Parametric Insurance as an Alternative to Liability for Compensating Climate Harms

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Interstate compensation for climate change based on legal liability faces serious obstacles. Structural incongruities related to causation, time, scope, and scale impede application of tort law to climate change, while political opposition from developed countries prevents intergovernmental consideration of liability as a means of compensating for climate damages. Insurance, however, in particular parametric insurance triggered by objective environmental indices, is emerging as a promising alternative to liability. This is manifest in the UNFCCC and the Paris Agreement, which ruled out recourse to legal liability, and in the formation and expansion of regional sovereign climate risk insurance schemes in the Caribbean, Africa, and the Pacific. Theory and early practice suggest that parametric insurance exhibits five key advantages compared to legal liability in the climate change context: (1) it does not require that causation be demonstrated; (2) it has evolved to provide catastrophic coverage; (3) it is oriented toward the future rather than the past; (4) it is contractual, rather than adversarial, in nature; and (5) it provides a high degree of predictability. Compensation based on parametric insurance represents a novel climate policy option with significant potential to advance climate politics.

I. Introduction

Efforts by some states to obtain compensation for climate change from other states on the basis of liability are unlikely to succeed. Climate lawsuits have failed in multiple jurisdictions largely due to judicial determinations that climate change is a non-justiciable 'political question.' Beyond this, a number of structural incongruities exist between tort law and climate change, including issues related to causation, duty of care, temporal proximity, and scale of damages. At the international level, political recognition of such obstacles has effectively been institutionalised with the adoption of the Paris Agreement.

Yet developments in and around the Paris Agreement, rooted in discussions that predate the United Nations Framework Convention on Climate Change (UNFCCC), also point toward a potential alternative to liability as a basis for intergovernmental compensation for climate damages: parametric insurance. While traditional loss-based insurance in which indemnities are tied to actual losses is a familiar complement to many tort systems, parametric insurance, in which payouts are determined by the value of an independent index, is a recent development that may under some circumstances serve as a substitute for liability law. Compared to loss-based insurance, parametric insurance alleviates problems of moral hazard and adverse selection but introduces the new problem of 'basis risk.' In this article, I argue that parametric insurance avoids the incongruities likely to impede future application of legal liability to climate change while offering additional advantages in terms of institutional culture and predictability, all of which make parametric insurance a promising alternative basis for interstate compensation for climate change.

The analysis presented here is restricted in two important ways. First, it is focused on potential compensation for climate harms *among states*, that is, on an intergovernmental basis. Clearly, existing international liability law is based on tort systems developed in various domestic settings; while national tort laws will thus inform the analysis, the focus will be squarely on their implications for interstate relations. And

DOI: 10.21552/cclr/2018/4/4

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second, the ideas explored here are considered at the conceptual level rather than in detail, based on the assumption that the compatibility or lack thereof between climate and alternative forms of compensation is ultimately a function of structural consistency.

I proceed as follows. In the next section, I briefly review the history of climate tort actions and discuss key structural incongruities likely to frustrate future national and international tort claims. I then consider the political and discursive turn away from liability and toward insurance in international climate negotiations. Next, I differentiate parametric insurance from traditional loss-based insurance. I then explore three emerging regional climate risk insurance schemes. Finally, I consider ways in which compensation based on parametric insurance may be superior to compensation based on liability in the climate context. I end with a discussion and conclusion.

II. Legal Liability and Climate Change

To date, no interstate climate liability claims have been pursued, but a limited number of tort actions seeking money damages for losses have been filed in domestic courts.[1] Almost all have been filed in the United States (US). In *Comer v. Murphy Oil USA, Inc.*, plaintiffs sued fossil fuel companies for damages related to Hurricane Katrina, arguing that climate change made the storm more destructive than it otherwise would have been.[2] The case was ultimately dismissed on multiple bases including a ruling that climate policy is a non-justiciable 'political question' beyond the purview of the courts, and federal displacement (preemption) of state law. In *California v. General Motors Corp.*, the state of California sued several automobile manufacturers seeking climate-related damages caused by GHG emissions from their vehicles.[3] This case was also dismissed on grounds of non-justiciability, and the state dropped a subsequent appeal. In *Native Village of Kivalina v. ExxonMobil Corp.*, a native Alaskan village sued an array of oil and gas and utility companies seeking to recover damages from climate change.[4] This case was dismissed on grounds of non-justiciability, failure to demonstrate causation, and federal statutory displacement of federal common law tort actions.

More recently, damage claims filed by California municipalities against multiple fossil fuel companies in *City of Oakland v. BP p.l.c.* were dismissed based on displacement as well as the international scope of the suits (related suits involving different California jurisdictions are pending, as are a handful of similar suits outside California).[5] In *Harris County Flood Control District v. Kerr*, the court rejected a claim of liability for flood damage due in part to the vast scale of future climate liabilities its success would imply.[6] The only liability claim pursued outside the US is in Germany, where a private international law suit, *Lliuya v. RWE AG*, has been filed by a Peruvian national seeking tort damages from a German utility.[7] An initial dismissal based on failure to demonstrate causation was overturned on appeal, and the case is currently proceeding through the courts.

Up to now, such cases have generally failed due to issues of preemption and the reticence of courts to take up issues they regard as political in nature. Even if progress was not frustrated for these reasons, however, deeper structural problems would likely hinder successful tort-based climate litigation. Legal theory and economic analysis suggest at least four structural incongruities between traditional conceptions of liability and essential features of climate change as a public policy issue that pose serious obstacles to applying tort law to climate change.

