supra* note 47, at 145, 186-91.

⁹⁵ See Schwarze & Wagner, *supra* note 45, at 162-63 (making such a proposal).

⁹⁶ See Kunreuther & Michel-Kerjan, *supra* note 5, at 1842.

⁹⁷ See Magnus, *supra* note 67, at 124 (criticizing the generous compensation for victims of flooding (up to 8.1 billion euros!) after the Elbe flooding in 2002). For a similar criticism, see Zeckhauser, *supra* note 59, at 114.

⁹⁸ See Schwarze & Wagner, *supra* note 45, at 166-67 (discussing the advantages of insurance-based solutions over government disaster funds).

CONCLUSION

Kunreuther and Michel-Kerjan's article provides interesting and convincing data showing that insurers will have to take into account more weather-related incidents with potentially high damage in the near future. In this Commentary, I first focused on some problems that may arise in the case of liability insurance for climate-change-related damage. Two major issues that will arise in climate change litigation are retroactivity and uncertainty about causation. I argued that the way in which these issues are solved may have important implications for the insurability of climate change liability. Even though a retroactive liability (also for past emissions) may be desirable from a distributional perspective, it may seriously endanger the insurability of such a liability. The same conclusion can be reached concerning the uncertainty over causation: solutions suggested in legal doctrine (or even in case law) amounting to a shift of the risk of causal uncertainty to enterprises can cause serious insurability problems. Many of these can be avoided if a proportional liability rule is followed. Even though Kunreuther and Michel-Kerjan rightly argue that proportional liability may not be the miracle solution to climate change liability (since many uncertainties still arise), it may be desirable, as it allows climate change liability to remain insurable.

In addition, I formulated a few further concerns about the supply and demand in the case of climate-change-related damage generally. To some extent, I continued where Kunreuther and Michel-Kerjan ended their article by asking whether government intervention may be necessary. I argued that the insurability of climate-change-related damage can probably not be assessed without taking into account the possibility of government intervention. This may indeed be, as I tried to show, to some extent unavoidable in order to guarantee a supply and demand for this type of damage, and hence to create an insurance market at all. I offered the following suggestion for how this government intervention could take place: (1) mandatory coverage for specific weather-related events, if possible limited to specific risk areas (if the administrative costs of determining the risk areas are not too high); and (2) accompanying facilitative (perhaps temporary) strategies to support the capacity, provided that these are based on market principles (i.e., charging a correct price) and promote rather than distort competition. Under these conditions, one may hope that insurers, supported by government, may also play an important role in covering damage resulting from climate change.