First, the concept of liability is traditionally based on an assumption of deterministic causation in which an accident is shown to be the result of a series of preceding actions and events, which can be traced directly from an initial cause to the injury in question. In tort law this concept of causation is reflected in the but for test ('but for X, would Y have occurred?'). Climate science, however, treats causation in strictly probabilistic terms, that is, a climate effect does not follow straightforwardly and inevitably from a climate condition, but rather follows from that condition with some degree of likelihood. When considering climate, no event can be said to necessarily follow from any cause or condition. Thus,

1 Sabin Center for Climate Change Law, 'Climate Change Litigation Databases' <http://www.climatecasechart.com> accessed 23 July 2018.

2 *Comer v Murphy Oil USA, Inc* [2013].

3 *California v General Motors Corp* [2009].

4 *Native Village of Kivalina v ExxonMobil Corp* [2013].

5 *City of Oakland v BP plc* [2018].

6 *Harris County Flood Control District v Kerr* [2016].

7 *Lliuya v RWE AG*.

no particular instance of damage associated with weather or climate can be attributed unequivocally to climate change as opposed to natural variability. (By extension, no damage can be attributed unequivocally to any individual agent that contributed to climate change, either by releasing carbon dioxide directly or by enabling industrial-era anthropogenic emissions.) And yet liability law generally requires definitive causal statements (based on the preponderance of evidence). Contrasting theories of causation thus appear to impede efforts to integrate legal liability and climate change.

Second, under the negligence rule common to domestic tort law, a duty of care is assumed to be relatively unproblematic to define, and by extension so too is a breach of that duty. In the case of climate change, however, specifying a standard of reasonable care for acts that entail emissions of GHGs is extremely difficult due to both the wide variety of activities linked to GHG emissions, and the tenuous connection between any such activity and eventual climate change damages.[8] Moreover, a duty of care necessarily applies to acts with foreseeable harms, yet it makes little sense to regard climate harms ultimately produced by the sum total effects of discrete emissions activities as foreseeable from the vantage point of any potential defendant or class of defendants.[9]

Third, related to but distinct from the issue of foreseeability, successful liability claims ordinarily require a high degree of temporal proximity such that injuries materialize relatively quickly after wrongful conduct has taken place. But climate change is a stock problem caused by the accumulation of carbon dioxide and other warming pollution over decades and centuries. The time delays inherent to climate change conflict with the time demands required by torts.[10] At the extreme, injurers may cease to exist long before injuries manifest themselves, posing significant challenges to successful tort actions.

Fourth, the monumental scale of awards that might be granted in cases of climate change liability means that successful climate tort action could plausibly threaten to undermine the economic foundations of the societies tort systems are intended to serve. While contemporary debates about tort reform reflect longstanding disputes about the appropriate limits of compensation, there is little disagreement that some limits should exist on damage awards, hence widespread acceptance of quantitative ceilings (financial caps), temporal boundaries (statutes of limitations), etc. By contrast, worst-case climate change scenarios pose the risk of virtually unlimited damages.[11] Put simply, the potentially catastrophic scale of damages from climate change poses a fundamental challenge to the economic and legal boundary assumptions embedded in tort law.[12] Concerns about the scale of potential damages lie behind several court decisions to dismiss tort claims based on the political question doctrine.[13]

To be sure, none of these obstacles is insurmountable. Continuing advances in weather attribution science coupled with broader acceptance of statistical evidence in tort cases could in theory ease some of the challenges related to causation.[14] Strict liability rules could conceivably be applied to damages from climate change. Mechanisms could be devised to address the intergenerational tort aspects of climate change.[15] Very strict limits could be placed on liability for the potentially immense damages associated with climate change. Yet the simultaneity and interconnectedness of these problems render tort law a decidedly unattractive option for compensating climate harms. In short, a growing number of legal observers have come to regard climate change as, in the words of Douglas Kysar, 'the paradigmatic anti-tort.'[16]

At the level of public international law, the norm of strict liability might alleviate some of the problems related to use of the negligence rule in domes-

8 David Hunter and James Salzman, 'Negligence in the Air: The Duty of Care in Climate Change Litigation' [2007] U Pa L Rev 1741.

9 Douglas A Kysar, 'What Climate Change Can Do About Tort Law' [2011] Envtl L 1, 17.

10 Eric Biber, 'Climate Change, Causation, and Delayed Harm' [2009] Hofstra L Rev 975.

11 Gernot Wagner and Martin L Weitzman, *Climate Shock: The Economic Consequences of a Hotter Planet* (PUP, 2015).

12 John Fabian Witt, *The Accidental Republic: Crippled Workingmen, Destitute Widows, and the Remaking of American Law* (HUP, 2004) 208.

13 Daniel A Farber, 'Tort Law in the Era of Climate Change, Katrina, and 9/11: Exploring Liability for Extraordinary Risks' [2008] Val U L Rev 1075, 1094.

14 For novel approaches to causation from the law and economics perspective, see Steven Shavell, 'Uncertainty over Causation and the Determination of Civil Liability' [1985] J L & Econ 587.

15 Eduardo M. Penalver, 'Acts of God or Toxic Torts? Applying Tort Principles to the Problem of Climate Change' [1998] Nat Resources J 563, 593-595.

16 Kysar (n 9) 4; See also Elizabeth Fisher, Eloise Scotford, and Emily Barritt, 'The Legally Disruptive Nature of Climate Change' [2017] Mod. L. Rev. 173; and Maria Lee, 'Climate Change Tort' (SSRN Working Paper, 2015).

tic settings. Yet critical issues of scale and causation would remain as formidable obstacles. Indeed, unease over potential costs largely explains the international politics of 'loss and damage,' to which I now turn.

III. Loss and Damage: Liability vs Insurance

Within the UNFCCC, the injurious effects of climate change have been discussed primarily in terms of 'residual harms,' or harms that cannot be avoided through conventional mitigation or adaptation measures. Debates about whether and how to address these harms date back at least as far as the negotiations to create the UNFCCC itself.[17] These debates have been characterized by multiple discourses, with key terms understood in multiple, sometimes contradictory, ways.[18]

In the early to mid-2000s, the term 'compensation' became strongly associated with the concept of liability. Two distinct frames came to dominate discussions of residual harms within the UNFCCC: a 'liability and compensation' frame principally advanced by developing countries and international non-governmental organizations (NGOs), and a competing 'risk management and insurance' frame pushed by developed countries.[19] For proponents of the liability and compensation frame, 'funding and action by developed states, particularly those with the greatest responsibility for historic greenhouse gas emissions, is seen as a legal and moral requirement to recompense vulnerable states.'[20] In this view, satisfying the demands of climate justice requires that rich polluting countries compensate victims of climate harm through the traditional instrument of legal liability. By contrast, for backers of the risk management and insurance frame, 'the diagnostic framing ... sees the problem as one mainly of 'risks,' and the prognostic framing thus advocates insurance as the appropriate solution to the problem.'[21] From this perspective, a risk management approach, including risk transfer and in particular insurance, is the ideal way to manage uncertainty and mitigate risks arising from climate change.

Since the late 2000s, however, these two framings of climate harm have been subsumed under a third frame known as 'loss and damage.' Lisa Vanhala and Cecilie Hestbaek have argued persuasively that loss and damage originated as a deliberately ambiguous frame enabling a broader global discussion about residual harms despite varying interests and assumptions about the nature of the problem and possible solutions.[22] Within this new, synthetic frame, 'loss' is understood as harms that are permanent and cannot be repaired (non-economic in nature) and 'damage' is construed as harms that can be repaired (economic in nature).[23] Loss and damage are understood to be caused by both extreme weather events and slow onset events. In 2013, the issue of residual harms was formally organized under the UNFCCC Warsaw International Mechanism for Loss and Damage associated with Climate Change Impacts (WIM).

At the 21st Conference of the Parties (COP21) in Paris in 2015, loss and damage was a hotly contested topic. Many developing country parties and NGOs pushed for inclusion of a compensatory mechanism to help redress climate wrongs.[24] But developed countries categorically refused to countenance the notion of public international climate liability, including any reference to compensation, and in the end they prevailed.[25] The Paris Agreement's Article 8 on loss and damage made no mention of liability and compensation, and the accompanying (non-binding) Paris Decision stated unequivocally that the Agreement 'does not involve or provide a basis for any liability or compensation.'[26] Instead, the Agreement cast the issue in terms of 'Comprehensive risk assessment and management' and 'Risk insurance fa-

17 M J Mace and Roda Verheyen, 'Loss, Damage and Responsibility After COP21: All Options Open for the Paris Agreement' [2016] RECIEL 197.

18 Elisa Calliari, 'Loss & Damage: A Critical Discourse Analysis of Parties' Positions in Climate Change Negotiations' [2016] J Risk Res 1.

19 Lisa Vanhala and Cecilie Hestbaek, 'Framing Climate Change Loss and Damage in UNFCCC Negotiations' [2016] Global Envtl Pol 111.

20 ibid 123.

21 ibid 121-122.

22 ibid 112.

23 Erin Roberts and Saleemul Huq, 'Coming Full Circle: The History of Loss and Damage Under the UNFCCC' [2015] Int'l J Global Warming 141.

24 Megan Rowling, 'Climate 'Loss and Damage' Controversy Smoulders at Paris Talks' *Reuters* (9 December 2015).

25 Doreen Stabinsky, 'Rich and Poor Countries Face Off Over 'Loss and Damage' Caused by Climate Change' (*The Conversation*, 7 December 2015) <https://theconversation.com/rich-and-poor-countries-face-off-over-loss-and-damage-caused-by-climate-change-51841> accessed 25 July 2018.

26 UNFCCC, Decision 1/CP.21, para 51.

cilities, climate risk pooling, and other insurance solutions,'[27] with the Decision instructing the WIM to compile information on 'insurance and risk transfer' and to facilitate 'comprehensive risk management strategies.'[28] (This shift had been signaled months earlier at a G7 summit in Elmau, Germany, where industrialized countries announced a 'climate risk insurance initiative'—subsequently named 'InsuResilience'—aimed at covering 400 million vulnerable people by 2020.)[29]

While the term 'insurance' was in effect discursively divorced from the term 'compensation,' the underlying idea behind compensation, ie, monetary transfer in recognition of loss, remained operative during and after COP21. For example, while in Paris the US announced a contribution of $30 million for climate risk insurance initiatives 'to help vulnerable populations strengthen their climate resilience.'[30] Following this, the G7 announced an additional $420 million of public funds to support its newly launched InsuResilience initiative.[31]

Why do industrialized countries appear open to addressing climate harms through insurance but not through liability? The reason for opposition to the latter is straightforward: Annex I countries fear being held legally responsible for the enormous damages associated with climate change, and have rejected any language that might provide grounds for interstate liability.[32] Providing compensation for climate damages on the basis of legal liability would likely impose huge direct costs on developed countries, while putting them at a competitive disadvantage relative to emerging economies, many if not all of whom would also be the recipients of such large-scale transfers. While primarily a matter of money, there is also an important moral aspect to developed country opposition to climate liability—industrialized countries have repeatedly resisted talk of liability and compensation due to its implicit equation with moral culpability.[33]

Insurance, however, is an instrument that seems more compatible with the interests of developed countries.[34] Insurance is closely associated with the risk management paradigm, originally developed in the private sector but increasingly proposed as a strategic approach to public policy.[35] Insurance is costly, but the financial archetype is paid for by policyholders, not society at large. Even when premiums are publicly subsidized, its pooled nature spreads costs while its market characteristics imply efficient delivery. Research suggests that, in terms of the portion of expenditures reaching victims, insurance is more efficient than tort due to lower administrative costs and legal fees.[36] Market provision and reduced transaction costs imply that compensation via insurance would cost less than compensation through tort systems (though to my knowledge no comparative studies have been undertaken to test this proposition), and reinsurance and similar devices limit the costs of catastrophes. Because insurance is focused on the immediate past and future events, historical wrongs are at least partially excluded from consideration. Lastly, the largely technical discourse around insurance resists moral arguments about blame and victimhood, unlike the justice discourse around liability. Taken together, the ideological appeal of market solutions, potential for cost reductions, prospect of displacing some costs onto policyholders, possible involvement of the private sector, and other factors may make insurance a less objectionable and/or more attractive option for developed country governments under pressure to address loss and damage in a serious way.

Since Paris, the notion of liability has effectively been excluded from intergovernmental policy discussions about climate change. Political opposition to public international liability is buttressed by those fundamental legal problems tied to causation, duty of care, temporality, and scale of damages identified above. Considering all these impediments, the issue of climate change appears to be highly inhospitable to the application of legal liability as a means to compensate harms from climate change, whether in na-

27 UNFCCC, Paris Agreement, art 8.

28 UNFCCC (n 26) para 48.

29 G7, Annex to the Leaders' Declaration [2015] 4.

30 US Department of State, US Climate Risk Insurance Announcement [2015].

31 G7, Joint Statement on InsuResiliece: The Initiative on Climate Risk Insurance [2015].

32 Maxine Burkett, 'Reading Between the Red Lines: Loss and Damage and the Paris Outcome' [2016] Climate L 118.

33 Gwynne Taraska, *The Meaning of Loss and Damage in the International Climate Negotiations* (Center for American Progress 2015).

34 See discussion of the 'risk management' perspective in Emily Boyd, Rachel A James, Richard G Jones, Hannah R Young, and Friederike E L Otto, 'A Typology of Loss and Damage Perspectives' [2017] Nature Climate Change 723.

35 Georges Dionne, 'Risk Management: History, Definition, and Critique' [2013] Risk Mgmt & Ins Rev 147.

36 Kenneth S Abraham, *The Liability Century: Insurance and Tort Law from the Progressive Era to 9/11* (HUP 2008) 9-10.

tional courts or among states. Insurance thus warrants a closer look.

IV. Insurance: Loss-Based vs Parametric

As noted, parties to the Paris Agreement promoted risk transfer as the key policy instrument for managing risks of residual climate harms. Risk transfer entails one agent passing risk to another by paying for indemnification against possible losses. The primary form of risk transfer is insurance, in which the agent pays a premium in exchange for guaranteed indemnification against specified contingencies. Traditionally, insurance has been based on losses, which is to say that insured parties are indemnified following the results of a claims adjustment process in which actual losses are identified and monetized. Loss-based insurance relies upon post-event damage assessment. Conventional insurance of this sort has long served as a complement to tort liability systems, in the form of both 'first-party insurance' and liability insurance.

The structure of traditional insurance, such as for property or health, makes it particularly vulnerable to two problems. First, moral hazard occurs when the existence of insurance coverage encourages insured parties to take more risks based on the expectation that the insurance provider will pay for any resulting damages. For example, a driver protected by automobile insurance might be tempted to drive more recklessly than she otherwise would, feeling secure in the knowledge that any accident would be covered by her insurance provider. Second, adverse selection occurs when those parties more exposed to risk purchase coverage at a higher rate than those less exposed to risk. This is due to information asymmetry between the purchaser and provider of insurance: individual purchasers know more about the risks they face and buy policies to reflect this, but providers know less and thus are unable to structure their pricing adequately to account for varied risk. Adverse selection works to undermine the gains from pooling risk by shrinking and/or shifting the pool towards individuals more likely to suffer losses. As a result, the provider must make proportionately more payouts drawn from a relatively diminished fund compared to a larger, optimal risk pool. Adverse selection can threaten the financial integrity of insurance systems.

Recently, in response to the high costs and practical difficulties inherent in determining losses from weather events, natural disasters, and other catastrophes, the insurance industry has developed a new form of insurance based on an index rather than losses.[37] Parametric insurance (also known as index-based insurance) is novel in that insured parties are indemnified based not on actual losses, but rather based on the value of a predetermined index (or parameter) that serves as a proxy for damages. Rainfall, for example, is commonly used as a proxy for crop losses. If the index diverges from a predefined range of values, coverage is triggered and the insurance provider compensates the policyholder according to an agreed formula. The indices that drive these systems are objective environmental variables not (directly) subject to human manipulation. Premiums for parametric policies are more expensive than those for traditional loss-based policies because they cover stochastic covariate risks (such as drought) involving a potential for widespread, simultaneous losses.[38]

By decoupling losses from payouts, parametric insurance changes the dynamics of traditional insurance in five basic ways. First, compared to traditional insurance, parametric insurance alleviates the problem of moral hazard. Where losses are covered, insured parties may be incentivized to engage in risky behavior because they are shielded from its full costs. But where losses are not covered, and payouts are instead tied to systemic conditions outside the control of individual parties, there is a reduced incentive for insured parties to take additional risks since they will bear the full costs regardless of whether parametric payments are triggered. They may receive support from parametric insurance, but they still suffer damages if losses materialize. Parametric payouts may be used to pay for these damages, but these resources are then unavailable for other uses.

Second, decoupling losses from payouts has a similar but opposite effect on deterrence. Under loss-based insurance, if premiums are tied to level of care, insured parties have incentives to increase their level of care so long as doing so is reflected in lower premium prices. This results in additional deterrence of risky behavior. Where payouts are not based on loss-

37 Joanne Linnerooth-Bayer and Stefan Hochrainer-Stigler, 'Financial Instruments for Disaster Risk Management and Climate Change Adaptation' [2015] Climatic Change 85.

38 ibid 95.

es, however, premiums are not tied to the level of care taken with respect to particular activities, and covered agents have no extra incentive to exercise precaution. Hence, the additional deterrence provided under conventional loss-based systems is lost under parametric insurance.

Third, by switching the basis of payouts from individual losses about which providers have relatively little information, to objective, publicly available index values tied to predefined disbursements, the problem of adverse selection is reduced. Insurance providers can model parametric risk more accurately and price products more appropriately to help ensure financial solvency. In essence, parametric insurance entails greater symmetry of information and thus a larger and/or more diversified risk pool.

Fourth, all things being equal, parametric insurance involves lower transaction costs. Under loss-based insurance, loss assessment is often a long and costly process. Parametric insurance, by contrast, does not involve loss assessment, since independent algorithms rather than actual losses determine payouts. One particular advantage is that parametric payouts are disbursed more rapidly than traditional indemnities requiring loss investigations.

Fifth, the decoupling of payouts from damages characteristic of parametric insurance also introduces a new problem known as basis risk. Basis risk is the potential difference between claims that are paid out (based on index values) and actual losses suffered. Basis risk pertains primarily to parties that experience damage but do not receive compensation because coverage was not triggered by a change in index value. Where basis risk occurs, policyholders may become dissatisfied with parametric insurance, leading to cancellation or nonrenewal, reduced enrollment, suboptimal risk pooling, and financial instability. There are a number of ways to mitigate basis risk, including improved data collection and risk modeling, phased payouts, and gap insurance to protect against uncovered losses.[39]

Most parametric insurance schemes have taken the form of weather index insurance (also known as weather derivatives) primarily intended to protect farmers and other vulnerable populations in developing countries from losses due to extreme weather and natural disasters.[40] A number of weather index insurance schemes have been successfully implemented including: a rainfall-based drought insurance scheme for farmers in Malawi;[41] Mongolia's Index Based Livestock Insurance Project (IBLIP) protecting against severe winter weather;[42] and the Uruguay Hydro Energy Insurance program, based on a rainfall index and designed to protect against risks to hydropower.[43] In all these cases, the cause of an event or condition is immaterial to the policy; all that is required for coverage to be triggered is the occurrence of the event. These and similar schemes have generally been conceived of as weather shock response mechanisms, and program developers, sponsors, and beneficiaries have all highlighted the relative speed of disbursements as one of their most advantageous features.

V. Toward Climate Risk Insurance

As such programs have gotten off the ground, two early trends have become apparent. First, while parametric insurance schemes were initially narrowly focused on protecting agriculture against weather risks, they have quickly expanded and been integrated into broader policy platforms for disaster risk reduction and climate adaptation. This is sometimes referred to as comprehensive all-risks parametric insurance, or more simply climate risk insurance.[44] Stakeholders continue to regard fast payouts as an important attribute of these schemes. Whereas weather index insurance is intended to address extreme weather events, climate risk insurance appears capable of addressing slow onset events as well through innovations such as incentives for risk reduction, extended policy periods, and alternative trigger designs.[45]

A second emerging trend is that parametric insurance has increasingly been organized at the regional

39 Neil A Doherty and Andreas Richter, 'Moral Hazard, Basis Risk, and Gap Insurance' [2002] J. Risk & Ins 9.

40 Jerry R. Skees and Benjamin Collier, *The Potential of Weather Index Insurance for Spurring a Green Revolution in Africa* (GlobalAgRisk Inc 2008).

41 GFDRR, *Weather Index-Based Crop Insurance in Malawi* (World Bank 2011).

42 IBLIP, *Introduction to Index-Based Livestock Insurance Project in Mongolia* (World Bank 2007).

43 M Navarro-Martin, *Mitigating the Impact of Drought on Energy Production and Fiscal Risk in Uruguay* (World Bank 2014).

44 James M Van Nostrand and John G Nevius, 'Parametric Insurance: Using Objective Measures to Address the Impacts of Natural Disasters and Climate Change' [2011] Envtl Claims J 227.

45 Balogun Kehinde, 'Applicability of Risk Transfer Tools to Manage Loss and Damage from Slow-Onset Climate Risks' [2014] Pro Econ & Fin 710.

level with membership composed of sovereign states. These sovereign risk pools (also known as sovereign catastrophe risk pools, sovereign disaster risk pools, or simply climate risk insurance schemes) offer parametric insurance to national governments. Regionalization has helped compensate for the relatively higher cost of parametric insurance compared to loss-based insurance by expanding and diversifying the risk pool, leading to lower premiums.[46]

There are now three major regional climate risk insurance schemes. The Caribbean Catastrophe Risk Insurance Facility (CCRIF) was set up in 2007 as the world's first sovereign catastrophe risk pool (in 2014 it reorganized as a segregated portfolio company and is regulated by the Cayman Islands Monetary Authority).[47] CCRIF offers parametric insurance products to eighteen Caribbean member states plus Nicaragua. Participating states pay annual premiums based on the amount of risk transferred. CCRIF products include insurance policies covering tropical cyclones, excess rainfall, and earthquakes, with indices based on wind speed and storm surge, rainfall volume, and ground shaking, respectively. From 2007 to 2016, CCRIF made a total of 36 payouts to 13 countries, with compensation totaling $130 million. All payouts were made within two weeks of the triggering event. CCRIF is currently introducing an Aggregated Deductible Cover feature designed to insure against basis risk, and developing new insurance products covering drought and fisheries.

The African Risk Capacity (ARC) was established by the African Union in 2012 as a sovereign risk pool treaty organization to provide rainfall index-based drought insurance to member states (33 states have signed the ARC treaty, four have ratified it).[48] ARC is composed of both intergovernmental and commercial entities. Countries receive payouts within two to four weeks of harvest. A unique feature of ARC is that participating states are required to submit peer-reviewed and approved contingency plans prior to triggering events to help guide action if and when disbursements are made. Since coming into operation in 2015, ARC has paid out $34 million to four countries. ARC is developing a suite of new insurance offerings providing coverage for river floods, tropical cyclones, and disease outbreaks.

Lastly, the five-member Pacific Catastrophe Risk Assessment and Financing Initiative (PCRAFI) was launched in 2013 as a sovereign catastrophe risk pool offering parametric insurance policies covering tropical cyclones, earthquakes, and tsunamis.[49] It is constituted as a captive insurance company owned and supervised jointly by member states and donor countries, with strong links to Pacific regional organizations. Since its inception, PCRAFI has made three payouts totaling $6.7 million, all delivered within ten days of the triggering event. PCRAFI is currently transitioning from formal World Bank sponsorship to full independence.

In parallel with the growth of these climate risk insurance schemes, the G7 InsuResilience initiative has expanded and transformed into the InsuResilience Global Partnership, now backed by the G20 as well as the V20 group of 49 developing countries vulnerable to climate change.[50] InsuResilience has become centrally focused on supporting CCRIF, ARC, and PCRAFI, and played a critical role in capitalizing the latter. To date, donors have pledged $550 million in financial support to the InsuResilience program.[51] Since COP21 the locus of activity related to international compensation for climate damages has arguably shifted away from the WIM and the UNFCCC more generally toward InsuResilience and other entities like the Munich Climate Insurance Initiative that are primarily focused on risk transfer and risk management more broadly.

Parametric insurance systems are relatively new phenomena and assessments of their effectiveness are ongoing. Early evaluations of local weather index insurance programs show positive results where there is high uptake, but persistent low demand due to financial constraints and impediments to learning.[52] Limited evidence indicates that sovereign risk pools have been more successful, but systematic as-

46 Pablo Suarez and Joanne Linnerooth-Bayer, *Insurance-Related Instruments for Disaster Risk Reduction* (UNISDR Paper, 2010) 17.

47 See generally CCRIF SPC, *Annual Report: 2016-17* (CCRIF SPC 2017).

48 See generally ARC, *Report of the Sixth Session of the Conference of the Parties of the African Risk Capacity (ARC) Agency* (ARC 2018).

49 See generally PCRAFI Program, *PCRAFI Program Phase II* (PCRAFI Program 2018).

50 InsuResilience Global Partnership, *Concept Note: Shaping the InsuResilience Global Partnership* (InsuResilience Global Partnership 2018).

51 German Federal Ministry for Economic Cooperation and Development, *InsuResilience: Climate Risk Insurance for Poor and Vulnerable People in Developing Countries* (BMZ 2017) 1.

52 Hans P Binswanger-Mhkize, 'Is There Too Much Hype About Index-Based Agricultural Insurance?' [2012] J Dev Stud 187.

sessments are lacking.[53] The InsuResilience program is coordinating a comprehensive, multi-year impact evaluation of climate risk insurance approaches that is currently in its early stages.[54]

VI. Climate Change: Liability vs Parametric Insurance

Bringing together, elaborating, and supplementing many of the points made in preceding sections, there are at least five basic ways in which parametric insurance differs from liability in the climate context, which help explain why the former may hold more promise as a means of compensating for climate damages than the latter.

First and most important, whereas liability requires that causation be demonstrated, insurance may or may not require that specific causes be present in order for coverage to be triggered. Traditional loss-based insurance policies typically provide for 'excluded perils,' or causes of loss that are not covered, and therefore causation plays an important role in the claims adjustment process. Parametric insurance, however, is based not on losses but rather on proxy values that either do or do not obtain; what drives those values is ultimately immaterial. Indices are intended to correlate with actual losses, and are inspired by underlying causal theories, but causation does not matter for the operation of a parametric scheme. Whether rainfall values of a weather index are due to natural variability, anthropogenic influences, or some combination of these factors does not affect payouts—only recorded values determine disbursement.

Second, as argued earlier, the scale of damages conceivably attributable to climate change challenges the boundary assumptions of tort law that effectively exclude losses from 'megascale' events. By contrast, insurance has evolved to specifically cover catastrophes, largely through the instrument of reinsurance whereby insurance providers transfer their risk to reinsurers who in turn protect themselves through additional risk transfer and diversification. Reinsurance is practiced in both loss-based insurance systems and parametric systems. For example, all three sovereign risk pools discussed above use traditional reinsurers to cover significant portions of their aggregate coverage limits.[55]

Third, whereas liability is an ex post process insofar as legal proceedings begin only *after* an event has occurred, insurance is an ex ante process in which policies are agreed and premiums paid *before* any event transpires. Put differently, insurance is primarily prospective in nature, focused on protecting against future harms rather than litigating past wrongs. By contrast, liability is primarily retrospective, compensating for prior damages instead of guarding against foreseeable risks. One consequence of these contrasting temporalities is that insurance requires comparatively more information in advance of an event, whereas liability requires more information following an event. This distinction is not absolute: insurance relies on historical data while liability has a deterrent effect on current and future behavior. Yet the essential temporal orientation of each is clear, with liability looking backward and insurance looking forward. This focus on the future characterizes traditional loss-based and parametric insurance, as both forms are fundamentally concerned with managing risk. In the context of climate change, a future orientation arguably encourages parties to look past historical climate wrongs toward ways of coping with anticipated climate harms (although in practice it is likely that developed country financing would be viewed at least in part through the prism of climate justice).

Fourth, parties to a liability claim have a relationship that is fundamentally adversarial in nature.[56] Parties, whether natural or legal persons, inhabit the roles of plaintiff and defendant and seek to win their case before a judge or jury. This adversarialism derives from the legal character of torts. By contrast, insurance originates in finance and thus is fundamentally contractual in nature.[57] Policyholders agree to contracts with insurance providers prior to an event. If a subsequent event is 'qualifying,' payouts are distributed according to contract terms and conditions. The contractual obligations characterizing the insur-

53 Nikolas Scherer, *How to Advance Regional Climate Risk Insurances* (Adelphi Policy Brief, 2017).

54 Raul Fernandez and Laura Schafer, *Impact Evaluation of Climate Risk Insurance Approaches: Status Quo and Way Forward* (MCII 2018).

55 World Bank Group, *Sovereign Climate and Disaster Risk Pooling: World Bank Technical Contribution to the G20* (World Bank 2017) 37.

56 Robert A Kagan, *Adversarial Legalism: The American Way of Law* (HUP 2001).

57 Richard V Ericson, Aaron Doyle, Dean Barry, *Insurance as Governance* (University of Toronto Press 2003).

Table 1: Key Differences Between Liability and Parametric Insurance as Bases for Compensation for Climate Harms

Climate Harm Issue	Liability	Parametric Insurance
Causation	Necessary	Unnecessary
Megascale Damages	Challenges boundary assumptions	Catastrophic coverage, reinsurance
Time Orientation	Past	Future
Roles	Adversarial	Contractual
Predictability	Low	High

ance relationship pertain to both loss-based and parametric systems. As above, differences between liability and insurance as social institutions are important in the climate context, where antagonism has very different implications compared to behavior based on explicit mutual agreement.

Fifth, the regularity of premiums combined with a reasonable certainty of recovery (assuming a well-designed insurance scheme) imparts a higher level of predictability regarding compensation to insurance compared to torts. In liability systems, at any given time actors may find themselves in the role of plaintiff or defendant (or both), depending on the natural course of events defined by expected and unexpected circumstances. Whether harms will affect any agent, and if so how, cannot be reliably predicted, although precautions can be taken. Predictability is of course limited in the case of insurance as well, but less so: policyholders make scheduled premium payments, providers model risks based on actuarial data, and covered parties can be confident that payouts will be received in the event of qualifying harms. Greater predictability is a feature of both loss-based and parametric insurance, and is considered a particular benefit of weather index and climate risk insurance systems insofar as it allows for more investment in local adaptation measures.[58]

These differences help explain much of why parametric insurance may be more promising as a means of compensating for climate losses compared to liability. Causation in climate is complex and subject to uncertainty in a way that conflicts with the ontological underpinnings of liability, but is compatible with the logic of insurance based on indices. The lack of a need to demonstrate causation in the case of parametric insurance also avoids the problem of time delay that hampers the application of tort law to climate change, since the temporal distance between cause and effect is irrelevant to the operation of parametric schemes. Similarly, the catastrophic scale of potential climate damages challenges some of the contextual assumptions of tort law, but is aligned (at least conceptually) with the disaster risks envisioned by parametric insurance. The pooling of risk as well as the installment structure of premium payments characteristic of parametric insurance may constitute a monetary frame likely to be perceived by actors as more manageable and therefore more acceptable compared to the lump-sum frame evoked by conventional views of legal liability; this may alter perceptions about the tractability of compensation for climate change damages. Contemplating compensation from a perspective that is forward-looking and nonantagonistic, rather than backward-looking and oppositional, has obvious appeal for developed countries when it comes to climate politics. Finally, the greater predictability inherent to a system of parametric insurance compared to legal liability likely holds significant appeal for parties occupied with budgeting and planning activities. Table 1 (above) provides an overview of these key differences between liability and parametric insurance.

These distinctive attributes of parametric insurance appear to make it a better fit for compensating

58 Joanne Linnerooth-Bayer and Reinhard Mechler, 'Insurance for Assisting Adaptation to Climate Change in Developing Countries: A Proposed Strategy,' [2011] Climate Pol'y 621.

damages from climate change than interstate liability. This conclusion is supported by the recent emergence of intergovernmental, parametric climate risk insurance schemes with anecdotal evidence of success, and by the institutionalization of a risk management and insurance approach to loss and damage under the UNFCCC. It is important to note, however, that these advantages would be offset to some degree by the introduction of basis risk. So far there is little evidence that basis risk has undermined climate risk insurance schemes, and product designs meant to offer protection are currently being developed and introduced. But potential basis risk is an unavoidable feature of index approaches that responsible policymakers would need to take into account if parametric insurance were to become a workable foundation for future international climate compensation.

VII. Discussion and Conclusion

Insurance, and parametric insurance in particular, has now displaced legal liability as the starting point in intergovernmental discussions about compensation for harms from climate change. The essential question is whether this represents a significant shift in policy entailing robust financial support from industrialized countries, or instead a fig leaf meant to suggest a bold new approach while concealing continued reluctance to pay for loss and damage and other developing country priorities.

Certainly, skepticism is warranted. It is possible that compensation via parametric insurance may cost less than compensation via liability (though again this has not been demonstrated), but even if that were true such compensation would still be expensive. Whatever the mode of compensation, experts estimate the costs of climate damages over the next century to be in the range of hundreds of trillions of dollars; one prominent study recommends a goal to provide $200-300 billion per year for loss and damage by 2030.[59] The political demands of the state system, the power of economic self-interest, and the history of climate politics all suggest that significant new international transfers to compensate for climate damages, even if channeled through a superior mechanism, should not be anticipated.

Yet the fact is that while no money has been awarded or paid for climate damages on the basis of liability, over half a billion dollars has been pledged to climate risk insurance programs since the Paris Agreement was signed. This is a far cry from the scale of resources ultimately required, but it is also a far cry from previous pledges to finance loss and damage. When considered in combination with the explicit political support for parametric insurance expressed by the G7, G20, and V20 (in contrast to the deliberate exclusion of any reference to liability in the Paris Agreement), I believe there are grounds for cautious optimism that the turn toward insurance may constitute something more than a public relations ploy.

Future events will determine whether this is justified. Much will depend on whether CCRIF, ARC, PCRAFI, and potentially other schemes and programs can be expanded in scope and scale in ways that are both meaningful and cost-effective. The results of the comprehensive InsuResilience impact evaluation currently underway will likely influence whether and how this occurs.

In conclusion, this analysis strongly suggests that parametric insurance may function as a superior alternative to legal liability as a basis for international compensation for climate change harms. While the analysis has drawn on empirical data including court cases, political discourse, and institutional developments, it has been conducted primarily at the conceptual level, and its initial conclusions require much more substantial empirical grounding. They also require deeper consideration in terms of institutional design. One overarching set of questions pertains to the potential legal status of an intergovernmental climate compensation scheme based on parametric insurance. Would public international law provide an appropriate primary basis for constituting such a scheme, as for example with ARC? Or would international commercial law serve as a more suitable foundation, as exemplified by CCRIF? Alternatively, would a political arrangement be preferred, as in the case of G7/G20/V20 support for regional climate risk insurance schemes? If the latter, how would it relate to the UNFCCC?

A much less apparent question, though perhaps even more consequential, is how a compensation scheme based on principles of parametric insurance might apply to the emerging and controversial topic

59 Julie-Ann Richards and Liane Schalatek, *Financing Loss and Damage: A Look at Governance and Implementation Options* (Heinrich Boell Stiftung North America 2017).

of solar geoengineering. Solar geoengineering is a proposed technological intervention to reflect a small portion of incoming sunlight back to space in order to ameliorate many of the impacts of climate change.[60] Deploying this technology would entail substantial uncertainty, making a workable compensation system a political precondition for its use. Parametric insurance might not only fulfill this function, it may also help address deeper uncertainties regarding the effects of solar geoengineering. Uncertainty about environmental surprises and 'unknown unknowns' are linked to broader sociopolitical and ethical concerns about geoengineering which, left unaddressed, are likely to preclude its use. By covering both expected *and* unexpected impacts of solar geoengineering, parametric insurance might facilitate its adoption as part of a comprehensive, multipronged policy approach to reduce overall climate risk.

60 NRC, *Climate Intervention: Reflecting Sunlight to Cool Earth* (NAP, 2015).